

Third Edition

HANDBOOK OF
SELF-REGULATION

RESEARCH, THEORY, AND
APPLICATIONS

Edited by

KATHLEEN D. VOHS

ROY F. BAUMEISTER



ebook

THE GUILFORD PRESS

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THE GUILFORD PRESS
New York London

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www.guilford.com

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Printed in the United States of America

This book is printed on acid-free paper.

Last digit is print number: 9 8 7 6 5 4 3 2 1

Library of Congress Cataloging-in-Publication Data

Names: Vohs, Kathleen D., editor. | Baumeister, Roy F., editor.

Title: Handbook of self-regulation : research, theory, and applications /
edited by Kathleen D. Vohs, Roy F. Baumeister.

Description: Third edition. | New York : The Guilford Press, 2016. | Revised
edition of Handbook of self-regulation, 2011. | Includes bibliographical
references and index.

Identifiers: LCCN 2015041548 | ISBN 9781462520459 (hardback : alk. paper)

Subjects: LCSH: Self-control. | Self-management (Psychology) | BISAC:
PSYCHOLOGY / Social Psychology. | MEDICAL / Psychiatry / General. |
PSYCHOLOGY / Personality. | PSYCHOLOGY / Clinical Psychology.

Classification: LCC BF632.H262 2016 | DDC 153.8—dc23

LC record available at <http://lcn.loc.gov/2015041548>

To Oliver Vohs

—K. D. V.

To those who build, rather than destroy

—R. F. B.

About the Editors

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Preface

Scholarship on self-regulation has blossomed since the publication of the second edition of the *Handbook of Self-Regulation* in 2011. There have been a flood of papers, expansions into diverse areas of inquiry, and the development of ever more sophisticated methods and tools. The terrific explosion of theories and findings needed a home where the latest developments could be summarized for a general audience, and this edition was created with that in mind.

This edition of the *Handbook* is markedly different from the prior two. A few topics changed hands, to give readers a sense of how different teams approach similar topics. In Chapter 9, “Consensus versus Anarchy in the Senate of the Mind: On the Roles of High-Level versus Low-Level Construal in Self-Control,” Jessica J. Carnevale and Kentaro Fujita present an updated treatment of the popular construal-level theory. Beliefs and practices related to religion contribute to, and sometimes detract from, self-control, as discussed in Chapter 17, “Religion and Self-Regulation: Integrating Skills-Based and Motivation-Based Accounts,” by Kristin Laurin and Aaron C. Kay. In addition, Russell A. Barkley, a preeminent scholar of attention-deficit/hyperactivity disorder, updated his chapter (Chapter 27) quite substantially to reflect new thinking. These fresh takes are highlights of the current edition.

The biggest change to the *Handbook* is the addition of 19 new chapters. That number alone attests to the progress that has taken place in the field of self-regulation. Implicit self-regulation processes are now included, reflecting the wealth of theorizing and empirical work in that area. Whether and how people regulate responses reflecting deep-seated mental associations is covered by Andrew M. Rivers, Jimmy Calanchini, and Jeffrey W. Sherman in Chapter 4, “Self-Regulation of Implicit Social Cognition.” The role of routine, often automatic, habits in aiding self-control is covered in Chapter 6, by Wendy Wood.

Several new chapters focus on physical needs. The role of sleep in successful self-regulation has been a surprisingly neglected topic, which Zlatan Krizan and Garrett Hisler seek to rectify in Chapter 11. The physiology of self-control, from the brain to

other internal organs, is covered in Chapter 8, “Pause and Plan: The Physiology of Self-Regulation,” by Suzanne C. Segerstrom, Ian A. Boggero, and Daniel R. Evans.

Motivation is a central component of self-control, and two new chapters focus on it. Motivational and attentional inputs to self-control are reviewed in Chapter 10, “Beyond Limited Resources: Self-Control Failure as the Product of Shifting Priorities,” by Michael Inzlicht and Brandon J. Schmeichel, to explain self-control failure. Wilhelm Hofmann and Kathleen D. Vohs summarize their work on feelings of desire instigating and thwarting self-control efforts in Chapter 5.

So many advances have occurred in studying self-regulation from social, organizational, and cultural perspectives that they garnered an entire new section. Trust is the bedrock of interpersonal, organizational, and economic exchange, and Catrin Finkenauer and Francesca Righetti’s work in Chapter 14, “Trust and the Perception of Self-Control: Knowing When to Trust Others,” shows that perceptions of trustworthiness rest in large part on whether the person is thought to have good self-control. Eli J. Finkel, Gráinne M. Fitzsimons, and Michelle R. vanDellen’s chapter (Chapter 15), “Self-Regulation as a Transactive Process: Reconceptualizing the Unit of Analysis for Goal Setting, Pursuit, and Outcomes,” is aimed at getting scholars to consider dyadic influences on self-control. How romantic partners seek to control each other is the focus of Chapter 16, by Jeffry A. Simpson, Nickola C. Overall, Allison K. Farrell, and Yuthika U. Girme. The workplace is where people spend a huge chunk of their time, and Drew B. Mallory and Deborah E. Rupp summarize research on workplace demands that people stifle, guide, and exaggerate their emotional reactions in Chapter 18, “Focusing in on the Emotion Laborer: Emotion Regulation at Work.”

Who exerts good self-control, and how to get more of it, are topics of three new chapters. Adding to an understanding of persistence in the face of obstacles is Lauren Eskreis-Winkler, James J. Gross, and Angela L. Duckworth’s chapter (Chapter 21) on grit. Persistence makes up a third of the facets (along with inhibition and initiation) in a new trait scale presented by Rick H. Hoyle and Erin K. Davisson in Chapter 22, “Varieties of Self-Control and Their Personality Correlates.” One of the most popular questions that arises in discussions of self-control effects is what can be done to improve one’s self-control. Training effects, such as the potential benefits of practicing self-control, are reviewed in an important new chapter (Chapter 24) by Elliot T. Berkman.

Several new chapters advance positions that might be seen as counter to traditional work in the area of self-control, bringing more nuanced perspectives. Two concern positivity, and the dangers that it can bring if unchecked. In Chapter 30, “Problems with Positive Thinking and How to Overcome Them,” Gabriele Oettingen and Julie Y. A. Cacia detail decades-long work on the follies of believing that one can simply think positive thoughts and good life outcomes will follow. Alta du Pont, Keith Welker, Kirsten E. Gilbert, and June Gruber’s chapter (Chapter 20) on unbridled positive emotions is an important counterpoint to prevailing views on the necessity of being happy to achieve goals. Taking on the notion that persistence is always a good strategy, Joseph T. McGuire and Joseph W. Kable outline the adaptiveness of cutting off persistence and delaying gratification in Chapter 29.

Last, no handbook of self-regulation would be complete without addressing the problems and challenges stemming from lapses of self-control. New to this edition is Chapter 28, “Self-Control and Crime: Theory, Research, and Remaining Puzzles,” by Michael Rocque, Chad Posick, and Alex R. Piquero, who discuss the myriad connections from

low self-control to criminal activity. Financial difficulties, which hit many people during and after the Great Recession, often have roots in problematic self-control. Poornima Vinoo, Kim Ly, and Dilip Soman's overview of self-control's ties to financial outcomes (Chapter 32) is a welcome addition.

As a special bonus, purchasers of this edition of the *Handbook* will have online-only access to two important chapters from the second edition: "Promotion and Prevention Systems: Regulatory Focus Dynamics within Self-Regulatory Hierarchies" (Abigail A. Scholer and E. Tory Higgins) and "Self-Efficacy Beliefs and the Architecture of Personality: On Knowledge, Appraisal, and Self-Regulation" (Daniel Cervone, Nilly Mor, Heather Orom, William G. Shadel, and Walter D. Scott). These chapters were and are central to the study of self-regulation, and each reviewed the literature in such a comprehensive manner that there was no need to have them fully overhauled for the third edition. We are confident that readers of this edition of the *Handbook* will enjoy these bonus chapters, which can be found at www.guilford.com/vohs2-materials.

Interest in and the study of self-regulation show no signs of stopping. Almost all of the other contributors from earlier editions responded with a resounding yes to our invitation to contribute to the current edition, and their chapters offer exciting new updates. Our goal in putting together the third edition of the *Handbook of Self-Regulation* was not only to create a home for the most exciting recent work, but to inspire you—as it has us.

To more and better self-regulation!

KATHLEEN D. VOHS
ROY F. BAUMEISTER

Contents

PART I. BASIC REGULATORY PROCESSES

1. Self-Regulation of Action and Affect <i>Charles S. Carver and Michael F. Scheier</i>	3
2. The Self-Regulation of Emotion: Theoretical and Empirical Advances <i>Sander L. Koole and Amelia Aldao</i>	24
3. Self-Control and Ego Depletion <i>Heather M. Maranges and Roy F. Baumeister</i>	42
4. Self-Regulation of Implicit Social Cognition <i>Andrew M. Rivers, Jimmy Calanchini, and Jeffrey W. Sherman</i>	62
5. Desire and Self-Regulation <i>Wilhelm Hofmann and Kathleen D. Vohs</i>	76
6. The Role of Habits in Self-Control <i>Wendy Wood</i>	95

PART II. COGNITIVE, PHYSIOLOGICAL, AND NEUROLOGICAL DIMENSIONS OF SELF-REGULATION

7. The Cognitive Neuroscience of Self-Regulatory Failure <i>Dylan D. Wagner and Todd F. Heatherton</i>	111
8. Pause and Plan: The Physiology of Self-Regulation <i>Suzanne C. Segerstrom, Ian A. Boggero, and Daniel R. Evans</i>	131
9. Consensus versus Anarchy in the Senate of the Mind: On the Roles of High-Level versus Low-Level Construal in Self-Control <i>Jessica J. Carnevale and Kentaro Fujita</i>	146

10. Beyond Limited Resources: Self-Control Failure as the Product of Shifting Priorities <i>Michael Inzlicht and Brandon J. Schmeichel</i>	165
11. The Essential Role of Sleep in Self-Regulation <i>Zlatan Krizan and Garrett Hisler</i>	182
12. Automatic Self-Regulation: From Habit to Goal Pursuit <i>Esther K. Papies and Henk Aarts</i>	203
13. Planning Promotes Goal Striving <i>Peter M. Gollwitzer and Gabriele Oettingen</i>	223

PART III. SOCIAL, ORGANIZATIONAL, AND CULTURAL DIMENSIONS OF SELF-REGULATION

14. Trust and the Perception of Self-Control: Knowing When to Trust Others <i>Catrin Finkenauer and Francesca Righetti</i>	247
15. Self-Regulation as a Transactive Process: Reconceptualizing the Unit of Analysis for Goal Setting, Pursuit, and Outcomes <i>Eli J. Finkel, Gráinne M. Fitzsimons, and Michelle R. vanDellen</i>	264
16. Regulation Processes in Romantic Relationships <i>Jeffrey A. Simpson, Nickola C. Overall, Allison K. Farrell, and Yuthika U. Girme</i>	283
17. Religion and Self-Regulation: Integrating Skills-Based and Motivation-Based Accounts <i>Kristin Laurin and Aaron C. Kay</i>	305
18. Focusing in on the Emotion Laborer: Emotion Regulation at Work <i>Drew B. Mallory and Deborah E. Rupp</i>	323

PART IV. PERSONALITY AND SELF-REGULATION

19. Impulsivity as a Personality Trait <i>Colin G. DeYoung and Amanda R. Rueter</i>	345
20. The Emerging Field of Positive Emotion Dysregulation <i>Alta du Pont, Keith M. Welker, Kirsten E. Gilbert, and June Gruber</i>	364
21. Grit: Sustained Self-Regulation in the Service of Superordinate Goals <i>Lauren Eskreis-Winkler, James J. Gross, and Angela L. Duckworth</i>	380
22. Varieties of Self-Control and Their Personality Correlates <i>Rick H. Hoyle and Erin K. Davisson</i>	396

PART V. DEVELOPMENT AND SELF-REGULATION

23. The Development of Executive Functions and Self-Regulation: A Bidirectional Psychobiological Model <i>Clancy Blair</i>	417
24. Self-Regulation Training <i>Elliot T. Berkman</i>	440

25. Effortful Control: Relations with Emotion Regulation, Adjustment, and Socialization in Childhood 458
Nancy Eisenberg, Cynthia L. Smith, and Tracy L. Spinrad
26. Aging and Self-Regulation 479
William von Hippel and Julie D. Henry

PART VI. SELF-REGULATION CHALLENGES

27. Attention-Deficit/Hyperactivity Disorder and Self-Regulation: Taking an Evolutionary Perspective on Executive Functioning 497
Russell A. Barkley
28. Self-Control and Crime: Theory, Research, and Remaining Puzzles 514
Michael Rocque, Chad Posick, and Alex R. Piquero
29. Deciding to Curtail Persistence 533
Joseph T. McGuire and Joseph W. Kable
30. Problems with Positive Thinking and How to Overcome Them 547
Gabriele Oettingen and Julie Y. A. Cachia
31. Self-Regulatory Failure and Addiction 571
Michael A. Sayette and Kasey G. Creswell
32. The Role of Self-Regulation in Financial Well-Being 591
Poornima Vinoo, Kim Ly, and Dilip Soman
- Author Index 607
- Subject Index 636

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Abigail A. Scholer and E. Tory Higgins

Self-Efficacy Beliefs and the Architecture of Personality: On Knowledge, Appraisal, and Self-Regulation
Daniel Cervone, Nilly Mor, Heather Orom, William G. Shadel, and Walter D. Scott

PART I

BASIC REGULATORY PROCESSES

CHAPTER 1

Self-Regulation of Action and Affect

CHARLES S. CARVER
MICHAEL F. SCHEIER

This chapter outlines a viewpoint on self-regulation in which behavior is seen as reflecting feedback control. In fact, we propose that two layers of control manage two different aspects of behavior, jointly situating behavior in both time and space. We think this arrangement helps people handle multiple tasks in their lives. It helps transform the simultaneous pursuit of many goals into a stream of actions that shifts repeatedly from one goal to another over time.

The view described here has been identified with the term *self-regulation* for a long time (Carver & Scheier, 1981, 1990, 1998, 1999a, 1999b). This term, however, means different things to different people. It is sometimes used as roughly equivalent to *self-control*: overriding of one action tendency in order to attain another goal. We prefer to reserve the term *self-control* for such cases and use the term *self-regulation* more broadly. Our use of this term is intended to convey the sense that self-corrective adjustments are taking place as needed to stay on track, whatever one's current purpose is (whether overriding another impulse or simply reacting to perturbations from other sources), and that these corrective adjustments originate from within. These points converge in the view that behavior is a continual process of moving toward (and sometimes away from) goals. Additional points are made in this chapter, but these ideas lie at its heart.

The ideas presented in this chapter are broad strokes, as much meta-theory as theory. We describe a viewpoint on the structure of behavior that accommodates diverse ways of thinking about what qualities of behavior matter and why. For this reason, we believe this viewpoint complements a wide variety of other ideas about what goes on in human self-regulation.

BEHAVIOR AS GOAL DIRECTED AND FEEDBACK CONTROLLED

In describing the application of this viewpoint, the easiest place to start is with the goal concept. This construct is prominent in today's psychology under a wide variety of names

(Elliot, 2008). The concept is broad enough to cover both long-term aspirations (e.g., creating and maintaining a good impression among colleagues) and the end points of very short-term acts (e.g., pulling one's car squarely into a parking space). Goals generally can be reached in diverse ways, and a given act can occur in the service of disparate goals (Carver & Scheier, 1998). People who think in terms of goals tend to assume that understanding a person means understanding that person's goals—indeed, that the substance of the self consists partly of the person's goals and the organization among them (cf. Mischel & Shoda, 1995).

Feedback Loops

We have long espoused the view that movement toward a goal reflects the functioning of a negative, or discrepancy-reducing, feedback loop (MacKay, 1966; Miller, Galanter, & Pribram, 1960; Powers, 1973; Wiener, 1948). This involves sensing some present condition and comparing it to a desired or intended condition (as a reference value). If there is a discrepancy between the two, action occurs to change the sensed condition. The overall effect is to bring the sensed condition into conformity with the intended one (Powers, 1973). If the intended condition is a goal, the effect is to bring behavior into conformity to the goal—thus, goal attainment.

There are also discrepancy-enlarging loops, in which deviations from the comparison point increase rather than decrease. The comparison point in this case is a threat, an “anti-goal.” Effects of discrepancy enlargement in living systems are typically constrained by discrepancy-reducing processes. Thus, for example, acts of avoidance often segue into other acts of approach. Put differently, one is sometimes able to avoid something one finds aversive by the very act of approaching something else. Such dual influence occurs in active avoidance: An organism fleeing a threat spots a relatively safe location and approaches it.

The principle of feedback control applies both to static end states and to moving targets (Beer, 1995). Many goals are dynamic, evolving over the course of a behavioral stream (e.g., taking a vacation across Europe, raising children to be good citizens). In such cases, the goal is the process of traversing the changing trajectory of the activity, not just the arrival at the end.

We started with the goal construct. What we bring to the conversation about goals (though we were certainly not the first to do so) is the notion that goal seeking involves feedback control. Why feedback control? Why not just goals and goal attainment? The feedback loop is often seen as an engineering concept (and engineers do use it), but the concept also has roots in physiology and other fields. *Homeostasis*—processes by which the body self-regulates physical parameters such as temperature, blood sugar, and heart rate—reflects a feedback process (Cannon, 1932). The concept has been useful enough in diverse fields that it is sometimes even suggested that feedback processes are some of the fundamental building blocks of all complex systems.

We believe there is merit in recognizing functional similarity between the systems underlying human behavior and other complex systems (cf. Ford, 1987; von Bertalanffy, 1968). Nature is a miser and a recycler. It seems likely that an organization that works in one complex system will tend to recur elsewhere as well. For the same reason, it seems likely that principles embodied in movement control (which also rely in part on principles

of feedback) have more than just a little in common with principles underlying higher mental functions (Rosenbaum, Carlson, & Gilmore, 2001). For these reasons, we have continued to use the principle of feedback control as a conceptual heuristic over the years.

Levels of Abstraction

Goals exist at many levels of abstraction. You can have the goal of being a good citizen but you can also have the goal of conserving resources—a narrower goal that contributes to being a good citizen. One way to conserve resources is recycling. Recycling entails other, more concrete goals: placing newspapers and empty bottles into containers and moving them to a pickup location. All of these are goals, values to be approached, but at varying levels of abstraction.

It is often said that people's goals form a hierarchy (Powers, 1973; Vallacher & Wegner, 1987), in which abstract goals are achieved by attaining the concrete goals that help define them. Lower-level goals are attained by briefer sequences of action (formed from subcomponents of motor control, e.g., Rosenbaum, Meulenbroek, Vaughan, & Jansen, 2001). Some sequences of action have a self-contained quality, such that they run off fairly autonomously once triggered.

Viewed from the other direction, sequences can be organized into programs of action (Powers, 1973). *Programs* are more planful and require choices at various points. Programs, in turn, are sometimes (though not always) enacted in the service of principles. *Principles* are abstractions that provide a basis for making decisions within programs and suggest that certain programs be undertaken or avoided. What Powers called principles are roughly equivalent to values (Schwartz & Bilsky, 1990; Schwartz & Rubel, 2005). Even that is not the end of potential complexity. Patterns of values can coalesce to form a very abstract sense of desired (and undesired) self, or a sense of desired (and undesired) community.

All these classes of goals can be reference points for self-regulation. When a person strives for a goal at one level, self-regulation presumably is evoked simultaneously at all levels below that one. Striving for a midlevel goal, however, does not ensure that a level higher is considered at all. We return to the diversity among potential superordinate goals later in the chapter.

FEEDBACK PROCESSES AND AFFECT

Thus far we have considered action—getting from here to there. Another salient part of human experience is feelings, or *affect*. Two fundamental questions about affect are what it consists of and where does it come from. Affect pertains to one's desires and whether they are being met (e.g., Clore, 1994; Frijda, 1986, 1988; Ortony, Clore, & Collins, 1988). But what is the mechanism by which it arises?

We suggested an answer to this question (Carver & Scheier, 1990, 1998, 1999a, 1999b) using feedback control once again as an organizing principle. We suggested that feelings are a consequence of a feedback process that runs automatically, simultaneously with the behavior-guiding process, and in parallel to it. Perhaps the easiest way to convey what this second process is doing is to say that it is checking on how well the first process

(the action loop) is doing at reducing *its* discrepancies (we first consider approach loops). Thus, the input for this second loop is some representation of the *rate of discrepancy reduction in the action system over time*.

An analogy may help. Action implies change across states. Thus, behavior is analogous to distance. If the action loop controls distance (change across states), and if the affect loop assesses the progress of the action loop, then the affect loop is sensing the analogue of velocity, the first derivative of distance over time. To the extent that this analogy is meaningful, the input to the affect loop should be the first derivative over time of the input used by the action loop.

Input alone does not create affect (a given rate of progress has different affective effects in different circumstances). We believe that, as in any feedback system, this input is compared to a reference value (e.g., Frijda, 1986, 1988). In this case, the reference is an acceptable or desired rate of behavioral discrepancy reduction. As in other feedback loops, the comparison checks for deviation from the standard. If there is one, the output function changes.

We suggest that the error signal from the comparison in this loop (signal of a discrepancy) is manifested subjectively as affect, positive or negative valence. Specifically, if the rate of progress is below the criterion, negative affect arises. If the rate is high enough to exceed the criterion, positive affect arises. If the rate is indistinguishable from the criterion, no affect arises.

In essence, the argument is that feelings with a positive valence mean one is doing better at something than one needs to, and feelings with a negative valence mean one is doing worse than one needs to (for more detail, see Carver & Scheier, 1998, Chapters 8 and 9). One implication of this line of thought is that for any given action domain, there should be a bipolar dimension of potential affective valence. That is, for a given action, affect can be positive, neutral, or negative, depending on how well or poorly the action is going.

What determines the criterion for this loop? The criterion likely is quite variable for unfamiliar activities. For a familiar activity, the criterion likely reflects accumulated experience, in the form of an expected rate (the more experience one has, the more one knows what to expect). Whether “desired” or “expected” or “needed” most accurately depicts the criterion may depend greatly on the context.

The criterion can also change. The less experience the person has in a domain, the more fluid the criterion; in a familiar domain, the criterion is more stable. Still, repeated overshoot of the criterion normally yields an upward drift in it (e.g., Eidelman & Biernat, 2007); repeated undershoot yields a downward drift. Thus, when functioning adaptively, the system recalibrates over experiences in such a way that the criterion stays within the range of those experiences (Carver & Scheier, 2000). A somewhat unexpected effect of recalibration would be to keep the balance of a person’s affective experiences (positive to negative) relatively similar over time, even if the rate criterion changes considerably.

Two Kinds of Behavioral Loops, Two Dimensions of Affect

The view just outlined rests on the idea that positive feeling results when a behavioral system is making rapid progress in doing what it is organized to do. Thus far we have

considered only systems organized to reduce discrepancies. There is no obvious reason, though, why the principle should not apply as well to systems organized to enlarge discrepancies. If that kind of a system is making rapid progress doing what it is organized to do, there should be positive affect. If it is doing poorly, there should be negative affect.

The idea that affects of both valences can occur would seem comparable across both approach and avoidance systems. That is, both approach and avoidance have the potential to induce positive feelings (by doing well), and both have the potential to induce negative feelings (by doing poorly). But doing well at moving *toward an incentive* is not quite the same as doing well at moving *away from a threat*. Thus, the two positives may not be quite the same, nor may the two negatives.

Based on this line of thought, and drawing on insights from Higgins (e.g., 1987, 1996) and his collaborators, we posit two sets of affects, one relating to approach, the other to avoidance (Carver & Scheier, 1998). Approach-related activities lead to such positive affects as elation, eagerness, and excitement, and such negative affects as frustration, anger, and sadness (Carver, 2004; Carver & Harmon-Jones, 2009b). Avoidance-related activities lead to such positive affects as relief and contentment (Carver, 2009) and such negative affects as fear, guilt, and anxiety.

Merging Affect and Action

The two-layered viewpoint we have described implies a natural link between affect and action. If the input function of the affect loop is a sensed rate of progress in action, the output function must be a change in rate of that action. Thus, the affect loop has a direct influence on what occurs in the action loop.

Some changes in rate output are straightforward. If one is lagging behind, one pushes harder. Sometimes the changes are less straightforward. The rates of many “behaviors” are defined not by a literal pace of physical action but by choices among actions or entire programs of action. For example, increasing one’s rate of progress on a project at work may mean choosing to spend a weekend working rather than skiing. Increasing one’s rate of being a kind person means taking an action that reflects that value when an opportunity arises. Thus, rate adjustments must often be translated into other terms, such as concentration, or reallocation of time and effort.

The idea of two feedback systems functioning in concert with one another is something we more or less stumbled into. It turns out, however, that such an arrangement is quite common in control engineering (e.g., Clark, 1996). Engineers have long recognized that having two control systems functioning together—one controlling position, the other controlling velocity—permits the device in which they are embedded to respond in a way that is both quick and stable, without overshoots and oscillations.

The value of the combination of quickness and stability is not limited to electromechanical devices. A person with highly reactive emotions is similarly prone to overreact and to oscillate behaviorally. A person who is emotionally nonreactive is slow to respond even to urgent events. A person whose reactions are between the two extremes responds quickly but without undue overreaction and oscillation. Affect makes responses quicker (because this system is time-sensitive) and—if the responses are not too intense—the responses are also stable. Being able to respond quickly yet accurately confers a clear adaptive advantage.

Our focus here is on how affects influence behavior, emphasizing the extent to which they are interwoven. Note, however, that the behavioral responses related to the affects also lead to reduction of the affects. Thus, in a very basic sense, the affect system is itself self-regulating. Certainly, people also make voluntary efforts to regulate emotions (Gross, 2007), but the affect system does a good deal of that on its own. Indeed, if the affect system is optimally responsive, affective arousal will generally be minimized over the long term because the relevant deviations are countered before they become intense (cf. Baumeister, Vohs, DeWall, & Zhang, 2007).

AFFECT ISSUES

This theoretical model of affect differs from others in several ways. At least two of the differences appear to have important implications.

Divergent Views of Dimensionality Underlying Affect

One difference concerns relations among affects. Several theories (though not all) conceptualize affects as aligned along dimensions. Our view fits that picture, in a sense. It holds that affects related to approach have the potential to be either positive or negative, as do affects related to avoidance, thus forming a bipolarity for each motivational tendency.

Most dimensional models of affect, however, take a different form. For example, Gray (e.g., 1990, 1994) held that one system is engaged by cues of punishment and cues of frustrative nonreward. It thus is responsible for negative feelings, whether those feelings relate to approach or to avoidance. Similarly, he held that another system is engaged by both cues of reward and cues of escape or avoidance of punishment. It thus is responsible for positive feelings, whether the feelings relate to avoidance or to approach.

In that view, each system is responsible for affect of one valence. This yields two unipolar dimensions, each linked to the functioning of a behavioral system. A similar position has been taken by Lang and colleagues (e.g., Lang, 1995; Lang, Bradley, & Cuthbert, 1990), Cacioppo and colleagues (e.g., Cacioppo & Berntson, 1994; Cacioppo, Gardner, & Berntson, 1999), and Watson, Wiese, Vaidya, and Tellegen (1999).

This view is quite different from ours. There is not a wealth of information addressing this difference, but there is some. Probably least studied is “doing well” in threat avoidance. Higgins, Shah, and Friedman (1997, Study 4) found that when there was an avoidance orientation to a task (instructions to avoid failing), a good outcome led to elevations in reports of calmness. With an approach orientation, however (instructions to succeed), a good outcome did not affect calmness. Thus, calmness was linked to doing well at avoidance but not to doing well at approach. In other research, people were asked to respond to hypothetical scenarios introducing, then removing, a threat (Carver, 2009). Reports of relief related principally to degree of threat sensitivity. In yet other research, relief has been linked both to the avoidance of an aversive experience and to the completion of an aversive activity (Sweeny & Vohs, 2012).

A larger accumulation of evidence links certain negative affects to “doing poorly” in approaching incentives; just a few are noted here (for detail, see Carver & Harmon-Jones, 2009b). In the study by Higgins and colleagues (1997) just described, people with

an approach orientation who experienced failure reported elevated sadness. This did not occur with an avoidance orientation. This suggests a link between sadness and doing poorly at approach.

The broader literature of self-discrepancy theory also makes a similar point. Many studies have shown that sadness relates uniquely (controlling for anxiety) to discrepancies between actual selves and ideal selves (for reviews, see Higgins, 1987, 1996). *Ideals* are qualities the person intrinsically desires: aspirations, hopes, positive images for the self. There is evidence that pursuing an ideal is an approach process (Higgins, 1996). Thus, this literature also suggests that sadness stems from a failure of approach.

Other research examined the effects of frustrative nonreward (Carver, 2004, Study 1). Participants were led to believe they could obtain a reward if they performed well on a task. All were told they had done poorly, however, and got no reward. Sadness and discouragement at that point related to sensitivity of the approach system, but not sensitivity of the avoidance system.

There is also a good deal of evidence linking the approach system to anger (Carver & Harmon-Jones, 2009b). As one example, Harmon-Jones and Sigelman (2001) induced anger in some persons but not others, then examined cortical activity. They found elevated left anterior activity, which previous research (e.g., Davidson, 1992) had linked to activation of the approach system. In other studies (Carver, 2004), people reported the feelings they experienced in response to hypothetical events (Study 2) and after the destruction of the World Trade Center (Study 3). Reports of anger related to sensitivity of the approach system, whereas reports of anxiety related to the avoidance system.

There is also, however, an accumulation of evidence that contradicts our view, instead placing all negative affects on one dimension and all positive affects on another dimension. This evidence, briefly summarized by Watson (2009), consists primarily of a large number of studies in which people reported their moods at a particular time or across a particular span of time. As Carver and Harmon-Jones (2009a) pointed out, however, an affective response to a particular event differs in important ways from a mood, which tends to aggregate experiences over multiple events. It seems likely that different influences come into play in the creation or maintenance of moods than underlie specific focused affective responses to events.

We have devoted a good deal of space to this issue. Why? It is an important one because it has implications for the search for a conceptual mechanism underlying affect. Theories of two unipolar dimensions appear to equate greater activation of a system to more affect of that valence. If the approach system relates to feelings of both valences, such a mechanism is not tenable. A conceptual mechanism is needed that addresses both positive and negative affect in the approach function (and, separately, the avoidance function). The mechanism described here does so.

One more note about dimensionality: Our viewpoint is dimensional in the sense that it is predicated on a dimension of system functioning (from very well to very poorly). However, the affects that fall on that dimension do not themselves form a dimension, apart from the fact that they represent both valences. For example, depression (when things are going extremely poorly) is not simply a more intense state of frustration (when things are going less poorly). The affects themselves appear to be nonlinear consequences of linear variation in system functioning. Anger and depression are both potential consequences of approach going poorly; which one emerges appears to depend on whether the goal seems lost or not (see also Rolls, 1999, 2005).

Coasting

Another important issue also differentiates this model from most other viewpoints (Carver, 2003). Return to the argument that affect reflects the error signal in a feedback loop. Affect would therefore be a signal to adjust progress—whether rate is above the criterion or below it. This is intuitive for negative feelings but not for positive feelings. In our view, positive feelings arise when things are going better than they need to. But the feelings still reflect a discrepancy, and the function of a negative feedback loop is to minimize discrepancies. Such a system would “want” to see neither negative nor positive affect. Either one would represent an “error” and promote changes in output that eventually would reduce it (see also Izard, 1977).

This viewpoint argues that people who exceed the criterion rate of progress (and who therefore have positive feelings) automatically tend to reduce effort in this domain. They “coast” a little—not stop, but ease back, such that subsequent progress returns to the criterion. The impact on affect would be that the positive feeling itself is not sustained for very long. It begins to fade.

Increasing effort to catch up when behind, and coasting when ahead, are both presumed to be specific to the goal to which the affect is linked. Usually (though not always) this is the goal from which the affect arises in the first place. We should also be clear about time frames. This view pertains to the current, ongoing episode. This is *not* an argument that positive affect makes people less likely to do the behavior again later on.

A system of this sort would operate in the same way as a car’s cruise control. If progress is too slow, negative affect arises. The person responds by increasing effort, trying to speed up. If progress is better than needed, positive affect arises, leading to coasting. A car’s cruise control is similar. A hill slows the car down; the cruise control feeds the engine more fuel, speeding back up. If the car crosses the crest of a hill and rolls downward too fast, the system cuts back on fuel and the speed gradually drags back down.

The analogy is intriguing partly because both sides of it are asymmetrical. In both cases, addressing the problem of going too slow requires expending more resources. Addressing the problem of going too fast entails only cutting back. A cruise control does not apply the brakes; it only reduces fuel. The car must coast back to the velocity set point. The immediate effect of the cruise control on a high rate of speed thus depends on external circumstances. If the downhill path is steep, the car may exceed the cruise control’s set point all the way to the valley below. In the same fashion, people usually do not respond to positive affect by trying to dampen the feeling. They only ease back a little on resources devoted to the domain in which the affect has arisen. The feeling may be sustained for a long time (depending on circumstances), as the person coasts down the subjective hill. Eventually, though, the reduced resources would cause it to fade. Generally, then, the system would act to prevent great amounts of pleasure, as well as great amounts of pain (Carver, 2003; Carver & Scheier, 1998).

Does positive affect (or making greater than expected progress) promote coasting? To test this idea, a study must assess coasting with respect to the goal underlying the affect (or the unexpectedly high progress). Creating positive affect in one context and assessing its influence elsewhere (e.g., Isen, 1987, 2000; Schwarz & Bohner, 1996) does not test this question.

A few studies satisfy these criteria. Mizruchi (1991) found that professional basketball teams in playoffs tend to lose after winning. It is unclear, however, whether the

prior winner slacked off, the loser tried harder, or both. Louro, Pieters, and Zeelenberg (2007) explicitly examined the role of positive feelings from surging ahead in the context of multiple-goal pursuit. In three studies they found that when people were relatively close to a goal, positive feelings prompted decrease in effort toward that goal and a shift of effort to an alternate goal. They also found a boundary on this effect (it occurred only when people were relative close to their goal). Another study, using an intensive experience sampling procedure across a 2-week period, similarly found that greater than expected progress toward a goal was followed by reduction in effort toward that goal (Fulford, Johnson, Llabre, & Carver, 2010).

Coasting and Multiple Concerns

The idea that positive affect leads to coasting, which would eventually cause reduction of the positive affect, strikes some as unlikely. On the surface it is hard to see why a process would be built-in that limits positive feelings—indeed, that reduces them. After all, a truism of life is that people supposedly are organized to seek pleasure and avoid pain.

There are at least two potential bases for this tendency. One is that it is not adaptive for organisms to spend energy needlessly. Coasting prevents that. A second stems from the fact that people have multiple simultaneous concerns (Atkinson & Birch, 1970; Carver, 2003; Carver & Scheier, 1998; Frijda, 1994). Given multiple concerns, people do not optimize performance on any one of them but rather “satisfice” (Simon, 1953)—do a good-enough job on each concern to deal with it satisfactorily. This permits handling of many concerns adequately, rather than just one (see also Fitzsimons, Friesen, Orehek, & Kruglanski, 2009).

A tendency to coast would virtually define satisficing regarding that particular goal. That is, reducing effort would prevent attainment of the best possible outcome. A tendency to coast would also promote satisficing regarding a broader array of goals; that is, if progress toward goal attainment in one domain exceeds current needs, coasting in that domain (satisficing) would make it easy to devote energy to another domain. This would help ensure satisfactory goal attainment in the other domain and, ultimately, across multiple domains.

PRIORITY MANAGEMENT AS A CORE ISSUE IN SELF-REGULATION

The line of reasoning just outlined, which begins to implicate positive feelings in a broad function within the organism, deserves much further consideration. This function is the shifting from one goal to another as focal in behavior (Dreisbach & Goschke, 2004; Shallice, 1978; Shin & Rosenbaum, 2002). This basic and very important function is often overlooked. Humans usually pursue many goals simultaneously, but only one can have top priority at a given moment. People manage their many goals by shifting among them. This means there are changes over time in which goal has the top priority. How are those changes managed?

An influential view of priority management among goals was proposed many years ago by Simon (1967), who noted that ongoing events can be relevant to goals with less than top priority, even though they are largely out of awareness. Sometimes events that occur during the pursuit of the top-priority goal create problems for a goal with a lower

priority. Indeed, the mere passing of time can create a problem for the second goal, if passing of time makes its attainment less likely. If the second goal is also important, an emerging problem for its attainment needs to be taken into account. If there arises a serious threat to the second goal, a mechanism is needed for changing priorities, so that the second goal replaces the first one as focal.

Feelings and Reprioritization

Simon (1967) reasoned that emotions are calls for reprioritization. He suggested that emotion arising with respect to a goal that is outside awareness eventually induces people to interrupt what they are doing and give that goal a higher priority than it had. The stronger the emotion, the stronger the claim that the unattended goal should have higher priority than the current focal goal. Simon did not address negative affect that arises with respect to a currently focal goal, but the same principle seems to apply. In that case, negative affect seems to be a call for an even greater investment of resources and effort in that focal goal than is now being made.

Simon's analysis applies easily to negative feelings, when a nonfocal goal demands a higher priority and *intrudes* on awareness. However, there is another way in which priority ordering can shift: The currently focal goal can *relinquish its place*. Simon acknowledged this possibility obliquely, noting that goal completion terminates pursuit of that goal. However, he did not address the possibility that an as-yet-unattained goal might also yield its place in line.

Carver (2003) expanded on that possibility, suggesting that positive feelings are a cue to *reduce* the priority of the goal to which the feeling pertains. This appears consistent with the sense of Simon's analysis but suggests that the prioritizing function of affect pertains to both valences. Positive affect regarding avoidance (relief or tranquility) indicates that a threat has dissipated, no longer requires as much attention as it did, and can now assume a lower priority. Positive affect regarding approach (happiness, joy) indicates that an incentive is being attained. Even if it is not yet attained, the affect signals that one could temporarily put this goal aside (one could let oneself coast).

If a focal goal diminishes in priority, what follows? In principle, this situation is less directive than when a nonfocal goal demands higher priority. What happens next in this case depends partly on what else is lined up and whether the context has changed in important ways while one was busy with the focal goal. Opportunities to attain incentives sometimes appear unexpectedly, and people put aside their plans to take advantage of them (Hayes-Roth & Hayes-Roth, 1979; Payton, 1990). It seems reasonable that people experiencing positive affect should be most prone to shift goals at this point if something else needs fixing or doing (regarding a next-in-line goal or a newly emergent goal), or if an unanticipated opportunity for gain has appeared.

On the other hand, sometimes neither of these conditions exists. In such a case, no change in goal would occur, because the downgrade in priority of the now-focal goal does not render it lower than the priorities of the alternatives. Thus, positive feeling does not *require* that there be a change in direction. It simply sets the stage for such a change to be more likely.

Apart from evidence of coasting per se, there is also evidence that is consistent with the idea that positive affect tends to promote shifting of focus to other things that need attention (for broader discussion, see Carver, 2003). As an example, Trope and Neter

(1994) induced a positive mood in some people but not others, gave them all a social sensitivity test, then told them that they had performed well on two parts of the test but poorly on a third. Subjects then indicated their interest in reading more about their performances on the various parts of the test. Positive-mood participants showed more interest in the part they had failed than did controls, suggesting that they were inclined to shift focus to an area that needed their attention. This effect has been conceptually replicated by Trope and Pomerantz (1998) and Reed and Aspinwall (1998).

Phenomena such as these have contributed to the emergence of the view that positive feelings represent psychological resources (see also Aspinwall, 1998; Fredrickson, 1998; Isen, 2000; Tesser, Crepaz, Collins, Cornell, & Beach, 2000). The idea that positive affect serves as a resource for exploration resembles the idea that positive feelings open people up to noticing and turning to emergent opportunities, to being distracted into enticing alternatives—to opportunistic behavior. Some evidence also fits this idea (Kahn & Isen, 1993).

Priority Management and Depressed Affect

One more aspect of priority management that should be addressed concerns the idea that in some circumstances goals are not attainable and are better abandoned. Sufficient doubt about attaining a goal results in an impetus to disengage from efforts to reach it, and even to disengage from the goal itself (Carver & Scheier, 1998, 1999a, 1999b). Abandonment clearly means a decrease in priority for that goal. How does this sort of reprioritization fit into the picture sketched earlier?

At first glance, this seems to contradict Simon's (1967) position that negative affect is a call for higher priority. However, there is an important distinction between two approach-related negative affects, which elaborates on Simon's thinking. Some negative affects pertaining to approach coalesce around frustration and anger. Others coalesce around sadness, depression, and dejection. The former demand increase in priority; the latter promote decrease in priority.

As noted earlier, our view on affect rests on a dimension from doing well to doing poorly, but the affects themselves do not simply form a continuum (Figure 1.1). Inadequate movement forward (or no movement, or loss of ground) gives rise at first to frustration, irritation, and anger. These feelings (or the mechanism that underlies them) engage effort more fully, to overcome obstacles and enhance progress. This case fits the priority management model of Simon (1967).

Sometimes, however, continued efforts do not produce adequate movement forward. Indeed, if the situation involves loss, movement forward is precluded because the incentive is gone. When failure seems (or is) assured, the feelings are sadness, depression, despondency, grief, and hopelessness (e.g., Finlay-Jones & Brown, 1981). Behaviorally, the person tends to disengage from—give up on—further effort toward the incentive (Klinger, 1975; Lewis, Sullivan, Ramsay, & Allessandri, 1992; Mikulincer, 1988; Wortman & Brehm, 1975).

As noted, negative feelings in these two kinds of situations parallel two divergent effects on action. Both effects have adaptive properties. In the first situation—when the person falls behind but the goal is not seen as lost—feelings of frustration and anger accompany increase in effort, a struggle to gain the incentive despite setbacks (Figure 1.1). This struggle is adaptive (thus, the affect is adaptive) because the struggle fosters goal attainment.

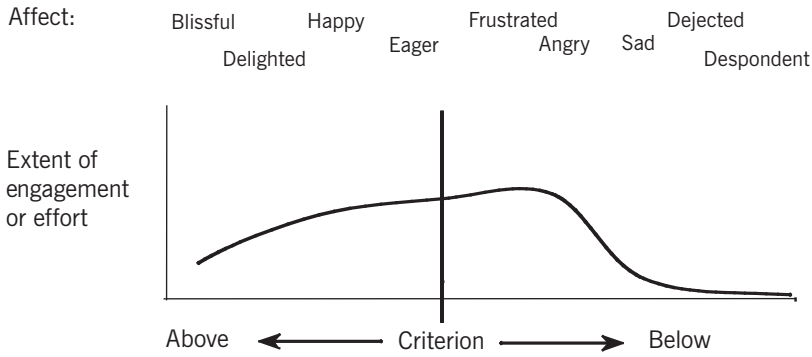


FIGURE 1.1. Hypothesized approach-related affects as a function of doing well versus doing poorly compared to a criterion velocity. A second (vertical) dimension indicates the degree of behavioral engagement posited to be associated with affects at different degrees of departure from neutral. From Carver (2004). Copyright 2004 by the American Psychological Association. Adapted by permission.

In the second situation—when effort appears futile—feelings of sadness and depression accompany *reduction* of effort (Figure 1.1). Sadness and despondency imply that things cannot be set right, that effort is pointless. Reducing effort in this circumstance can also be adaptive (Mens, Wrosch, & Scheier, in press; Wrosch, Scheier, Carver, & Schulz, 2003; Wrosch, Scheier, & Miller, 2013; Wrosch, Scheier, Miller, Schulz, & Carver, 2003). It conserves energy rather than waste it in pursuit of the unattainable (Nesse, 2000). If reducing effort also helps diminish commitment to the goal (Klinger, 1975), it eventually readies the person to take up other incentives in place of this one.

DUAL-PROCESS MODELS OF FUNCTIONING

Another topic we would like to discuss is the idea that human behavior reflects two modes of functioning, an idea that has received a good deal of interest over the past decade or so. Quite a long time ago, Epstein (1985, 1994) argued for a *rational* system that operates mostly consciously, uses logical rules, is verbal and deliberative, and thus fairly slow, and an *experiential* system that is intuitive and associative, relies on salient information, uses shortcuts and heuristics, and functions nonverbally and quickly. Both systems are always at work. What behavior occurs depends on which system is presently dominant, which can be influenced both by situational constraints and individual differences.

A great many others in social and personality psychology have since made arguments that resemble these in broad strokes (for overviews, see Carver, 2005; Carver, Johnson, & Joormann, 2008; Hofmann, Friese, & Strack, 2009). Similar ideas also exist in developmental psychology. Rothbart and others propose three temperaments: approach, avoidance, and effortful control (e.g., Rothbart, Ahadi, & Evans, 2000; Rothbart, Ellis, Rueda, & Posner, 2003; see also Kochanska & Knaack, 2003; Nigg, 2000). Approach and avoidance temperaments are termed *reactive*, meaning that the actions that follow from them are relatively automatic. *Effortful control* is superordinate to approach and

avoidance temperaments (e.g., Ahadi & Rothbart, 1994) and concerns attentional management and inhibitory control (the ability to suppress an approach behavior when it is situationally inappropriate). The label *effortful* conveys the sense that this is an executive, planful activity, resembling depictions of the deliberative mode of the models just outlined.

This process is most obviously displayed in restraint of approach-directed impulses. It is important to realize, however, that it can also be displayed in other ways. Effortful control can override a strong reflexive tendency toward avoidance, allowing a person to stay in an anxiety-provoking social situation rather than fleeing. Similarly, if a person's approach temperament is unreactive, effortful control can override a reflexive tendency toward *inaction*. For example, deployment of effortful control can make one go out and exercise when one does not really want to do so. Thus, effortful control can move a person toward either restraint or action, depending on what reflexive response is being overcome.

This line of reasoning casts a somewhat unusual light on the concept of impulsiveness. In this view, what is impulsive is what is *reactive*, whether its overt display is action or inaction. Impulsive responses are relatively immediate reactions to some stimulus in disregard of other considerations. The key, in this view, is that whatever action property emerges represents a reactive, automatic association to the stimulus.

One of the more interesting aspects of the dual-processing viewpoint is evidence that the two modes learn in different ways, and that the two patterns of learning create parallel influences on action that potentially compete with one another, thus requiring continuous arbitration (Daw, Niv, & Dayan, 2005; Otto, Gershman, Markman, & Daw, 2013). The two processing modes appear to use different aspects of the available information (Rudman, Phelan, & Heppen, 2007). The reactive system is sometimes said to create model-free learning, and the deliberative system is said to create model-based learning (Daw et al., 2005; Otto et al., 2013).

The idea of dual systems is by no means without controversy (e.g., Evans & Stanovich, 2013; Keren & Schul, 2009), and the many variations on this idea that have been posed by different theorists sometimes differ substantially from one another. What we have found useful is the main points of emphasis, which are fairly broadly shared among theories.

Another Look at Hierarchical Organization

Various depictions of the characteristics of these two modes of functioning have a certain degree of resemblance to depictions earlier in the chapter of two levels of abstraction in action control. Specifically, the deliberative mode of functioning tends to resemble what was earlier described as *program control*, and the impulsive mode of functioning tends to resemble what was earlier described as *sequence control*.

We said earlier that programs require decisions and reflect intentions. They seem to be managed top-down, using effortful processing. Planfulness, characteristic of programs, is also characteristic of behavior managed by a deliberative system. Sequences that are implied by a given plan are evoked whenever that plan is engaged, as part of the plan's pursuit. However, in other cases sequences may also be triggered simply by associations in memory or by contextual cues. In such cases, they would occur in relatively automatically

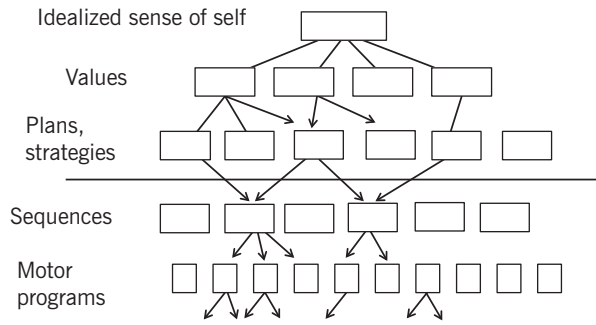


FIGURE 1.2. Schematic of a hierarchical organization of goals at multiple levels of abstraction, in which attainment of higher order goals is created by the execution of actions attaining lower order goals. If a goal is undertaken at a given level (e.g., Program level), execution of action at all subordinate levels follows. However, it may also be possible for an action to be triggered at a lower level (e.g., Sequence control) without its having been specified from a higher level. Such an action would proceed relatively automatically. This may differentiate actions guided by a deliberative system from actions guided by a reflexive system.

once triggered (Figure 1.2). This latter event resembles the more basic mode of functioning portrayed in the *dual-process view*.

Of interest in this regard is evidence that different brain areas manage effortful and automatic versions of the same behavior (Casey, Tottenham, & Fossella, 2002; Lieberman, Gaunt, Gilbert, & Trope, 2002; Posner & DiGirolamo, 2000). This in itself hints that there may be an important boundary between action control that is deliberative versus action sequences that are organized enough to be spontaneous once cued. Other evidence also supports the idea that intention-based and stimulus-based actions involve different process of action initiation (Keller et al., 2006).

In previous discussions (e.g., Carver & Scheier, 1998, 1999a) we have frequently noted that what level of control is functionally superordinate can vary with the situation (and across persons). That is, a person can behave according to a principle (e.g., a moral or ethical value); the same person may behave according to a concrete program. The person can also behave in ways that seem more impulsive, without regard to either principle or plan. Situations in which this seems to occur were said to include (but were not necessarily limited to) cases of deindividuation and alcohol intoxication. In the past, we noted this point and how different the behaviors could be. Now we find ourselves wondering whether this division maps onto the two modes of processing that have been postulated by others.

Self-Control

The idea that both spontaneous goals and planful goals exist and can come into conflict with each other also occurs in the literature on self-control and self-control failure (Baumeister & Heatherton, 1996; Baumeister, Heatherton, & Tice, 1994). That literature focuses on cases in which a person is motivated to act in some particular way and also motivated to restrain that action.

Discussion of self-control failure tends to portray these cases as involving a relatively automatic tendency to act in one way, as a product of habit or salient situational cues, being opposed by a planful and effortful tendency to restrain that act. The action that is being inhibited is often characterized as an impulse, a desire that will automatically be translated into action unless it is controlled (perhaps in part because it is habitual, perhaps in part because it is more primal). The restraint is typically presumed to be effortful, and to depend on limited resources. If the planful part of the mind can attend to the conflict, the person can resist the impulse. If not, the impulse is more likely to be expressed. This portrayal seems consonant with two-mode models of functioning (Hofmann et al., 2009).

SELF-CONTROL AND PSYCHOPATHOLOGY

These ideas may also have implications for thinking about problems in behavior. Many sorts of problems are characterized broadly as either externalizing disorders (e.g., impulsive violence, substance use, vandalism, theft, and risky sexual behaviors) or internalizing disorders (e.g., depression or anxiety). It is relatively straightforward to see a conceptual link from impulsiveness and lack of self-control to externalizing disorders, and there is a good deal of empirical evidence to support that connection (Carver & Miller, 2006; Cyders et al., 2007; Dick et al., 2010; Whiteside & Lynam, 2003; Zapolski, Cyders, & Smith, 2009).

Far less intuitive is the idea that impulsivity also creates a vulnerability to internalizing problems. Particularly unlikely would seem to be a link between impulsiveness and depression. Nonetheless, there is support for that idea as well. A variety of indirect evidence suggests that depression is characterized by reflexive responsiveness to sad emotions (reviewed by Carver et al., 2008), which, as we earlier suggested, represents a kind of impulsiveness. Several studies have also found empirical links between self-reports of aspects of impulsivity and both depressive symptoms (Clarke, 2012; d'Acremont, & Van der Linden, 2007; Karyadi & King, 2011) and diagnosis of major depressive disorder (Carver, Johnson, & Joormann, 2013; Ekinici, Albayrak, & Caykoylu, 2011; Granö et al., 2007; Henna et al., 2013; Peluso et al., 2007; Swann, Steinberg, Lijffijt, & Moeller, 2008).

These and other associations have led some to suggest that overreactivity to emotion may represent a transdiagnostic vulnerability to diverse pathologies when taken in combination with other factors (e.g., Depue & Lenzenweger, 2005; Johnson, Carver, & Joormann, 2013; Johnson-Laird, Mancini, & Gangemi, 2006). The idea that diverse aspects of impulsiveness versus self-control may be important to these very broad classes of problems is a highly intriguing one, and we will be interested in seeing how well it is supported over the coming years.

ACKNOWLEDGMENT

The current version of the chapter was prepared while Charles S. Carver was a Fellow at the Center for Advanced Study in the Behavioral Sciences, Stanford University.

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CHAPTER 2

The Self-Regulation of Emotion

Theoretical and Empirical Advances

SANDER L. KOOLE

AMELIA ALDAO

A teenager goes off on an eating binge when she feels lonely or depressed. A bank manager runs for hours each morning to take his mind off his impending divorce. A politician is struggling to hide her joy over a rival's downfall during a press conference. A CEO practices yoga to handle the stress of her demanding work life. A student works through a childhood trauma by keeping a diary on his innermost feelings.

In these and in many other situations in everyday life, people are at once engaged in the self-regulation of action (briefly, self-regulation) and the self-regulation of emotion (briefly, emotion regulation). Self-regulation and emotion regulation are often so intertwined that it is hard to demarcate where one ends and the other begins. Over the past few decades, both types of regulation have become the focus of considerable theoretical and empirical research (for reviews, see Aldao, Nolen-Hoeksema, & Schweizer, 2010; Baumeister, Schmeichel, & Vohs, 2007; Webb, Miles, & Sheeran, 2012; for a comprehensive overview, see Gross, 2015). Nevertheless, the interface between self-regulation and emotion regulation has only recently received systematic attention. Learning how self-regulation interfaces with emotion regulation is likely to generate important new insights into both processes, leading to a more in-depth understanding of how people can successfully navigate their environments. Self-regulation research may illuminate how people function as active agents in managing their emotional lives. Conversely, emotion regulation research may shed light onto how people direct their actions in emotion-arousing contexts.

In this chapter, we contribute to the ongoing integration between self-regulation and emotion regulation research by reviewing contemporary research on the self-regulation of emotion. We have a fourfold plan in this chapter. First, we consider the “emotion” part of emotion regulation, by discussing the kinds of responses that people may target in the emotion regulation process. Second, we turn to the “regulation” part of emotion regulation, by discussing the control processes that may underlie emotion regulation. Here, we review models that emphasize deliberate forms of emotion regulation (Erber & Erber,

2000; Ochsner & Gross, 2008; see also McRae, Ochsner, & Gross, 2011), as well as models that touch upon more implicit processes (Koole, Webb, & Sheeran, 2015). Third, we consider the emerging literature on training self- and emotion-regulatory skills and its implications for treating mental disorders. Fourth, we provide a summary of our main conclusions regarding the self-regulation of emotion.

THE “EMOTION” IN EMOTION REGULATION

In emotion regulation, people seek to redirect the spontaneous flow of their emotions. Emotions are understood here as people’s valenced (positive or negative) reactions to events that they perceive as relevant to their ongoing concerns. Emotions in this conception comprise multiple components, including specific thoughts and feelings, along with behavioral and physiological responses (Cacioppo, Berntson, & Klein, 1992; Frijda, 2006; Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005). Inevitably, there is overlap between emotion regulation and related constructs, such as regulating one’s moods (feeling generally good or bad, often without a clear cause; Erber & Erber, 2000) or coping with stress (feelings that arise from dealing with demanding situations; Folkman, 2010). Our definition of *emotion regulation* is therefore broad and inclusive, and subsumes the regulation of all kinds of responses that are in one way or another emotionally charged, from specific emotions such as anger or fear to global mood states and from short-lived feelings that last only a fraction of a second to chronic life stress.

What Is Special about Emotion Regulation?

One useful way to understand what emotion regulation entails is to ask whether there is something special about emotion regulation relative to other types of emotion processing. The late emotion theorist Lazarus (1991) made some insightful observations with regard to this issue. He noted that people’s primary emotional response to the situation can be qualitatively different from their secondary emotional response. The primary emotional response relates to people’s immediate, raw response to emotion-relevant events; the secondary response pertains to their ability to regulate their primary emotional response (Baumann, Kaschel, & Kuhl, 2007). Lazarus’s observations therefore helped delineate how emotion regulation differs from other emotion processes. People’s primary emotional response represents their immediate, unregulated emotional response. This primary response is succeeded by a secondary emotional response, which is driven by emotion regulation. The transition from primary to secondary emotional responding may occur so fast that people hardly notice it. As such, it can be empirically challenging to separate people’s primary emotional response from the subsequent emotion regulation processes.

At a conceptual level, however, the distinction between primary emotion generation and subsequent emotion regulation is straightforward (see also Gross & Feldman Barrett, 2011). To illustrate this distinction, Figure 2.1 displays how a prototypical emotional response unfolds in time (see Koole, 2009). To keep things simple, we focus on a single emotional response with a single maximum strength. People’s primary emotional response is represented by the *entry gradient*, or the steepness with which the emotional response reaches its full force. This primary response can be thought of as *emotional sensitivity*,

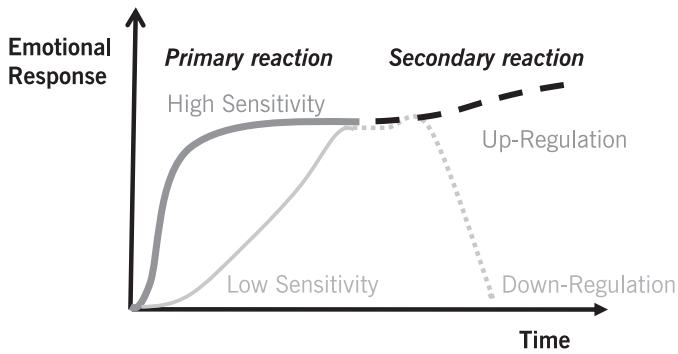


FIGURE 2.1. Hypothetical model of emotional sensitivity versus emotion regulation. From Koole (2009). Copyright 2009 by Taylor & Francis Group. Reprinted by permission.

or the ease with which people get into a specific emotional state. Emotional sensitivity is determined by any variable that influences people's initial emotional response to the situation, including qualities of the stimuli that people encounter (e.g., highly arousing stimuli are likely to trigger emotions more rapidly than mildly arousing stimuli), personal characteristics (e.g., highly neurotic individuals may enter negative states more quickly than less neurotic individuals), and the broader situation (e.g., during an economic crisis, threatening thoughts may spring to mind more easily).

The offset of the emotional response is depicted in Figure 2.1 as the *exit gradient*, or the steepness with which the emotional response returns to a neutral baseline. This return to baseline may occur without any conscious, symbolic cognitive processing. Consider, for instance, *habituation*, or the phenomenon in which a stimulus no longer elicits an emotional response after the stimulus is repeatedly presented (for a review, see Rankin, 2009). Rudimentary forms of habituation can be observed in animals such as sea slugs, which possess no more than a few hundred neurons (LeDoux, 2002). Although habituation can apparently occur without any higher-order processing, it nevertheless exerts an important influence on the exit gradient of emotional responding. As such, habituation may be one of the most elementary processes that may be recruited in emotion regulation. When more complex self-regulatory strategies fail, people may still be capable of leaving unwanted emotional states by resorting to elementary habituation processes.

Over the course of evolution, humans eventually acquired the capacity for more cognitively sophisticated forms of emotion regulation. These more sophisticated processes presumably increased the efficiency and flexibility of emotion regulation. Similar to emotional sensitivity, emotion regulation is determined by qualities of the stimuli that the person encounters (e.g., stimuli that appear at irregular intervals may be harder to adjust to than stimuli that appear at regular intervals), characteristics of the person (e.g., ruminators may dwell on negative experiences more than nonruminators), and the broader situation (e.g., when at home and among friends, people may down-regulate emotional distress more quickly than when alone in a foreign country).

Although emotion regulation refers to the effectiveness with which people exit a given emotional state, this should not be taken to mean that emotion regulation always serves to speed up this exiting process. Indeed, whereas some forms of emotion regulation are aimed at decreasing the intensity of an emotional response (*down-regulation*), other

forms of emotion regulation involve the up-regulation or maintenance of an emotional response. In the latter cases, emotion regulation is aimed at increasing the intensity of an emotional response (*up-regulation*) or at keeping the intensity of an emotional response stable over time (*maintenance*). Common to all instances of emotion regulation, however, is that they alter the steepness of the exit gradient, thus determining how long (or short) the activation of an emotional response persists over time (Koole, 2009).

The Process Model of Emotion Regulation

Now that we have determined what people's emotion regulation efforts have in common, we can ask how we can distinguish different types of emotion regulation from each other. One natural place to start is to consider which emotional responses are targeted in emotion regulation. The latter approach has been elaborated by the process model of emotion regulation (Gross, 1998b). According to the process model, emotions are generated in a sequence of four stages, and each stage may be targeted in emotion regulation. Furthermore, the process model assumes that emotion regulation gets harder as an emotional response gains momentum (Gross, 2001). The earlier people intervene in the emotion generation process, the more effective and efficient they will be in regulating their emotions.

In the first stage, the process model proposes that people encounter a situation that triggers an emotional response. If people foresee that their emotional response is undesirable, then they may try to move toward a different situation (a strategy known as *situation selection*). In the second stage, if the situation is unavoidable, people may try to change the situation (a strategy known as *situation modification*). In the third stage, people may or not attend to the emotion-relevant features of the situation. At this stage, they may use attentional deployment, by directing their attention away from the emotional stimuli. For instance, people may perform a cognitively demanding task during or after an emotional event (Erber & Tesser, 1992; Van Dillen & Koole, 2009). In the fourth stage, people generate cognitive appraisals of the situation, which may give rise to an emotional response. In this stage, people may engage in cognitive change, for instance, by reinterpreting a potentially upsetting situation as being harmless (Ochsner & Gross, 2008). In the fifth stage, people's emotions become expressed in their behavior. In this last stage, people may engage in response modulation, by directly manipulating the physiological, experiential, or behavioral expressions of their emotions. For instance, people may inhibit their spontaneous emotional expressions (Gross, 1998a) or control their breathing (Philippot, Chapelle, & Blairy, 2002).

The process model (Gross, 1998b) helped to shape and define emotion regulation research by offering a coherent logic for analyzing how different emotion regulation strategies may affect people's emotional responses. In so doing, the process model stimulated many researchers to investigate emotion regulation processes systematically. The majority of this research focused on cognitive reappraisal as a prototypical emotion regulation strategy of the cognitive change phase. The effectiveness of cognitive reappraisal has usually been compared to the effectiveness of an alternative emotion regulation strategy. This alternative strategy has often been expressive suppression as a prototypical emotion regulation strategy of the response modulation phase. Typically, cognitive reappraisal has been found to be more effective and less effortful than expressive suppression (e.g., Gross, 1998b; Richards & Gross, 2000; see also the meta-analysis by Webb, Miles, et

al., 2012). Thus, a key set of predictions of the process model has been confirmed by empirical research.

However, some of the evidence has been mixed. In particular, it appears that the effectiveness of emotion regulation strategies is not tightly coordinated with the unfolding of emotional responses, as the process model (Gross, 1998b) suggests. For instance, some forms of reappraisal are more effective when they are applied not before, but during, emotion elicitation (Urry, 2009). This contradicts the notion that it is inherently more effective to intervene earlier rather than later in emotion regulation. In a related vein, research has shown that some response modulation strategies such as controlled breathing (Philippot et al., 2002) and progressive muscle relaxation (Pawlow & Jones, 2002) are often effective in emotion regulation.

To incorporate new empirical findings, the original process model (Gross, 1998b) has been successively revised and extended. In one reformulation, Gross and Thompson (2007) recognized that “emotion generation is an ongoing process, not a one-shot deal” (p. 16). According to this view, “emotion regulation can also occur in parallel at multiple points in the emotion generative process. Using many forms of emotion regulation might in fact be the modal case” (p. 17). A subsequent update of the process model (Sheppes & Gross, 2011) replaced the notion that emotion regulation is more effective when it is instigated early during emotion generation (the *generic timing hypothesis*) with the idea that emotion-generative and emotion-regulatory processes compete with another at earlier or later stages of information processing (the *process-specific timing hypothesis*). Finally, the process model has recently been extended to explain how emotion regulation unfolds dynamically over time (Gross, 2015). The extended process model has shifted the theoretical emphasis toward processes that determine the implementation of emotion regulation strategies, or the “regulation” in emotion regulation. It is to this topic that we turn next.

THE “REGULATION” IN EMOTION REGULATION

Emotion regulation is by definition a control process. As such, emotion regulation belongs to a larger family of processes whereby people exert control over their own behavior. Indeed, modern emotion regulation research has drawn considerable inspiration from theories of human self-regulation and cognitive control (Carver & Scheier, 1998 and Chapter 1, this volume; Kuhl, 2000; Posner & Snyder, 1975). Building on these theories, researchers have proposed several models of the control processes that drive emotion regulation.

Goal-Oriented Models of Emotion Regulation

Social and personality psychologists have suggested that emotion regulation may be understood as a form of self-regulated, goal-directed behavior (Erber & Erber, 2000; Larsen, 2000; Tice & Bratslavsky, 2000). Self-regulation is conceived as a cybernetic control process that comprises two main components. First, there is a monitoring process, which compares the individual’s current state with a desired state. Second, there is an operating system that reduces any discrepancies between these two states (Carver & Scheier, 1998). Thus, when people engage in emotion regulation, they may compare their current emotional state to a desired emotional state and take appropriate steps to

bring their current emotional state closer to the desired emotional state. Self-regulatory systems of this sort are typically hierarchically ordered (Carver & Scheier, 1998), with lower-order goals geared toward concrete behavior control, and higher-order goals oriented toward more abstract principles. Accordingly, emotion regulation processes may range from the control of concrete behavior (e.g., “Take a deep breath and count to 10”) to abstract goals (e.g., “I want to be in control of my emotions”; see also Gross, 2015, for an extended discussion of this point).

A related approach has proposed that emotion regulation is governed by cognitive control processes. *Cognitive control* is a superordinate control process that allows people to override strongly activated but situation-inappropriate action tendencies (Posner & Snyder, 1975). It may be applied to emotional responses whenever hot, emotion-driven response tendencies threaten to interfere with cool, more cognitively driven response tendencies (McClure, Botvinick, Yeung, Greene, & Cohen, 2007; Ochsner & Gross, 2008; Schmeichel, 2007). Cognitive control involves two major processes that are associated with distinct neural structures (Botvinick, Braver, Barch, Carter, & Cohen, 2001). The first is a conflict-monitoring process, which constantly, efficiently, and nonconsciously scans for the presence of conflicts between alternative response tendencies. Whenever such conflicts are detected, an effortful regulatory process is engaged to override the unwanted response tendency. This override is proportional to the level of response conflict.

The link between emotion regulation and cognitive control has been confirmed by neuroimaging studies, which have observed a close correspondence between the neurological systems involved in both types of control. For instance, reappraisal of emotions, which consists of actively reinterpreting the meaning of a stimulus to lessen its emotional impact, leads to increased activation in the dorsal anterior cingulate cortex and the prefrontal cortex, areas that also support other forms of cognitive control (Botvinick et al., 2001; Miller & Cohen, 2001). Importantly, activation of these control systems leads to corresponding changes in the activity of regions such as the amygdala and the insula, which are important for assessing the emotional relevance of a stimulus (e.g., Beauregard, Levesque, & Bourgouin, 2001; for a review, see Ochsner & Gross, 2008). Such findings support the view that emotion regulation relies on cognitive control processes.

Self-regulation and cognitive control models offer converging and complementary insights about emotion regulation as a goal-directed activity. It therefore makes good sense to integrate the two kinds of models. One such integration was proposed by Webb, Schweiger-Gallo, Miles, Gollwitzer, and Sheeran (2012) in their action control perspective on emotion regulation. The action control perspective approaches emotion regulation as a general task that may be divided into subtasks. In particular, this perspective distinguishes three subtasks in emotion regulation: (1) identifying the need to regulate one's emotions, (2) deciding whether and how engage in emotion regulation, and (3) enacting emotion regulation (for a similar model, see Gross, 2015). These three subtasks may be further divided into smaller subtasks that afford a more differentiated analysis of emotion regulation processes.

According to the action control perspective (Webb, Schweiger-Gallo, et al., 2012), people's first task is to determine whether emotion regulation is needed. This task presumes that people have standards for appropriate or desired emotional responding, which they may derive from verbal instructions (e.g., Achziger, Gollwitzer, & Sheeran, 2008) or implicit or explicit beliefs about the utility of particular emotional states (Tamir, Chiu,

& Gross, 2007; Tamir, John, Srivastava, & Gross, 2007). Furthermore, people have to monitor whether their ongoing emotional responses diverge from the goal state (Etkin, Egner, & Kalisch, 2011). The task of identifying whether emotion regulation is required therefore involves many of the key processes that are emphasized by self-regulation theories (Carver & Scheier, 1998) and cognitive control theories (Botvinick et al., 2001).

When people have determined that emotion regulation is indeed warranted, the action control perspective (Webb, Schweiger-Gallo, et al., 2012) holds that the second task is to decide precisely how they will go about regulating their emotions. This decision-making process in emotion regulation has only recently begun to receive systematic attention. In a groundbreaking series of experiments, Sheppes and colleagues (e.g., Sheppes, Scheibe, Suri, & Gross, 2011; Sheppes et al., 2014; for a review, see Sheppes & Levin, 2013) demonstrated that people flexibly choose between regulation strategies to adapt to changing contexts. For instance, when emotional intensity was high, people were found to favor distraction strategies that presumably block unwanted emotions in an early processing stage. By contrast, when emotional intensity was low, people were found to favor reappraisal strategies that involve processing the meaning of the emotional situation. The dynamic and context-sensitive nature of strategy selection supports the importance of flexibility in emotion regulation (Aldao, Sheppes, & Gross, 2015; Bonanno, Papa, Lalande, Westphal, & Coifman, 2004).

Even after people have selected an emotion regulation strategy, they may still struggle to enact this strategy. According to the action control perspective (Webb, Schweiger-Gallo, et al., 2012), the enactment of emotion regulation strategies therefore forms a final, critical subtask in emotion regulation. Whether people are able to enact an emotion regulation strategy successfully may depend in part on whether people possess sufficient mental resources, such as working memory capacity (Schmeichel, Volokhov, & Demaree, 2008). In addition, the enactment of an emotion regulation strategy may depend on how well the situation lends itself to this strategy. For instance, situations with high emotional intensity are less suitable for enacting cognitive reappraisal strategies because such strategies require high levels of cognitive engagement with the situation (Sheppes & Levin, 2013). In a similar vein, some situations may offer more affordances for emotion regulation than others, for instance, by varying in the availability of social support (Koole & Veenstra, 2015). Notably, people may coordinate their personal resources to situational affordances by making *implementation plans* (plans that are tailored to the specifics of the situation). Indeed, research suggests that the efficiency of emotion regulation can be significantly enhanced through the use of implementation plans (e.g., Schweiger-Gallo, Keil, McCullough, Rockstroh, & Gollwitzer, 2009).

Beyond Goals: Need- and Person-Oriented Emotion Regulation

The preceding approaches have treated emotion regulation as an activity that is inherently directed by goals and plans that people articulate in common language, such as “I want to keep a straight face” or “If I have to take an exam, I don’t want to choke.” Much emotion regulation is indeed goal-directed in this way. However, other types of emotion regulation unfold in the absence of explicit, consciously verbalizable goals (Koole & Veenstra, 2015). For instance, the emotion-regulatory process of habituation that we mentioned earlier in this chapter requires no symbolic–linguistic processing. Another instance of emotion regulation without a clearly stated regulatory goal can be found in

people who are engaged in mindfulness practices, during which they simply observe their emotional reactions to events and do not try to change these reactions (Brown, Ryan, & Creswell, 2007). Although mindfulness does not involve any explicit goal to regulate one's emotions, it paradoxically promotes down-regulation of negative emotional states (Chambers, Gullone, & Allen, 2009). In view of these considerations, it seems useful to consider how emotion regulation may be guided by regulatory processes other than explicit, linguistically represented goals.

Need-Oriented Emotion Regulation

One very basic form of emotion regulation may occur when people are driven by the need to seek pleasure or to avoid pain. Among the first modern scholars to recognize the profound psychological significance of such hedonic needs was Sigmund Freud (1920/1961), when he proposed his classic pleasure principle. Freud regarded the pleasure principle as the prime directive of the *id*, an impulsive, child-like aspect of personality. Although Freud's personality theory soon fell into disrepute, the importance of hedonic needs continues to be recognized by modern theories of emotion regulation (e.g., Larsen, 2000; Westen, 1998).

Consistent with the notion of need-oriented emotion regulation, developmental psychologists have observed that children display early forms of self-soothing, such as sucking or turning away from angry faces, within 3 months of birth (Kopp, 1989; Rothbart, Ziaie, & O'Boyle, 1992). Such hedonic behaviors emerge regardless of caregiver intervention and well before children are capable of forming linguistic representations that can support abstract goals. Need-oriented emotion regulation may therefore be driven by elementary, sublinguistic processes. The elementary nature of hedonic needs is bolstered by the finding that, among adult participants, tendencies to approach positive affective stimuli and to avoid negative affective stimuli can be triggered automatically and without conscious intent (Chen & Bargh, 1999; Neumann, Förster, & Strack, 2003). Moreover, hedonic biases in information processing display important aspects of automaticity (Paulhus & Levitt, 1987; Roese & Olson, 2007; Tesser, 2000). These and related findings suggest that basic hedonic tendencies may remain ingrained in the human psyche throughout people's lives.

Although hedonic needs are grounded in prelinguistic processes, they may acquire the capacity to bias conscious reasoning processes (Kunda, 1990), as evidenced by numerous ego-defensive biases (Baumeister & Newman, 1994; Pyszczynski & Greenberg, 1987; Tesser, 2000). For instance, people may engage in selective criticism of threatening information (Liberman & Chaiken, 1992), make self-serving attributions (Campbell & Sedikides, 1999), or engage in downward social comparison (Taylor & Lobel, 1989). Notably, defensive bias is associated with neural activity in regions such as the ventromedial prefrontal cortex, which have been implicated in emotion regulation (Westen, Kilts, Blagov, Harenski, & Hamann, 2006). At the same time, defensive bias is not associated with activation in brain regions that support effortful self-regulation (Ochsner & Gross, 2008; Van Dillen, Heslenfeld, & Koole, 2009), suggesting that defensive bias is mediated by different processes than goal-oriented emotion regulation.

Need-oriented emotion regulation is narrow in its aims, in that hedonic needs are invariably oriented toward a positive hedonic balance in the immediate present. Because people's goals typically have a broader temporal horizon, conflicts may arise between

need-oriented emotion regulation and self-regulatory efforts that are geared toward long-term goals. Indeed, a provocative series of experiments found that emotional distress may cause need-oriented emotion regulation to take precedence over goal-directed forms of self-regulation (Tice, Bratslavsky, and Baumeister (2001). Relatedly, field studies indicate that harmful activities that people may use in need-oriented emotion regulation, such as binge eating or excessive alcohol intake, are more prevalent under high levels of emotional distress (Greeno & Wing, 1994; Mohr, Brennan, Mohr, Armeli, & Tennen, 2008).

Despite the potential for conflict with broader self-regulation processes, need-oriented emotion regulation may have important benefits. Enduring negative emotional states invoke considerable psychological costs because such states mobilize many mental and physical resources within the individual (Sapolsky, 2007). By shortening the duration of negative emotional states, need-oriented emotion regulation may allow people to preserve important resources. Moreover, even though need-oriented emotion regulation is rigid in its aims, there may be considerable flexibility in the means by which people attain hedonically favorable outcomes (Tesser, 2000).

Person-Oriented Emotion Regulation

Beyond goals and hedonic needs, emotion regulation may also be driven by integrative processes that are known as “the self” (Baumeister, 1998) or “the whole person” (McAdams & Pals, 2006). This person-oriented form of emotion regulation derives from existential/humanistic approaches to personality (e.g., Frankl, 1985; Maslow, 1968), and has deep roots in Asian philosophy (Cahn & Polich, 2006; Tang & Posner, 2009) and many religious traditions (Koole, McCullough, Kuhl, & Roelofsma, 2010). These seemingly disparate paradigms have converged on notions of self-regulatory process that go beyond fragments of the self (e.g., goals or hedonic needs), and rather encompass the functioning of the whole person (Kuhl, Quirin, & Koole, 2015). In person-oriented emotion regulation, the person’s functioning is coordinated by integrating as many subsystems and processes as possible for supporting a chosen course of action. Person-oriented emotion regulation thus supports an “inner democracy” (Kuhl, 2000), by regulating people’s actions in harmony with the totality of their inner needs, motives, and autobiographical experiences. These integrated networks of personality systems are closely connected with the autonomic nervous system. Person-oriented emotion regulation is not mediated by explicit intentions, but rather by integrated feelings or intuitions about appropriate courses of action (Kuhl et al., 2015).

There are two main ways in which emotion regulation may coordinate the functioning of the whole person. First, person-oriented emotion regulation may prevent people from becoming trapped in specific motivational–emotional states, thus promoting flexibility in global personality functioning. Flexibility in emotional functioning arises when people dynamically adjust their emotional responses to the demands of the situation, so that emotion regulation becomes contextualized (Aldao, 2013; Aldao et al., 2015; Bonanno & Burton, 2013; Kashdan & Rottenberg, 2010).

One well-documented form of situated emotion regulation is *counter-regulation*, a process whereby people switch their attention toward emotional states that are opposite in valence to emotional states that are momentarily activated (Rothermund, Voss, & Wentura, 2008). Counter-regulation has emerged as a distinct pattern in various attentional biases toward positive or negative information (e.g., Derryberry, 1993; Tugade

& Frederickson, 2004). Depending on the valence of the emotion that predominates in a given context, counter-regulation may inhibit either positive or negative emotion (Rothermund et al., 2008). If counter-regulation supports flexible self-regulation, then the pattern should be especially apparent among individuals who display high levels of self-regulatory efficiency. Consistent with this, counter-regulation is markedly stronger in individuals disposed toward flexible action control (Jostmann, Koole, Van der Wulp, & Fockenberg, 2005; Koole & Coenen, 2007; Koole & Jostmann, 2004), and markedly weaker among individuals suffering from chronic anxiety, phobia, or dysphoria (Mathews & MacLeod, 2005).

Next, by facilitating emotional changes, emotion regulation may promote coherence in personality functioning and personal growth (Baumann et al., 2007). Integration and personal growth may be promoted by emotion regulation strategies that foster deep cognitive processing of people's emotional experiences. For instance, expressive writing can turn initially disturbing emotional experiences into coherent narratives (Pennebaker & Chung, 2007), which down-regulates emotional distress and promotes self-insight (Klein & Boals, 2001). After a painful experience has been integrated into more extended cognitive networks, people may subsequently deal more effectively with similar emotional experiences. Indeed, individuals with more differentiated knowledge of self and emotion show greater efficiency in emotion regulation (Barrett, Gross, Conner, & Benvenuto, 2001; Rafaeli-Mor & Steinberg, 2002).

Person-oriented emotion regulation seeks to bridge the duality between mind and body. Indeed, bodily activities are typically integrated in emotion-regulatory activities such as meditation or mindfulness exercises. Research indicates that bodily activities such as controlled breathing or progressive muscle relaxation have a distinct influence on emotion regulation that cannot be reduced to attentional or appraisal processes (Boiten, Frijda, & Wientjes, 1994; Esch, Fricchione, & Stefano, 2003; Philippot et al., 2002; Rausch, Gramling, & Auerbach, 2006).

TRAINING EMOTION REGULATION ABILITIES

There are growing indications that people's competencies at emotion regulation can be enhanced through training (for reviews, see Baumeister, Gailliot, DeWall, & Oaten, 2006; MacLeod, Koster, & Fox, 2009; Tang & Posner, 2009). For instance, in one recent study, participants completed three structured training sessions during which they practiced reappraising negative images that were presented on a computer screen (Christou-Champi, Farrow, & Webb, 2015). A control group received no such training but otherwise followed the same procedures. Two weeks after the training, participants in the training group—relative to the control group—displayed more and faster down-regulation of negative emotion in response to aversive film clips, and reported using more reappraisal in their everyday life.

The plasticity of emotion regulation skills opens up many opportunities for research and applications. In terms of basic research, training effects may provide a new paradigm for unraveling the causal mechanisms that underlie emotion regulation. In this realm, it will be particularly important to conduct trainings that enhance emotion regulation abilities (e.g., mindfulness, heart rate variability) and the use of specific regulation strategies (e.g., cognitive reappraisal, suppression) and to test the complex interplay between

the two (Tull & Aldao, 2015). In applied terms, there has been a growing interest in incorporating explicit emotion regulation skills within psychosocial interventions targeting a number of mental health conditions. Examples include dialectical behavior therapy (Linehan, 1993) and group-based emotion regulation therapy (Gratz, Weiss, & Tull, 2015) for borderline personality disorder, acceptance-based behavior therapy (Roemer, Orsillo, & Salters-Pedneault, 2008) and emotion regulation therapy (Mennin & Fresco, 2014) for generalized anxiety disorder, and the unified protocol (Barlow, Allen, & Choate, 2004) and affect regulation training (Berking, Ebert, Cuijpers, & Hofman, 2013) for mood and anxiety disorders.

In realizing this basic and applied potential, it will be important to consider the scope of the emotion regulation skills that are to be taught. So far, training programs have exclusively focused on improving the efficiency of a specific set of emotion regulation strategies that minimize negative emotions and/or maximize positive emotions (e.g., Christou-Champi et al., 2015). This focus on hedonically rewarding emotion regulation seems theoretically rather limited given that both goal-oriented and need-oriented emotion regulation may run counter to hedonic concerns. Moreover, emotion regulation research suggests that the contribution of any particular set of emotion regulation strategies to psychological health is somewhat limited (Aldao & Nolen-Hoeksema, 2012). Instead, what seems to matter more is people's ability to flexibly and adaptively switch between emotion regulation strategies (Aldao, 2013; Aldao et al., 2015; Bonanno & Burton, 2013; Kashdan & Rottenberg, 2010; Sheppes & Levin, 2013). Such flexibility may be fostered by going beyond need-oriented (hedonic) emotion regulation toward goal-oriented and person-oriented forms of emotion regulation. In our view, it will be essential for future work to focus on not only enhancing the use of adaptive strategies but also teaching how and when to apply strategies more flexibly.

SUMMARY AND CONCLUSIONS

When people self-regulate, they are frequently confronted with potentially emotion-arousing situations. Processes of self-regulation are therefore closely intertwined with processes of emotion regulation. In this chapter, we have highlighted key aspects of the interface between self-regulation and emotion regulation by addressing some of the basic psychological processes that underlie the self-regulation of emotion.

In the first section of this chapter, we considered the "emotion" in emotion regulation, or the targets of emotion regulation. We conceived of emotion regulation processes broadly, as the processes whereby people regulate any type of affective or emotionally charged response, including attention, cognitive representations, and physical or behavioral responses. Emotion regulation targets the offset of emotional responding and is therefore distinct from processes involve the onset of emotional responding, or emotional sensitivity. The process model of emotion regulation has offered a pioneering analysis of the various emotional response systems that people may target for regulation. The model suggests that people may regulate their emotions by selecting or altering emotion-eliciting situations, deploying their attention elsewhere, changing their cognitions about the situation, or modulating their overt emotional responses.

In the second section of this chapter, we took a closer look at the "regulation" in emotion regulation by reviewing the types of control processes that people may use during

emotion regulation. Control processes determine how people monitor whether emotion regulation is required and how people implement specific acts of emotion regulation. We distinguished between three kinds of control processes, which vary in their level of complexity. As shown in Table 2.1, goal-oriented emotion regulation operates at an intermediate level of complexity and is governed by explicit, linguistically verbalizable goals. In goal-oriented emotion regulation, people have to (1) identify whether their emotional responses fall short of a goal state, (2) determine whether and how they are to engage in emotion regulation, and (3) enact the chosen emotion regulation strategy.

Emotion regulation research has mostly concentrated on goal-oriented emotion regulation. However, some control processes in emotion regulation may be either too basic or too complex to be represented by single linguistic goals. At a basic level, emotion regulation may be driven by fundamental hedonic needs to maximize pleasure and to minimize pain, which give rise to defensive behavior, such as self-serving attributions. Such need-oriented emotion regulation is rooted in visceral needs rather than explicit, linguistically represented goals. By contrast, other forms emotion regulation are driven by more complex processes than single goals because they involve a global balance between multiple self-aspects that exist within the person. The extended functions of emotion regulation therefore encompass not only specific goals and tasks but also hedonic needs and global personality functioning.

In the third section of this chapter, we considered research on training on emotion-regulatory abilities. Although our discussion was brief, we noted the considerable potential of this line of research. Emotion regulation researchers have much to gain from studying how emotion regulation training studies can afford new insights into the causal mechanisms of emotion regulation. On the other hand, applied researchers can incorporate those insights into treatment development and delivery.

The study of emotion regulation has broad implications for psychologists' understanding of self-regulation processes. In recent years, psychological theories have predominantly emphasized goals as the core mental representation that drives human self-regulation (Austin & Vancouver, 1996; Baumeister et al., 2006; Carver & Scheier, 1998). However, as we indicate in this chapter, goals only account for a limited number of emotion regulation processes. Some forms of emotion regulation operate on levels that are

TABLE 2.1. Hierarchical Model of Control Processes in Emotion Regulation

High complexity

Person-oriented emotion regulation:

Maintain global emotional balance (integrate multiple emotional directives)

Intermediate complexity

Goal-oriented emotion regulation:

Maintain single emotion regulation goal

Low complexity

Need-oriented emotion regulation:

Maximize pleasure, minimize pain

more elementary than goals, and appear to be driven by powerful hedonic needs. Other forms of emotion regulation transcend single goals and seek to forge a union between passion and reason, mind and body, and other dualities that may divide the human psyche. A complete analysis of human self-regulation therefore requires understanding how people flexibly navigate between their emotion regulation goals and emotional needs, and integrate these as wholly functioning persons. We hope that this chapter stimulates integration among the various traditions in the study of self-regulation and emotion regulation.

ACKNOWLEDGMENT

The authors gratefully acknowledge the support of a Consolidator Grant from the European Research Council (ERC-2011-StG_20101124) to Sander L. Koole.

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CHAPTER 3

Self-Control and Ego Depletion

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SELF-CONTROL

Imagine sitting alone in a room and in front of you is a plate of freshly baked chocolate chip cookies and a bowl of raw radishes. You are instructed to ignore the cookies and to eat the radishes. You might guess that this takes exertion of self-control. You would be right. This exact experiment was performed and showed that not only does resisting such a temptation requires self-control but also that use of self-control in one task makes it more difficult to use it in another, subsequent task, highlighting that self-control is necessary in multiple domains and is somewhat limited (Baumeister, Bratslavsky, Muraven, & Tice, 1998).

Self-control, defined as the ability to alter one's thoughts, emotions, and behaviors or to override impulses and habits, allows one to monitor and regulate oneself to meet expectations. These expectations can be imposed by society or by oneself, and include laws, norms, ideals, goals and other standards. For example, people are expected to be polite to their bosses even when their bosses have been rude, and this politeness requires self-control. People are expected to stop at red lights, even if no other cars are around, the light is annoyingly long, or they have somewhere important to be. Following this law, set in place to keep order and protect citizens, often requires self-control. Self-imposed standards that require self-control may include health criteria such as exercising at least four times a week or not eating sweets. Self-control is important not only for following specific rules and meeting specific standards, but also for succeeding in myriad broad domains: academic excellence, occupational accomplishments, stable and satisfying relationships, good adjustment, mental and physical health, overcoming prejudice, resisting addiction, regulation of criminal and violent acts, positive emotionality, and longevity (Baumeister, Heatherton, & Tice, 1994; Daly, Baumeister, Delaney, & MacLachlan, 2014; Deary, Weiss, & Batty, 2010; Finkel, DeWall, Slotter, Oaten, & Foshee, 2009; Gottfredson & Hirschi, 1990; Mischel, Shoda, & Peake, 1988; Moffitt et al., 2011; Muraven, 2008, 2010; Shoda, Mischel, & Peake, 1990; Tangney, Baumeister, & Boone, 2004).

Differences exist not only in chronic (trait) self-control (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012; Tangney et al., 2004), but also in situation-dependent (state) self-control abilities (Hofmann, Schmeichel, & Baddeley, 2012). These self-control abilities rely on a limited resource, akin to energy, that, when used repeatedly, the body and brain seek to conserve. The *strength model* of self-control posits that this resource can become depleted after intense use, but also be strengthened with extended use over time, much like a muscle (Muraven & Baumeister, 2000). *Ego depletion* refers to the state of diminished self-control resources, when one cannot or does not successfully implement further control. In homage to Freud (1923/1961a, 1933/1961b), *ego* alludes to this resource as a part of the self and as tied to energy. Accordingly, we review the core ego depletion findings and their implications in cognition and decision making, emotion and impulse regulation, health and fitness practices, overcoming addiction, and risky behavior. We end the chapter with findings that suggest how one can overcome self-control deficits in the short and long term.

EGO DEPLETION

Self-control resources are used in performance of countless tasks and functions, which can lead to or be affected by ego depletion. Research has shown that exerting self-control in one context impairs subsequent control in other contexts (e.g., Baumeister, Vohs, & Tice, 2007). Experimentation using the *dual-task paradigm* has allowed for such discoveries. In these experiments, participants perform two separate, unrelated tasks that both require self-control. Among these tasks are the Stroop color–word task, suppressing emotions while watching upsetting films, suppressing thoughts, the cold pressor task (keeping one’s arm in ice water), writing or typing under difficult constraints, forming and then breaking habits, and persevering even when bored or frustrated. Consistently, participants performed more poorly on the second task, suggesting that a limited resource had been expended during the first task, leaving less energy or decreasing motivation for the second (Baumeister et al., 1998; Hagger, Wood, Stiff, & Chatzisarantis, 2010; Muraven, Tice, & Baumeister, 1998; Schmeichel, 2007).

Self-control is used to override automatic impulses and behavior, and as such, depletion affects controlled processes in particular. This effect on controlled processes suggests that self-control depletion leads to a reduction of top-down control. Accordingly, people rely on habits, largely automatic responses, when their self-control is low (Neal, Wood, & Drolet, 2013). Likewise, one must use self-control to break or change a habit. For example, automatic prejudiced thoughts are restrained by self-control and depleted people make more prejudicial judgments than other people (Muraven, 2008). In general, people successfully suppress automatic and disturbing thoughts of death; however, when people are depleted, these thoughts become more prominent in the conscious mind (Gailiot, Schmeichel, & Baumeister, 2006). Similarly, self-aggrandizing thoughts that are usually inhibited in accordance with a cultural preference for modesty emerge in depleted egotists (Paulhus & Levitt, 1987; Vohs, Baumeister, & Ciarocco, 2005).

Because action and initiative also take self-control and energy, one may default to passivity when self-control resources are low. Experiments have shown that depletion leads to increases in diverse passive behaviors, including working less creatively, postponing decisions, staring at a blue screen on a broken computer before asking for help, eating

more peanuts when hungry only if they have no shells to remove, and collecting fewer resources for a building task (Vohs, Baumeister, Vonasch, Pocheptsova, & Dhar, 2014). Depleted people also give up more quickly on difficult tasks (Baumeister et al., 1998), especially if physical stamina or pain is required (Muraven et al., 1998; Vohs et al., 2008). These are just a few examples of how deficits in self-control can lead to a breakdown in productive and healthy functioning, which we discuss at length in subsequent sections.

Whether doing a tricky math problem, trying not to raise one's voice when upset, or resisting a beer to consume a healthier juice drink instead, one must use self-control to facilitate numerous favorable outcomes and to avoid a vast array of negative ones. We next review some of the effects of self-control deficits or ego depletion in five main domains: controlled cognition and decision making, emotion and impulse regulation, health and dieting, substance abuse and addiction, and risky behavior.

Controlled Cognition and Decision Making

As self-control is necessary for controlled but not for automatic processes, ego depletion disproportionately affects higher-level intellectual activities. For example, depletion does not significantly impair simple cognitive processes, such as rote memorization and citing general knowledge, but it does impair controlled and effortful cognition, such as logical reasoning, deduction, and making inferences from a reading (Schmeichel, Vohs, & Baumeister, 2003). Ego depletion can negatively affect higher-level cognitive processes due to its detrimental effects on regulation of test anxiety. For example, one set of studies showed that depleted participants performed more poorly on verbal learning and mental arithmetic tasks because they lacked the self-control to focus attention, suppress test anxiety, and ignore distracting worries, than did nondepleted participants (Bertrams, Englert, Dickhäuser, & Baumeister, 2013).

Furthermore, without self-control, people naturally rely on intuitive thinking and heuristics, or less effortful mental shortcuts. This is highlighted in a series of studies showing that depletion impairs performance on the Cognitive Reflection Test (CRT; Frederick, 2005), which includes three questions for which an intuitive, but incorrect, answer immediately comes to mind (Vonasch, Maranges, & Baumeister, 2015). Here is one of those CRT questions: A bat and a ball cost \$1.10. The bat costs \$1.00 more than the ball. How much does the ball cost? ____ cents." The intuitive answer that commonly comes to mind is 10 cents. However, the correct answer is 5 cents. Depleted participants were more likely than nondepleted participants to give the intuitive but wrong answer. The implication is that the depleted mind was content to stay with the quick and obvious answer rather than thinking the problem through carefully.

Decision making is also depleting, so that the same self-control resource is used for self-control and for making choices (Vohs et al., 2008). Part of the reason that choices are depleting is that careful consideration of alternatives and choosing among them (making trade-offs) require one not merely to rely on heuristics, but rather to rely on higher-level processing and weighing of information (Wang, Novemsky, Dhar, & Baumeister, 2010). Exerting self-control before decision making can lead to less rational choices, dependence on reference points, a lack of compromise, and increased susceptibility to irrational bias by logically irrelevant information (Pocheptsova, Amir, Dhar, & Baumeister, 2009).

As mentioned earlier, without ample self-control resources, people rely more heavily on heuristics, especially in decision making. For example, depleted people are more likely

than nondepleted people to rely on the recognition heuristic—or the assumption that if term, idea, or thing *a* is recognized more easily than *b*, then *a* is the more valuable or the correct choice (Pohl, Erdfelder, Hilbig, Liebke, & Stahlberg, 2013). Specifically, depleted participants tended to assume that a city they had heard of had a larger population than a city whose name they did not recognize.

Similar cognitive shortcuts resulting from depletion, such as reliance on anchors—initial judgments, allocations, or default positions—and situational cues, may underlie decision making deemed selfish, such as strategies in fiscal games. For example, a series of studies using dictator games, in which participants can give or take money from another person, found that depleted participants, relative to nondepleted participants, not only kept more money for themselves when they started with the money but also took less when their partners started with the money (Banker, Ainsworth, Baumeister, Ariely, & Vohs, 2015). In both cases, depleted participants made smaller changes to the initial allocation than nondepleted participants. Furthermore, one of these studies showed that depleted participants deviated less from original anchors on a price estimation task, relative to nondepleted participants, underscoring that the mechanism at play in similar competitive contexts is likely reliance on proximal situational cues rather than selfish interest *per se*. This “sticky anchor hypothesis” fits with other findings that depletion leads to reliance on heuristics and with findings that depleted people give more to charity based on situational cues (Fennis, Janssen, & Vohs, 2009).

Not only does decision making suffer when one is depleted, but decision making itself can be depleting. One of the earliest studies (Baumeister et al., 1998) to suggest this found that people who wrote an essay arguing against their own beliefs and were in a high-choice condition (i.e., believed that they chose to write the counterattitudinal essay) were significantly more depleted than those in the low-choice condition (i.e., given no choice about their essay assignment). Further support has been furnished by studies showing that diverse decision-making contexts, such as consumer decisions and college course selection, deplete self-control resources (Bruyneel, DeWitte, Vohs, & Warlop, 2006; Vohs et al., 2008). Moreover, self-control depletion can lead to increased passivity. For example, when people must make multiple decisions when purchasing a complex product, such as a custom car or suit, they are more likely to treat the standard options as heuristics, relying on these as default choices (Levav, Heitmann, Herrman, & Iyengar, 2010).

Impulse and Emotion Regulation

Monitoring and overriding automatic responses require self-control. Regulating emotions and impulses, common automatic responses, can be depleting and may be more difficult when you are depleted. Now, imagine that you have to exert control in order not to share a piece of information that is important to your personal identity. You might think this would be depleting, and you would be right. This requires top-down control, constant monitoring and editing what you say or do, and therefore self-control. For example, having to conceal information about your sexuality during an unrelated conversation leads to depletion and less monitoring in a subsequent interaction (in this case, less polite responses to an obnoxious e-mail) (Critcher & Ferguson, 2014).

Depletion makes control of many different impulses, including unethical risks, use of profanity, and disobeying simple instructions (e.g., to refrain from talking), more

difficult (Gailliot, Gitter, Baker, & Baumeister, 2012). Depletion inhibits inhibition. This disinhibition leads to increases in aggression in numerous contexts. Depleted persons, for example, were more likely to punish another person with extremely spicy hot sauce, loud noise blasts, and career-damaging evaluations, and reported stronger intentions to physically hurt someone who made advances on their girl/boyfriends. Furthermore, people reported experiencing depletion more intensely after inhibiting aggressive impulses (DeWall, Baumeister, Stillman & Gailliot, 2007)

Similarly, regulation of emotions can be depleting. For instance, suppressing emotion caused subsequent declines in performance on a memory game that required controlling attention (Pu, Schmeichel, & Demaree, 2010). Ego depletion has also been associated with intensification of a broad array of emotions, moods, and desires (Baumeister, Ramanathan, Mead, Schmeichel, & Hofmann, 2015; Marcora, Staiano, & Manning, 2009). Stronger reactions to both positive and negative stimuli and more intense desires result from depletion. For example, depleted people report an intensification of feelings and ratings for negative pictures and for neutral stimuli, and report more enjoyment of chocolate than nondepleted persons. When primed with relevant affect, people correctly identified more emotion-related words, and depletion intensified this effect. Maranges, Schmeichel, and Baumeister (2016) have shown that depletion leads to an intensification of pain during the cold pressor task and increased reliance on negative feelings in semantic processing. Additionally, depleted participants relied more on negative emotional associations by which to match words than their nondepleted counterparts.

Dieting, Health, and Fitness

Whether forcing oneself to go to the gym rather than sit on the couch, putting down the donut and picking up the apple, or chewing the piece of nicotine gum instead of smoking the cigarette, one must rely on self-regulatory resources to maintain a healthy lifestyle. Healthy eating, for instance, requires a consistent commitment to resist tempting cuisine and instead consume more nutritious, often less desirable, foods. This sort of inhibition and directed action can be depleting. In the paradigmatic depletion study with which we began this chapter, participants were randomly assigned to one of two taste test conditions. In one, they were required to resist freshly baked cookies and instead eat plain radishes and, in the other, they were allowed to eat the cookies and leave the radishes untouched. Those who had to resist the cookies gave up on a difficult (actually, impossible) tracing puzzle much more quickly than those who were allowed to indulge themselves (Baumeister et al., 1998). Furthermore, depleted dieters consume more cookies, candy, and other snack foods than nondieters (Vohs & Heatherton, 2000). In another experiment, people who were depleted by having to deal with stereotype threat indulged in unhealthy eating as well (Inzlicht & Kang, 2010).

Because depletion-based disinhibition leads to reliance on automatic responses, times of low self-control leave individuals with problematic eating habits more vulnerable to temptation than habitually healthy eaters. When people are depleted, their implicit and automatic, rather than explicit, attitudes about candy predict how much of it they will eat (Hofmann, Rauch, & Gawronski, 2007). This fits the general pattern that depletion weakens top-down mental control, allowing automatic, unconscious, and situational causes to guide behavior. However, increased susceptibility to social cues underlies an

exception to the general finding that depleted people prefer unhealthier, tasty foods. Specifically, when depleted people were told that their peers preferred healthier options, they ate more of these foods than their nondepleted counterparts (Salmon, Fennis, de Ridder, Adriaanse, & de Vet, 2014).

In addition to consumption of nutritious foods, physical exercise is important for good health and well-being. Regular fitness training requires self-control and self-control bridges the gap between fitness goals, plans, and actual regular exercise (Sniehotta, Scholz, & Schwarzer, 2005). Sports research has shed light on how self-control depletion can adversely affect athletic performance as well. For example, in one set of studies, participants who were depleted with a difficult transcription task (e.g., copying over a text and omitting all *e*'s and *n*'s) performed more poorly at basketball and dart-shooting tasks than nondepleted participants who performed an easy transcription task (e.g., had no special directions), particularly for people high in athletic performance anxiety (Englert & Bertrams, 2012). Of note, self-control overall can improve with consistent physical exercise (Oaten & Cheng, 2006c).

Substance Abuse and Addiction

Use and abuse of alcohol and drugs often result from self-control failure and, likewise, are largely predicted by low self-control. Recent theorizing suggests that addicts use self-control both to use and to stop using drugs, although the entirety of this argument is beyond the scope of this section (see Baumeister & Vonasch, 2015; Vonasch, Maranges, & Baumeister, in press). Self-control resources are employed to resist alcohol, which means that resistance becomes more difficult when self-control is depleted. Although, typically, the desire for alcohol in regular drinkers is not overpowering (Hofmann, Vohs, & Baumeister, 2012), frequent mild desires can eventually lead to problematic consumption. All it takes is one moment of weakness—which depletion provides. An experimental study by Muraven, Collins, and Nienhaus (2002) found that men with alcohol-use problems consumed more alcohol when depleted, even though they were expecting a (simulated) driving test afterward. These findings were replicated in a sample of male and female social drinkers: Those who suppressed their emotions while watching an evocative film clip became depleted and drank more alcohol than their nondepleted counterparts (Christiansen, Cole, & Field, 2012). In addition to consuming more alcohol when depleted, drinkers also become depleted when resisting a drink. For example, problem drinkers performed worse on a handgrip or self-stopping task after sniffing alcohol than when they sniffed just water (Muraven & Shmueli, 2006).

Many people have experienced a difficult morning without their cup of coffee or tea, so it is easy to acknowledge anecdotally how caffeine improves self-control and how resisting it takes self-control. Caffeine, a widely available stimulant with a relatively low addiction danger, can be healthy when consumed with temperance, but it can be unhealthy in large quantities, often causing anxiety (Sawyer, Julia, & Turin, 1982). We have begun to study the effects of caffeine on self-control. A recent study has shown that people who consumed caffeinated tea before writing an essay with difficult directions, which requires self-control, performed better on a subsequent cognitive word task relative to those whose tea was caffeine-free (Maranges & Baumeister, 2015). During stressful self-control-demanding exam times, university students rely more heavily on caffeine (Oaten & Cheng, 2006a).

A yet stronger stimulant, nicotine, serves as an inherent reward to smokers and has been shown to reduce depletion itself (Heckman, Ditte, & Brandon, 2012). Furthermore, to resist smoking requires self-control. People in one study had to use self-control to resist either sweets or vegetables. Those who resisted sweets became depleted and were more likely to smoke during a break as compared to those who resisted vegetables (Shmueli & Prochaska, 2009). Smokers who tried to quit while also dieting were less likely to quit than nondieting smokers (Patten & Martin, 1996).

The same resources necessary to resist alcohol or legal stimulants are necessary to fight against initial consumption of and addiction to illegal substances. One study found that cocaine users required more time to inhibit automatic behaviors and responses, indicating low self-control (Fillmore & Rush, 2002). At present, it is not clear whether low self-control predisposes one to cocaine use or, conversely, cocaine use causes low self-control (or both). Cocaine addicts also showed difficulties in regulating emotions and impulses in their first week of abstinence and continued to show impulse disinhibition (Fox, Axelrod, Paliwal, Sleeper, & Sinha, 2007). Even so, it is not clear whether those signs of poor self-control indicate predisposing factors or lingering consequences of sustained cocaine use.

Laboratory experiments on the direct effects of depletion on hard drug use are far more limited due to moral and legal obstacles that prevent such research. Therefore, here we review some of the naturalistic links between self-control and drug use. For example, a lack of social self-control in high-risk youth predicted a month's worth of cigarette smoking, alcohol consumption, marijuana use, and hard drug abuse when researchers controlled for personality disorders and demographic variables (Sussman, McCuller, & Dent, 2003). Trait self-control has not only been found to predict adolescent drug use directly but also to mediate the effects of parenting style and temperament on adolescent drug use (Chapple, Hope, & Whiteford, 2005; Wills & Dishion, 2004; Wills & Stoolmiller, 2002).

Risky Behavior

Self-control enables people to reduce and avoid risky behaviors such as unsafe sex, overspending, gambling, and crime, but this means that these behaviors increase when self-control is low. The impulse to engage in sexual activities is one of the strongest and most primal desires. In order to practice abstinence or safe sex, though, automatic responses must be monitored, overridden, and delayed, which require self-control. Restraining oneself from expressing sexual thoughts and behavior requires self-control (Gailliot, Baumeister, et al., 2007). Specifically, when looking back on times of sexual indulgence, people spontaneously recalled having used up their self-control prior to their sexual encounter. Depleted participants used more sexual words in an essay than nondepleted participants, and depleted young men reported being more likely to engage in acts of infidelity than their nondepleted counterparts. Depleted sexually inexperienced couples engaged in more sexual behavior in the laboratory than depleted experienced couples and nondepleted couples.

Some people feel a similarly strong impulse to shop, so self-control is necessary to resist such overspending or impulsive buying. Furthermore, irresponsible purchasing can be financially costly and lead to manifold repercussions, and knowing this encourages

people to be careful about their spending decisions. Basic consumer decisions are about not only choosing the normatively better item but also considering the affordability of that item. Accordingly, depleted people are less able to regulate their shopping habits (Roberts & Manolis, 2012). For example, in one set of studies, participants who were instructed to suppress thoughts and feelings or exaggerate happy emotions were more willing to pay higher prices for items, actually purchased more items and spent more money, and were more likely to make impulsive purchases relative to their nondepleted counterparts (Vohs & Faber, 2007).

The impulsivity and risk taking that result from low self-control are also important factors in gambling behavior (Blaszczynski, Steel, & McConaghy, 1997; Corless & Dickerson, 1989; Freeman & Muraven, 2010; Rugle & Melamed, 1993; Steel & Blaszczynski, 1998). Researchers found that low trait self-control and high risk taking predicted increased gambling (Arneklev, Grasmick, Tittle, & Bursik, 1993). In another study, Loxton, Nguyen, Casey, and Dawe (2008), controlling for alcohol use, found that those who scored higher on the Barrat Impulsiveness Scale, indicating poorer impulse control, were also problem gamblers according to the South Oaks Gambling Screen. Many studies have replicated this correlational relationship with self-report measures of self-control and of gambling behavior (Baron & Dickerson, 1999; Corless & Dickerson, 1989; Duckworth & Kern, 2011; Martins, Tavares, da Silva Lobo, Galetti, & Gentil, 2004; McQuade & Gill, 2012; O'Connor & Dickerson, 2003; Rugle & Melamed, 1993; Steel & Blaszczynski, 1998), but laboratory experiments on depletion and gambling are limited.

Low self-control has been deemed the biggest factor in criminality (Gottfredson & Hirschi, 1990). This "general theory of crime" inspired considerable research on self-control and crime. For example, one study, which followed 1,500 adults in the Midwest, found that low trait self-control significantly predicted more imprudent behaviors (e.g., drug and alcohol use, skipping work, urinating in public, having accidents, driving unsafely) and crime (e.g., stealing from or assaulting another person) (Evans, Cullen, Burton, Dunaway, & Benson, 1997). That is, the lower an individual's self-control, the more likely he or she is to engage in risky behaviors, commit a crime, and to be imprisoned. Prisoners' low self-control predicted negative social interactions with prison staff, substance abuse, assaults against staff, carrying weapons, punishments, infraction history, and assault against another inmate (DeLisi, Hochstetler, Higgins, Beaver, & Graeve, 2008).

Within the laboratory, both trait low self-control and ego depletion have been tied to student participants' cheating, including lying about extra time taken on tasks (Muraven, Pogarsky, & Shmueli, 2006). Other studies have replicated these findings and underscore that resisting unethical behavior, such as cheating, both requires and depletes self-control resources (Gino, Schweitzer, Mead, & Ariely, 2011). In these studies, participants controlled and diverted attention away from distracting stimuli (i.e., ignored words on a screen while watching a woman's face), wrote an essay with challenging restrictions, and performed the Stroop task, all of which led to cheating.

Thus, a great deal of research has shown that low self-control and ego depletion can lead to decrements in important personal and prosocial behaviors, including higher-level cognition, impulse and emotion regulation, dieting and exercising, resisting drugs, and avoiding risk and crime. How is it that our self-control, a limited resource key in so many

domains, is not constantly depleted and people are able to function relatively well? How can people fight against depletion in the short term and the long term?

OVERCOMING EGO DEPLETION AND IMPROVING SELF-CONTROL

The strength model of self-control compares self-regulatory abilities to a muscle, which provides a theoretical framework and a subsequent body of research that can largely answer these questions. Like a muscle, self-control can become depleted with intense use. This is not to say that the entirety of the limited resource can be used up on a 10-minute laboratory activity—that would not make it a very adaptive trait after all—but rather that the body and brain seek to conserve it as per our goals and motivations. For example, most 22-year-old girls cannot deadlift more than 100 pounds, yet in 2012, one young woman in Virginia lifted up an entire BMW to free her beloved father from under it (Newcomb, 2012). This is one of many examples that highlights how individuals can use their full physical strength under extreme conditions; however, in general, human bodies send signals to refrain from such use. Likewise, with acute cues and motivators, people can overcome their self-control depletion. Self-control abilities also resemble a muscle in that they can be strengthened over time with practice and exercise. Next we outline how to offset the detrimental effects of ego depletion in the short term and how to improve one's self-control strength over time.

Offsetting Depletion in the Short Term

Research has furnished multiple ways to motivate people to continue exerting self-control and to replenish somewhat the resource itself. Usually, these studies involve the dual-task paradigm—one self-control task followed by another, unrelated one—interrupted by or following another manipulation, which serves as the motivator or refresher. A perennial theoretical question is whether these factors actually replenish the resource, thus restoring self-control to its full powers, or merely encourage the person to allocate and expend more resources despite having already expended some.

Positive Affect

Feeling good has been shown to fend off depletion effects (Tice, Baumeister, Shmueli, & Muraven, 2007). Receiving a small gift or watching a comedy video offsets the effects of depletion. Similarly, depleted smokers who watched a comedy video smoked less than their depleted counterparts who did not get a boost in positive affect (Shmueli & Prochaska, 2012). Even implicit positive emotion sparked by subliminal positive messages counteracted depletion (Ren, Hu, Zhang, & Huang, 2010).

Religion

Prayer before using self-control to restrict emotional reactions to a funny video improved performance on the Stroop task, for example (Friesse & Wänke, 2014). Likewise, reading words related to religiosity, such as *divine* or *God*, led to resistance against depletion effects for those who had to use self-control on a prior task and led to better baseline

self-control performance among those who were not depleted (Rounding, Lee, Jacobson, & Ji, 2012).

Self-Affirmation

Bringing to mind the self and its ideals has been shown to neutralize depletion effects. For example, thinking of the values most important to oneself or engaging in self-affirmation eliminated the depleting effects resulting from a challenging writing task or stifling emotional reactions (Schmeichel & Vohs, 2009). Tapping into naturalistic use of self-control, to monitor and edit emotions, thoughts, and behavior to meet a standard, researchers showed that keeping in mind one's own standards counteracts depletion (Wan & Sternthal, 2008). Persons who had to use self-control on a prior activity and completed a phrase-making task with the word *I* performed better than those who never referred to the self (Alberts, Martijn & de Vries, 2011).

Agency

Activation of agentic responses can counteract depletion, emphasizing that motivations interact with self-control expenditures. Prompting people to take responsibility for their actions and to feel autonomous can stave off depletion effects, for instance (Muraven, Gagné, & Rosman, 2008). Reading an inspiring story of an athlete who overcame many obstacles to become a world record holder also does so (Martijn et al., 2007). Having participants make statements related to perseverance, (e.g., "He keeps going") led to better physical stamina on the handgrip task after a difficult puzzle task (Alberts et al., 2007). Within the same study, researchers provided some participants with a cue of a man in a business suit and the words "You can do it." These participants fared better in physical exertion after an attention control task than did nondepleted participants.

Power

A position of leadership and power over a subordinate during a laboratory activity led to better performance on a self-control task and counteracted the effects of depletion (DeWall, Baumeister, Mead, & Vohs, 2011). However, when participants were presented with an additional test for which they had not planned, they performed worse and showed deficits in self-control abilities. This indicates that the antidepletion effects of power are somewhat short-lived and that situational incentives encourage persons to expend diminishing resources rather than conserve them.

Construal Level

Thinking about local, specific, and tangential attributes of a situation comprise low-level construals, whereas attending to superordinate, global, and primary aspects of a situation comprise high-level construals. As mentioned earlier, self-control depletion diminishes top-down control, which is evident in a shift toward low-level construals (Bruyneel & DeWitte, 2012; Wan & Agrawal, 2011). Consistent with low-level construal, time seems to move more slowly after having used self-control resources (Vohs & Schmeichel, 2003). It should be the case, then, that depletion effects can be offset by high-level construals.

And this is the case: Several studies have shown that inducing high-level construals by asking *why* questions rather than *how* questions or instructing participants to generate superordinate category labels improved self-control in both depleted and nondepleted participants (Fujita, Trope, Liberman, & Levin-Sagi, 2006).

Money

Cues that remind people of money, such as income-related phrases, narratives about growing up wealthy, or handling play money, activate proactive responses and goal pursuit (Vohs, Mead, & Goode, 2006). This occurs even when the money is not directly related to the task at hand or presented as a reward. Another study showed that unscrambling money-related phrases led to better performance on the Stroop task among depleted participants (Boucher & Kofos, 2012).

Beliefs about Self-Control

Whether one believes that self-control is limited affects how well one does on self-control tasks. Personal theories about self-control resources can be manipulated, for example, with a questionnaire highlighting either a limited-resource model (e.g., “Working on a strenuous mental task can make you feel tired, such that you need a break before accomplishing a new task”) or a nonlimited-resource model (e.g., “Sometimes, working on a strenuous mental task can make you feel energized for further challenging activities”; Job, Dweck, & Walton, 2010). Both preexisting and manipulated implicit theories about self-control resources have been found to affect self-control outcomes, including Stroop task performance, intelligence quotient test problems, and goal pursuit (Job et al., 2010; see also Martijn, Tenbült, Merckelbach, Dreezens, & de Vries, 2002).

Planning

Efficient planning diminishes the need to make new decisions at every step of a challenging process and provides a set of custom heuristics that frees up self-control resources. For instance, in one set of studies, unless participants formed implementation intentions (simple plans in the form of “If X, then I do Y”; Gollwitzer, 1999), an initial self-control task led to deficits in a second self-control task (Webb & Sheeran, 2003). Particularly, participants made implementation intentions to prepare for the Stroop task, then showed less depletion on a second task. In a follow-up study, implementation intentions helped participants perform well on the Stroop task after an initial depleting task that was done without implementation intentions.

Action Orientation

People who take initiative to respond to demanding situations decisively and in order to promote change, or are *action-oriented*, fare better on tasks requiring self-control after a depleting task than those who are more preoccupied, hesitant, and prefer to maintain the status quo, or are *state-oriented* (Gröpel, Baumeister, & Beckmann, 2014). Action-oriented participants performed better than state-oriented people on an attention task after physical exercise and were better able to distinguish flashes of light as discreet rather

than a seemingly constant light, even when the flash rate was faster. The rate at which light flashes occur so quickly that one sees them as a single light is known as the *critical fusion frequency*. A third study showed that action-oriented participants also performed better than state-oriented people on the Stroop task after completing a difficult sensorimotor task. Presumably, action-oriented people fared so well because they are better at self-motivating (Kuhl, 1994). Perhaps cultivating an action-oriented drive or personal motivation could benefit people in overcoming depletion effects. However, it should be noted that some depletion research indicates that although conserving resources on an initial task and autonomous motivation allows people to stave off depletion effects in the short run (e.g., on a second self-control task), these factors do not counter depletion in the longer run (e.g., on a third or fourth task that requires self-control) (Graham, Bray, & Ginis, 2014).

Rest and Glucose

The situational cues and manipulations covered so far in this section likely motivate people to continue expending self-control resources as opposed to actually replenishing or increasing the resource. On the other hand, evidence suggests that both rest and consumption of glucose (a simple sugar) somewhat restore self-control resources after depletion. In a series of studies, Gailliot, Baumeister, and colleagues (2007) provided evidence that low levels of blood glucose predicted poor performance at self-control, whereas getting a dose of glucose helped to counteract the effects of depletion. (That investigation also reported that glucose levels decreased from before to after exerting self-control, but that finding has not been replicated reliably.) Still, for our present purposes, the key point is that ingesting glucose counteracts many effects of depletion. If glucose is indeed part of the resource involved in self-control, then consuming some glucose may well actually replenish it.

Resting after using self-control on one task and before using it on another task has been shown to neutralize the effects of ego depletion. For example, participants in one study were asked to stand on one leg and count down from 2,000 by sevens, an extremely taxing activity. Before performing the handgrip task, participants took a break, during which they answered easy questions on filler questionnaires. Those who were given a 10-minute break, as opposed to just a 1- or 3-minute break, performed just as well as nondepleted participants on the second task, suggesting that the break restored some self-control resources (Tyler & Burns, 2009).

How can people use these findings to fight off depletion in everyday life? There are multiple answers. Keeping in mind what is important—religion, values, and goals—and reminding oneself, “You can do it,” to activate agentic responses may serve to counteract depletion effects. Although we hope that this chapter has outlined the limited nature of self-control, we also acknowledge that beliefs about self-control abilities as unlimited counteract depletion effects. Likewise, thinking about *why* rather than *how*, or thinking in higher-level construals, can combat self-control depletion. Resting or consuming glucose between activities that require self-control seems to replenish this resource.

If one feels depleted at the end of the day but knows it would be better to go to the gym, several things can be done to reenergize self-control. First, one can think, “*Why* should I work out?” Probably the answer is “to be healthy and fit and to live longer,” which highlights long-term goals and helps one to think in higher-level construals.

Second, taking a 10-minute break before leaving work and heading to the gym or drinking a lemonade can refresh self-control stores. Self-affirmation may also highlight agentic abilities and prompt some positive affect. Then, go work out!

Strengthening Self-Control in the Long Term

Physical exertion, like use of self-control, leads to exhaustion and impairment in subsequent activities that also require strength. However, in the long run, both physical exertion, such as exercise, and practicing self-control lead to increased strength and stamina. Additionally, making plans to follow in potentially difficult future scenarios decreases the number of decisions that must be made or impulses that must be overridden at that time, saving self-control resources.

Exercise

Because self-control is thought to be a domain-general resource, practicing self-control in one domain should lead to improvements on different tasks and in other domains. Indeed, practicing standing up straight to improve one's posture, for example, can lead to improvements on the handgrip task (Muraven, Baumeister, & Tice, 1999). Self-control abilities can be promoted by monitoring and bettering study habits or financial decisions, or by exercising regularly, findings which were substantiated by a laboratory test that measured visual tracking in the face of distraction (Oaten & Cheng, 2006b). Another study sought to increase self-control strength by having participants perform self-regulatory exercises, such as switching to their nondominant hand for several routine activities and changing their speaking habits (e.g., not swearing). Afterward, in a laboratory test, these people showed less depletion after overcoming prejudicial stereotyping than did people who had not performed these exercises (Gailliot, Plant, Butz, & Baumeister, 2007).

Self-control training can even help people quit addictive behaviors. Two weeks of resisting sweets or regularly squeezing a handgrip doubled smokers' quitting success rate relative to those who did not practice self-control or just did simple math problems for 2 weeks (Muraven, 2010). Self-control practice can lead to improvements in romantic relationships. Simple and regular application of self-control to use one's nondominant hand or avoid abbreviations and curse words for 2 weeks improved control over inclinations to respond with physical aggression to one's partner's provoking behavior (Finkel et al., 2009).

Habits

As we mentioned at the beginning of this chapter, habits are highly automatic responses and therefore require and deplete less self-control than overriding impulses and deliberate action. Accordingly, habits also emerge more often when people are depleted (Neal et al., 2013). Good habits, then, serve to counteract negative effects of depletion insofar as they themselves are not depleting, and even when depleted, one can rely on them. Habitually going to the gym will make it easier to do it more often and consistently over time. Thus, many longitudinal studies have shown long-term improvements in self-control abilities as a function of habitual and scheduled rather than random self-regulatory exercises.

Indeed, one of the recent shifts in self-regulation theory has been to propose that effective self-regulation operates through habits or habitual avoidance of conflict. People with good self-control do not necessarily resist temptations and desires more often or more effectively than others (Hofmann, Baumeister, Förster, & Vohs, 2012). Rather, they seem to set up their lives to be less exposed to temptations (see de Ridder et al., 2012; Hoffman, Luhmann, Fisher, Vohs, & Baumeister, 2014).

That exercises in one domain, such as using one's nondominant hand, can lead to significant improvements in regulation of a seemingly irrelevant domain underscores not only the importance of self-control in meeting personal and social standards but also the importance of practicing it. Habitually practicing self-control—making the bed every morning, doing the dishes right after use, giving up sweets, or standing up straight—can drive improvements in your self-control in other areas of life. Packing a glucose drink in advance and planning exactly what time to turn off one's computer to end the work day and when, how to get to the gym, and which workouts to do can lead to fewer conflicts or temptations while trying to reach a fitness goal, for example. This also reduces the number of decisions that must be made at the time of the workout. Planning, then, will not only make it easier to go to the gym again in the future but also will have beneficial effects in other applications of self-control, such as in quitting smoking, eating more healthfully, staying calm during an argument, or resisting that impulse purchase.

CONCLUSION

Within this chapter, we have defined self-control, outlined myriad ego depletion findings, and described how one can improve one's self-regulatory powers over time. *Self-control*, the ability to alter one's thoughts, emotions, and behaviors, or to override impulses and habits, allows people to monitor and regulate themselves to meet expectations. *Ego depletion* refers to a state of diminished self-control resources, when one cannot or does not successfully implement further control. Numerous studies have shown that self-control is not only necessary for success in a multitude of domains but also that its depletion can lead to deficits in these domains.

Loss of top-down control, disinhibition, and passivity that result from self-control depletion underlie breakdowns in deliberate cognition and decision making, impulse and emotion regulation, dieting and exercise, substance use restriction, and control over risky behavior. When one is ego depleted, deliberate and controlled processes become more difficult, leaving one to rely on lower-level processing. Subsequent decision making and problem solving are vulnerable to the cognitive errors of intuitive thinking, particularly overdependence on heuristics. Concealing one's emotions or overriding one's impulses use self-control. Furthermore, when self-control resources are low, emotions can become intensified. Self-control goes hand in hand with a healthy lifestyle: Whether resisting sweets or willing oneself to go to the gym, one can rely on self-control.

Recent theories posit that self-control plays a role in all stages of addiction. Consistently supported is the finding that self-control is key to quitting addictive substances and maintaining sobriety. Trait and state self-control predict how likely people are to engage in risky and costly behaviors such as unsafe sex, overspending, gambling, and even crime. Although these studies suggest that self-control is limited and its deficits negatively affect

academic excellence, occupational accomplishments, stable and satisfying relationships, good adjustment, mental and physical health, overcoming prejudice, resisting addiction, regulation of criminal and violent acts, positive emotionality, and longevity, there is hope for improving one's self-control in the short and in the long run.

All in all, there is considerable and diverse evidence indicating that people regulate themselves as if they have a limited supply of self-control. There are currently lively theoretical and empirical debates about how much this pattern of ego depletion is tied to an actual physiological resource, such as glucose. Regardless of the physiological basis, the limited resource model provides a highly integrative way to encompass a large mass of research findings.

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CHAPTER 4

Self-Regulation of Implicit Social Cognition

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Implicit measures of social cognition have grown increasingly popular over the past two decades. Not only have they become ubiquitous within social psychology, but they are also now commonly applied in a broad array of domains beyond social psychology, ranging from brand evaluations (e.g., Perkins & Forehand, 2010) to phobias (e.g., Teachman, Gregg, & Woody, 2001) to addiction (e.g., Wiers, Houben, & de Kraker, 2007). Their widespread use is largely due to the assumption that implicit measures provide a more clear view into hidden cognitive processes than do explicit (i.e., self-report) measures. However, there is debate about which cognitive processes implicit measures primarily reflect. Tasks such as the Implicit Association Test (IAT; Greenwald, McGhee, & Schwarz, 1998) were initially designed to measure behavioral impulses induced by mental association between concepts (e.g., the outgroup) and attributes (e.g., negative). Explicit measures often do a poor job of assessing such impulses, especially socially undesirable ones, because explicit measures allow ample opportunity for initial impulses to be replaced by more socially desirable responses. In contrast, implicit measures minimize opportunity and motivation for responses to be deliberately altered. As such, implicit measures are commonly assumed primarily to reflect the influence of behavioral impulses activated by mental associations, free of self-regulatory processes that would constrain the expression of those impulses (e.g., Gawronski & Bodenhausen, 2007).

Self-regulation plays an important role in inhibiting undesirable impulses from influencing behavior in many situations encountered in everyday life (Hofmann, Vohs, & Baumeister, 2012; Vohs, Baumeister, & Ciarocco, 2005). However, self-regulation is typically conceptualized to be relatively slow, intentional, and resource-intensive. As such, self-regulatory processes require sufficient motivation and opportunity in order to influence behavior (Fazio, 1990). Implicit measures require behavioral responses, such as key presses and eye movements, which are not only behaviors in and of themselves, but they also predict other “everyday” behaviors (e.g., Gonsalkorale, von Hippel, Sherman,

& Klauer, 2009). Moreover, implicit measures were designed specifically to minimize motivation and opportunity for self-regulation to influence behavioral responses, for example, by requiring fast responses or by presenting stimuli outside of conscious awareness. However, a growing body of research suggests that some forms of self-regulation can operate quickly, efficiently, and/or unintentionally enough to influence responses on implicit measures. In this chapter, we review current research on such self-regulatory processes. We begin by discussing theoretical and definitional issues that have previously obscured the role of self-regulation on implicit measures. We then present evidence for several self-regulatory processes that contribute to performance on implicit measures. Finally, we introduce a tool to study self-regulatory processes—multinomial models—and review theoretical contributions produced by this tool.

CONCEPTUAL ISSUES AROUND SELF-REGULATION

Defining Automaticity versus Control

Implicit measures were initially developed to assess behavioral impulses (e.g., approach vs. avoidance) induced by different categories of stimuli (e.g., pictures of ingroup or outgroup members). These impulses, in turn, were assumed to reflect associations (e.g., between the ingroup and positive concepts, or between the outgroup and negative concepts) activated automatically upon exposure to the stimuli. In the context of cognitive processes, *automaticity* refers to a process that is activated quickly and unintentionally, does not depend on cognitive resources, operates outside of conscious awareness, and cannot be stopped once initiated. In contrast, *controlled* processes are ones that operate slowly and intentionally, depend on cognitive resources, operate within conscious awareness, and can be stopped once initiated (Bargh, 1999; De Houwer & Moors, 2012).

Early research showed that responses on implicit measures are indeed less controllable and their content is less consciously reportable than responses on explicit measures (Bargh, 1999). Over the years, this has led to various assumptions about the processes that drive responses on implicit measures: that they cannot be controlled (Rydell & McConnell, 2006); that they operate outside of conscious awareness (Wittenbrink, 2007); that they provide a “bona fide pipeline” to people’s true attitudes (Fazio, Jackson, Dunton, & Williams, 1995); and that these “true” attitudes are “cognitive monsters” that drive behavior, despite any attempt to control them (Bargh, 1999).

Operating Principles versus Operating Conditions

Because *automaticity* and *control* are defined in opposition to one another, and because implicit measures were designed to assess automatic processes, by definition, *controlled processes* of self-regulation could not possibly influence responses on implicit measures. However, this assumed relationship between *implicit measures* and *self-regulation* is problematic because these definitions describe both the qualitative nature of self-regulation (e.g., it inhibits behavioral impulses) and simultaneously sets boundaries on when it can operate (e.g., self-regulation can only happen when it is intentionally engaged). In reality, however, the principles describing the nature of a process are orthogonal to the principles describing the conditions under which that process operates (Gawronski, Sherman, & Trope, 2014; Sherman, Krieglmeier, & Calanchini, 2014); that is, any specific process

(e.g., attention, recollection, self-regulation) may occur in a relatively automatic or controlled fashion. As such, initial definitions of self-regulation that confounded operating principles (what does the process do?) with operating conditions (when may the process operate?) precluded any possibility of self-regulation in implicit social cognition.

Broadly speaking, *operating principles* describe what a given process does, whereas *operating conditions* refer to the conditions under which a given process operates (Gawronski et al., 2014; Sherman et al., 2014). Because operating principles are orthogonal to operating conditions, it is important to define them independently from one another. To illustrate this point, consider experimental work by Allen, Sherman, and Klauer (2010) investigating the influence of context cues on implicit racial bias. Typically, people's responses on implicit measures are biased in such a way that suggests that they have more positive attitudes toward white people than toward black people. However, when pictures of black people are presented in positive contexts, such as a church setting, responses become less biased (e.g., Wittenbrink, Judd, & Park, 2001). If self-regulation is defined in terms of the conditions under which it operates (i.e., requiring sufficient time, cognitive resources, and intent), then, by definition, self-regulation cannot account for Wittenbrink and colleagues' (2001) results. Instead, from that perspective, the reduction in bias observed by Wittenbrink and colleagues can only be attributed to different behavioral impulses induced by positive contexts. Alternatively, if self-regulation is defined in terms of what it does (i.e., constrains behavioral impulses and replaces them with more appropriate responses), rather than when it operates, it is conceivable that self-regulation is involved in the observed bias reduction.

Allen and colleagues (2010) tested two competing explanations: that positive contexts reduced implicit bias by influencing the activation of biased racial associations that, in turn, influenced behavioral impulses; or that positive contexts cue self-regulatory processes that, in turn, result in reduced implicit bias (see Monteith, Ashburn-Nardo, Voils, & Czopp, 2002). Allen and colleagues (2010) found support for the latter hypothesis: Positive contexts did not influence the activation of biased racial associations but, rather, induced stronger self-regulation relative to negative contexts. These findings are incompatible with the common assumption that self-regulation is a fundamentally nonautomatic process that cannot influence responses on implicit measures (e.g., Bargh, 1999; Wittenbrink, 2007). Indeed, researchers have identified several varieties of self-regulatory processes that influence responses on implicit measures.

EXAMPLES OF SELF-REGULATION ON IMPLICIT MEASURES

Goal-Driven Inhibition of Biased Associations

Goal-driven processes can regulate behavioral responses on implicit measures by inhibiting the activation of biased mental associations. For example, Moskowitz, Gollwitzer, Wasel, and Schaal (1999) argued that repetitive pursuit of egalitarian goals can inhibit the activation of racial stereotypes. Results from several experiments showed that people with chronically salient egalitarian goals showed less bias on an implicit measure than did people for whom egalitarianism was not chronically salient. Importantly, chronic egalitarians and nonegalitarians reported equivalent knowledge of racial stereotypes, which suggests that differences in implicit bias were due to self-regulatory processes activated by chronic egalitarian goals.

Expanding on these findings, Moskowitz and Li (2008) primed individuals with egalitarian or tradition goals rather than relying on individual differences in egalitarian motivations. Replicating the previous pattern of results, people primed with egalitarian goals demonstrated less racial bias on an implicit measure than people primed with tradition goals. Taken together, these findings demonstrate that goal-driven self-regulation can influence responses on implicit measures by inhibiting the activation of biased associations.

Reactive Correction

Glaser and Knowles (2008) proposed that a reactive form of self-regulation can influence responses on implicit measures. Specifically, they hypothesized that, for people who have practiced correcting for racial biases and are motivated to do so, these corrective actions become routinized. Consequently, such habitual corrective actions result in less implicit bias relative to people for whom these actions are not habitual. In testing this hypothesis, Glaser and Knowles found that, for people low in the motivation to avoid being prejudiced, the extent to which they associated black people with weapons predicted how quickly they “shot” armed black men relative to armed white men in a computer simulation. In contrast, for people high in the motivation to avoid being prejudiced, the extent to which they associated black people with weapons was unrelated to how quickly they “shot” armed black men relative to armed white men. In other words, people who were motivated to avoid being prejudiced were able to regulate their biased associations from influencing their behavior.

Goal Construal

Moving beyond the domains of racial stereotyping and prejudice, Fujita (2011) presents a version of self-regulation that is based on how goals are construed. Challenging the common assumption that self-regulation requires the effortful inhibition of impulses, Fujita instead proposed that self-regulation may be thought of as the heightened activation of distal goals in the face of proximal ones. As such, this alternative conceptualization of self-regulation can take both effortful and efficient forms. Effortful forms of self-regulation in pursuit of goals are related to executive functions such as working memory, inhibition, and task-switching abilities (for a review, see Hofmann, Schmeichel, & Baddeley, 2012). For example, a person with a goal to eat healthy food can do so by willfully inhibiting the impulse to eat a candy bar and deliberately selecting an apple instead. Such effortful self-regulatory processes can be diminished simply by engaging them, as well as by situational constraints such as exerting self-restraint in an unrelated prior task or by concurrently engaging in a cognitively taxing task (e.g., Sherman, Lee, Bessenoff, & Frost, 1998).

However, a more efficient form of self-regulation can be engaged by shifting focus from proximal goals to distal ones. For example, Fujita and Han (2009) demonstrated that people who were induced to focus on distal goals (e.g., being healthy) demonstrated an implicit preference for apples relative to candy. In contrast, people who were induced to focus on proximal goals (e.g., eating a tasty treat) demonstrated an implicit preference for candy relative to apples. In other words, focusing on distal versus proximal goals can influence responses on implicit measures by increasing the appeal of goal-congruent items and decreasing the appeal of goal-conflicting items.

As the three preceding examples demonstrate, a variety of self-regulatory processes can influence responses on implicit measures. However, this should not be interpreted as a comprehensive list of all of the forms of self-regulation that can do so. Instead, these findings demonstrate that self-regulation can operate under a broader range of conditions than initially expected and provide a more nuanced understanding of what implicit tasks measure.

MODELING APPROACHES TO INVESTIGATING SELF-REGULATION ON IMPLICIT MEASURES

In highlighting the influence of self-regulation on implicit measures, the broad point of the research reviewed so far is to establish that implicit measures are not process-pure but instead reflect the contribution of multiple processes. To be sure, implicit measures are influenced by underlying mental associations, which is what they were initially developed to measure. However, activation of mental associations is only one of many types of cognitive processes that contribute to behavioral outcomes observed on implicit measures (Conrey, Sherman, Gawronski, Hugenberg, & Groom 2005; Sherman et al., 2008). To further illustrate this important point, consider the Stroop (1935) color-naming task, which is structurally very similar to many implicit measures. In the most common version of the Stroop task, participants respond to the color in which a word is displayed and ignore the semantic meaning of the word itself. For example, the correct response to the word *blue* displayed in red ink would be “red.” A fully literate adult and a child who knows his or her colors but not words may perform equally well on the Stroop task, but for very different reasons. When the word *blue* is displayed in red ink, the adult must overcome his or her well-practiced habit of reading the word in order to name the color of the ink correctly, which adults are able to do on most trials. In contrast, the preliterate child has no reading habit to overcome, so he or she can easily respond correctly to the color of the ink. In other words, similar outcomes may result from quite different mixtures of cognitive processes.

The basic principle of different processes leading to the same outcome extends to measures of implicit social cognition as well. For example, consider the case of Strong Stan and Weak Willie, two hypothetical individuals completing an implicit measure designed to assess attitudes toward white and black people. Strong Stan has strong associations between whites and pleasant concepts, but also has a strong ability to regulate these biased associations. In contrast, Weak Willie only has weak associations between whites and pleasant concepts, but also has a weak ability to regulate these biased associations. Stan and Willie would appear equally unbiased on the implicit measure, but for different reasons. Stan can inhibit his strong biased associations from influencing his responses, whereas Willie does not have much bias to regulate in the first place.

In terms of behavioral responses, the adult and the child appear equally proficient at identifying colors, and Stan and Willie appear equally unbiased. However, as these examples illustrate, focusing on behavioral responses alone can obscure the contributions of multiple processes or combinations of processes that influence those responses. Fortunately, a tool exists that can disentangle the joint influence of multiple processes to behavioral responses: *multinomial modeling* (Batchelder & Riefer, 1999). At the most basic level, a multinomial model is simply a theory spelled out in precise mathematical

terms. A multinomial model begins with a set of variables and a set of equations that establishes relationships among the variables. The variables in the equations represent the hypothesized component processes that result in different responses on the measure of interest, and the equations define the manner in which the processes interact to produce those responses. Plugging in participants’ actual responses as outcomes in the equations yields estimates of the extent to which each of the processes contributed to those responses.

The Quadruple Process Model

One such multinomial model that has been extensively used to study the influence of self-regulation on implicit measures is the Quadruple Process model (Quad model; Conrey et al., 2005; Sherman et al., 2008). The Quad model specifies the contributions of four qualitatively distinct processes to performance on implicit measures of social cognition: (1) the activation of an association (Association aCtivation [AC]), (2) the ability to determine correct and incorrect responses (Detection [D]), (3) the ability to overcome activated associations when they conflict with the detected correct response (Overcoming Bias [OB]), and (4) the influence of a general response bias that guides responses in the absence of other available guides to response (Guessing [G]).

As an example of how the Quad model works, consider the earlier example of positive context reducing implicit bias against black targets (Allen et al., 2010). In this experiment, participants briefly viewed pictures of black or white males, and then judged whether a subsequent target word was positive or negative. To the extent that an image of a black male activates negative associations (AC), this predisposes participants to press the key labeled negative when judging a subsequent target word (see Figure 4.1). When the target word is negative (i.e., a *compatible* trial), the activated negative predisposition facilitates a correct response. In contrast, when the target word is positive (i.e., an *incompatible* trial), the activated negative disposition interferes with a correct response.

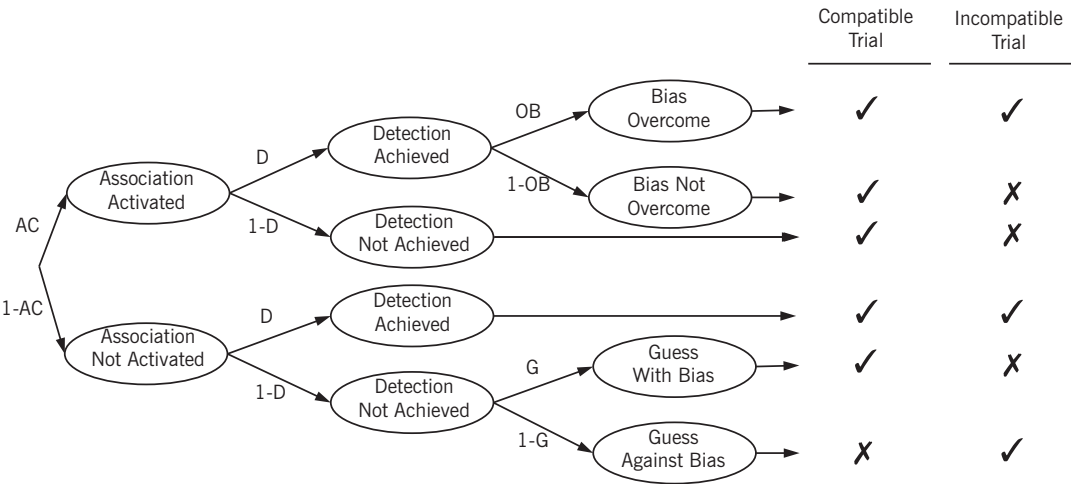


FIGURE 4.1. Quad model processing tree. ✓’s indicate correct responses; ✗’s indicate incorrect responses.

Participants can also make a correct response by accurately detecting (D) the valence of the target word. When a picture of a black male is followed by a negative word, both the activated negative association and detecting the correct response produce the same response tendency: to press the key labeled negative. However, when a picture of a black male is followed by a positive word, the response tendency activated by the negative association conflicts with the detected correct response. To the extent that participants are able to overcome their biased negative associations (OB), they will make a correct response by pressing the key labeled positive. However, if they fail to overcome their biased associations ($1 - OB$), these biased associations will drive an incorrect response to press the key labeled negative. Finally, when no associations are activated and the correct response is not detected, participants have to guess (G). Guessing is not necessarily random but, instead, may be quite strategic, such as a general positivity bias or a preference for stimuli on one side of the display (Conrey et al., 2005; Nisbett & Wilson, 1977).

The conditional relationships described by the model form a system of equations that predicts the numbers of correct and incorrect responses on the different trial types. For example, there are three different ways to make a correct response when a positive target word is preceded by a picture of a black male. The first way is when the picture of a black male activates negative associations (AC), the correct answer is detected (D), and the negative association is overcome in favor of the detected correct response (OB), which produces the equation $AC \times D \times OB$. The second way to make a correct response is when no biased associations are activated ($1 - AC$) and the correct response is detected (D), which produces the equation $(1 - AC) \times D$. Finally, the third way to make a correct response is when no biased associations are activated ($1 - AC$), the correct response is not detected ($1 - D$), and the participant guesses correctly (G), which produces the equation $(1 - AC) \times (1 - D) \times (G)$. Taken together, the overall likelihood of making a correct response on this trial can be represented by the sum of these equations: $AC \times D \times OB + (1 - AC) \times D + (1 - AC) \times (1 - D) \times (1 - G)$. Analogous equations can be produced for the other item categories (e.g., black males, white males, positive words, negative words; in both compatible and incompatible blocks). The parameter values in these equations are changed through maximum likelihood estimation until they produce a minimum difference between the observed data and the model's predicted data, and the resulting values are interpreted as the relative contributions of each process to responses on the implicit measure.

Using the Quad model, Allen and colleagues (2010) demonstrated that positive contexts decrease implicit bias toward black targets by increasing the likelihood of overcoming biased associations without changing the activation of those associations. In other words, self-regulation alone appears to account for the observed reduction in implicit bias. Initial assumptions that implicit measures are free of the influence of regulatory processes would not only have overlooked such a possibility but also would have deemed such an outcome inconceivable, by definition.

Other Applications of the Quad Model

ANTI-AGING BIAS

This multinomial model has been used to identify the influence of self-regulation across a number of implicit bias domains. For example, Gonsalkorale, Sherman, and Klauer

(2014) applied the Quad model to study implicit age bias (Nosek, Banaji, & Greenwald, 2002) and, in doing so, illustrated an important point about how failing to account for self-regulatory processes can obscure important between-group differences. A common finding in the implicit age bias literature is that younger and older adults have implicit biases that equally favor youth over age when measured in terms of behavioral responses on implicit measures. This apparent null result has been commonly interpreted to mean that old and young people equally associate positivity with youth more strongly than with age. This interpretation assumes that implicit measures solely reflect attitudinal associations and are free of the influence of other processes. However, recognizing that self-regulation also influences responses on implicit measures suggests an alternative hypothesis. As people age, they generally show diminished executive functioning (see von Hippel & Henry, Chapter 26, this volume), and this loss of executive functioning may be especially important for inhibiting biased associations. Thus, older adults might show similar levels of implicit anti-aging bias as younger adults not because they have equally strong associations between youth and positivity, but because they have weaker associations that they are less able to inhibit (Gonsalkorale et al., 2014; von Hippel, Silver, & Lynch, 2000).

Gonsalkorale and colleagues (2014) tested these two competing hypotheses by applying the Quad model to a large sample of data ($N = 90,000+$) from visitors to the Project Implicit website (*implicit.harvard.edu*) who completed an age bias IAT. Younger and older people demonstrated equivalent age bias on the IAT (Nosek et al., 2002). However, applying the Quad model to these data revealed that older people had significantly weaker old-negative and young-positive associations activated than did younger people. Additionally, and importantly, older people also had weaker ability to overcome the expression of their biased associations relative to younger people. Thus, the equivalent IAT bias demonstrated by older and younger individuals both falsely suggested that older and younger people have equally negative associations with aging and obscured important group differences in the ability to self-regulate responses. These findings highlight how failing to account for self-regulation on implicit measures can bias the interpretations of such data.

AGING AND IMPLICIT RACE BIAS

Another common finding in the implicit bias literature is that older people tend to show greater implicit racial bias than do younger people (von Hippel et al., 2000). A common interpretation of this finding is that older people as a cohort have more biased racial associations than do younger people because they grew up in a time in which racism was more socially acceptable (Nosek et al., 2002). Gonsalkorale and colleagues (2009) proposed as an alternative that the ability to self-regulate responses might instead account for these observed differences in implicit racial bias. By applying the Quad model to data from more than 15,000 participants who visited Project Implicit, Gonsalkorale and colleagues (2009) found strong support for the latter hypothesis: Biased racial associations did not vary with age, but the ability to regulate biased associations decreased significantly with age. Thus, differences between older and younger people in the expression of racial bias could be entirely explained by systematic differences in the ability to self-regulate behavior.

ALCOHOL AND IMPLICIT BIAS

In another application of the Quad model, Sherman and colleagues (2008) reanalyzed data from Bartholow, Dickter, and Sestir (2006), who had found that alcohol increased stereotypical responding on an implicit measure. There are several reasons why alcohol might have influenced stereotypical responses in this manner. On one hand, alcohol might increase the accessibility of biased associations. On the other hand, alcohol might inhibit the operation of self-regulatory processes that constrain the expression of biased associations. Application of the Quad model to these data revealed that activated associations appeared unaffected by alcohol intake, whereas self-regulatory processes were diminished. This finding illustrates the need for more nuanced conceptualizations of control processes: This self-regulatory process is efficient enough to influence responses on implicit measures, yet is still constrained by factors that diminish cognitive capacity (i.e., alcohol).

SELF-REGULATION AS A DOMAIN-GENERAL PROCESS

Though work using the Quad model had demonstrated that self-regulation can influence responses on implicit measures, the extent to which such self-regulatory processes are domain-general or domain-specific has remained an open question. Put another way, is the self-regulation measured by the Quad model specific to the attitude object in question or does it reflect a general ability to self-regulate across attitude objects? To address this issue, Calanchini, Sherman, Klauer, and Lai (2014) asked people to complete multiple IAT measures that varied in conceptual overlap. For example, some completed pairs of tests with high overlap (i.e., black/white and Asian/white IATs), while others completed pairs with low overlap (i.e., flower/insect and black/white IATs). A series of experiments revealed that people's ability to regulate their responses on one IAT correlated strongly with their regulatory ability on other IATs, regardless of how much the two IATs overlapped. This suggests that, in line with previous work (see Baumeister, Vohs, & Tice, 2007), the ability to self-regulate is largely domain-general. In contrast, activated associations (AC) were relatively sensitive to conceptual overlap. Specifically, AC correlated strongly when conceptual overlap was high, but correlated much less strongly when overlap was low. Taken together, these results indicate that responses on implicit measures such as the IAT are influenced by both domain-general and domain-specific processes.

The Stereotype Misperception Task and Multinomial Model

In order to investigate a different form of self-regulation, Krieglmeyer and Sherman (2012) developed the Stereotype Misperception Task (SMT) and a multinomial model of the task to measure the joint contributions of stereotype activation and application processes. The construction and logic of the SMT is similar to that of the Affect Misattribution Procedure (Payne, Cheng, Govorun, & Stewart, 2005). In a series of trials, an association-activating prime photograph of either a black or a white male is briefly displayed. Prime photographs are quickly followed by relatively ambiguous target faces that participants rapidly judge on a given dimension (e.g., "Is this face more or less threatening than average?"). Participants are explicitly instructed to avoid letting prime photographs influence their judgments of target images. Generally, participants judge target images in ways

that are consistent with stereotypes associated with the prime stimuli. For example, after exposure to prime photographs of black males, subsequent target images are more likely to be judged to be more threatening and more athletic than average compared against identical target stimuli following prime photographs of white males. Krieglmeier and Sherman (2012) tested and validated a multinomial model for disentangling processes of stereotype activation and application in the task.

The SMT model begins with a parameter representing the likelihood that stereotypical associations are activated by the prime stimuli (SAC; see Figure 4.2). When stereotypical associations are not activated ($1 - \text{SAC}$), a detection parameter (D) represents the likelihood of discerning the correct response based on the characteristics of the target stimulus (which actually vary on the dimension of interest; e.g., threat, athleticism). When stereotypical associations are activated (SAC), they can either be applied to a judgment (SAP) or can be corrected against ($1 - \text{SAP}$). As such, the stereotype application (SAP) parameter represents an alternate conceptualization of self-regulation than is represented by the overcoming bias (OB) parameter in the Quad model. Functionally, both SAP and OB represent processes that constrain activated associations from influencing behavioral responses. However, in the Quad model participants must detect (D) the correct task response in order to overcome their biased associations. In contrast, SAP exerts influence in the SMT model in the absence of a detected correct response. Whereas overcoming bias (OB) in the Quad model maps onto the concept of inhibition, regulating the expression of stereotypical associations ($1 - \text{SAP}$) in the SMT model is a form of self-regulation that maps onto the psychological concepts of contrasting or theory-based overcorrection (Krieglmeier & Sherman, 2012). Finally, when associations are not activated ($1 - \text{SAC}$) and detection of a correct response fails ($1 - \text{D}$), a guessing parameter (G) represents the tendency to choose from the available response options (e.g., more threatening).

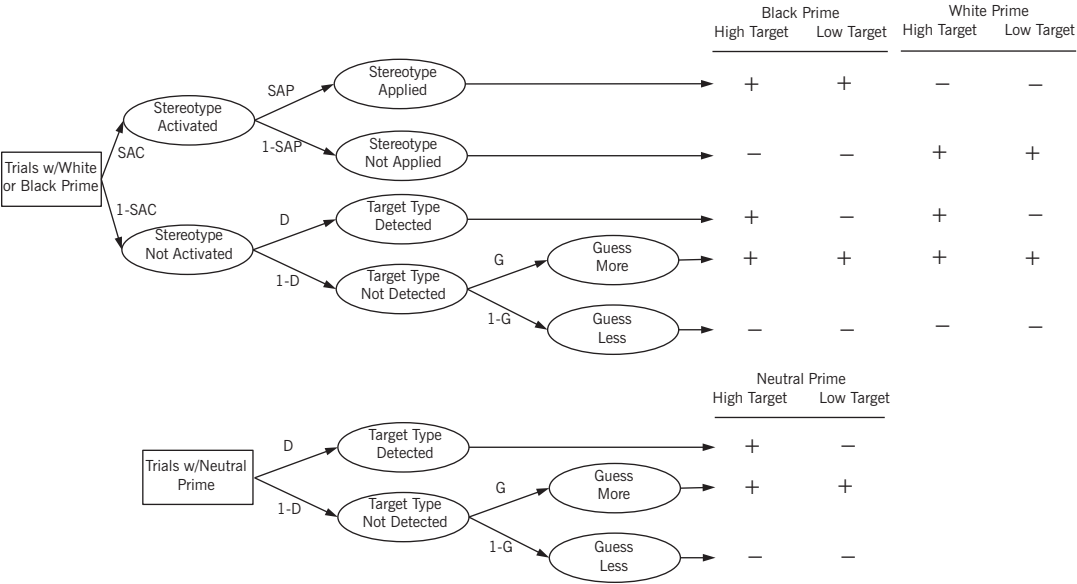


FIGURE 4.2. SMT model processing tree. Plus (+) symbols indicate “more threatening” judgments; minus (-) symbols indicate “less threatening” judgments.

Normative Strategies for Self-Regulation on Implicit Measures

Very recent work from our laboratory seeks to understand the mechanisms underlying people's ability to self-regulate on implicit measures of stereotyping. In three experiments, we manipulated the time separating the onset of stereotype-activating images of black and white males, and ambiguous target images in a modified SMT (Rivers, Sherman, Reichardt, & Klauer, 2015). As the time separating the prime and target images increased, people's judgments became less biased. Results from the SMT multinomial model indicated that in all three experiments, stereotype activation increased as time separation increased. However, in all three experiments, people also became less likely to apply activated stereotypes to their judgments with increasing time. Without the modeling approach, we would likely have assumed that the decrease in biased judgments at longer delays was necessarily due to decreased activation of stereotypes. This counterintuitive but seemingly robust finding warrants further research and underscores the importance of understanding self-regulation on implicit measures: People can self-regulate behavior even when stereotypical associations are highly active, and diminished stereotyping may occur even in the face of increased activation.

SUMMARY

In the last 25 years, research use of implicit measures of social cognition has converged on several important points. Implicit measures provide a window into an otherwise obscured cognitive landscape. They offer new perspectives on fundamental psychological concepts such as attitudes, stereotypes, and behavioral tendencies. Additionally, implicit measures have helped to generate new hypotheses about the conditions under which cognitive processes operate and influence behavior.

Historical definitional confounds between operating principles (what the process does) and operating conditions (when the process operates) have led to the assumption that responses on these measures are automatic and uncontrollable. It is certainly true that responses on implicit measures are less controllable than their explicit counterparts. However, there is now considerable evidence that people do self-regulate their responses on implicit measures (e.g., Payne, 2001; Sherman et al., 2008).

To whatever extent behavioral responses on implicit measures (e.g., button presses) predict more complex behaviors outside of the laboratory (e.g., behavior during a social interaction), then it follows that the processes that contribute to implicit task performance also may contribute to more complex behavior. Thus, if self-regulatory processes are important contributors to the button presses that reveal implicit attitudes, and if implicit attitudes predict complex intergroup behavior, then it is likely that the same self-regulatory processes that influence implicit task performance also influence broader behavior (e.g., Gonsalkorale et al., 2009).

This chapter highlights one powerful technique for dissociating the contributions of multiple processes to responses on implicit measures: multinomial models. This technique permits researchers independently and simultaneously to measure the contributions of multiple distinct processes to implicit task performance. These models also specify mathematically the manner in which these processes interact and constrain one another in producing that performance. Thus, by formally articulating the ways in which the

theorized processes interact, the theory itself can be evaluated quantitatively using model fit indices (e.g., chi-square). Because multinomial models make no assumptions about the operating conditions of the defined processes, they also provide a framework from which these boundary conditions can be empirically tested. When the operating principles of self-regulatory processes are defined independently of the conditions under which they operate, it becomes clear that implicit measures reflect the joint influence of multiple cognitive processes, including important contributions from self-regulation.

ACKNOWLEDGMENT

Preparation of this chapter was partially supported by an Anneliese Maier Research Award from the Alexander von Humboldt Foundation to Jeffrey W. Sherman.

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CHAPTER 5

Desire and Self-Regulation

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In everyday life, people spend a lot of time experiencing desire. Examples include innate desires for food, drink, sleep, sexual intercourse, and social connection, as well as acquired desires (e.g., for alcohol, cigarettes, and media consumption). Even though desires are often benign, functional, and evolutionarily adaptive, in a nontrivial number of cases, desire stands in more or less direct conflict with endorsed self-regulatory goals or moral values. Think of two ex-lovers who, upon meeting each other again after some time, reexperience a strong physical desire for each other despite the fact that both are now married to someone else. Or consider the alcoholic who is fully cognizant of the fact that giving in to the desire for another drink at a social event he is attending will likely impact his ability to drive home safely. To be sure, incompatible goals and values are not the sole reason that capacity for desire regulation is needed. Sometimes, the time or opportunity to enact a given desire may just not be right, such as when sitting in front of a mouth-watering dish at a restaurant and having to wait for your guest or colleagues to be served their selections as well. In summary, there are a number of reasons why the ability to regulate desire is such a highly valued aspect of everyday functioning.

In fact, the consequences of poor desire regulation can be enormous, especially if viewed from a societal level. It has been suggested, for instance, that 40% of deaths in the United States each year are associated with behaviors that are at least partially due to the way people deal with desires, including those for unhealthy foods, tobacco, alcohol, unprotected sex, aggressive urges, and illicit drugs (Schroeder, 2007). Gaining an optimal understanding of the psychology of desire and desire regulation is thus clearly warranted.

A large body of self-regulation research from the previous decade has focused on the processes and situational factors that facilitate or thwart people's success at self-control. For instance, a lot of research has investigated the behavioral outcomes brought about by the availability or lack of self-regulatory resources and the mechanisms underlying the phenomenon (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Hagger, Wood, Stiff, & Chatzisarantis, 2010; Vohs & Heatherton, 2000; see also Maranges & Baumeister,

Chapter 3, this volume), or the cognitive factors involved in the inhibition of prepotent action tendencies such as executive functions (e.g., Hofmann, Schmeichel, & Baddeley, 2012; see also Berkman, Chapter 24, this volume).

What has often been neglected—or subject only to implicit assumptions—is the nature of the motivational *driving* force giving rise to the problem of self-control. Understanding how desire emerges, waxes, and wanes, and when it becomes conflicting, is an important component in a unified understanding of typical self-control dilemmas (Hofmann, Baumeister, Förster, & Vohs, 2012; Hofmann & Van Dillen, 2012; Kotabe & Hofmann, 2015). Moreover, until recently, cases of desire regulation often have been couched in terms of a goal-conflict language (e.g., a short-term goal to enjoy tasty chocolate vs. a long-term goal to lose weight; a short-term goal to have enjoyable sex vs. a long-term goal to be faithful). Whereas such terminology is clearly elegant, parsimonious, and general, it may come at the cost of hindering a deeper analysis of the *specific* characteristics of the two opponents involved in such motivational struggles (Kotabe & Hofmann, 2015); that is, by treating desire as just another (short-term) goal, an important distinction is lost, and along with it analysis of what triggers and fuels desire and effective strategies to tame it. Yet by conceptualizing desire as an affective–motivational phenomenon of its own kind, scholars can start asking novel and specific research questions tailored to desire and its control (Hofmann & Nordgren, 2015). For instance, how do innate desires and abstract long-term goals differ at both cognitive and neuroscientific levels? Through which techniques and interventions can people render problematic desire less “hot” and urgent and/or make long-term strivings (e.g., going to the gym more often) eventually adopt the characteristics of a true desire?

This chapter therefore is centered on the concept of desire. We begin with a brief definition of desire and draw important links between desire and emotion. Next, we sketch the dynamical nature of desire and the various routes by which it can impact behavior. We then outline the conditions under which desire may become problematic, so that enacting a given desire may become a threat to the higher-order goal or value system of a person. We then provide a tripartite taxonomy of different desire regulation strategies, including (1) early-stage preventive strategies such as situation control, stimulus control, and early distraction; (2) middle-stage down-regulatory strategies such as cognitive reappraisal, suppression, and acceptance; and (3) late-stage inhibitory strategies and mechanisms such as inhibition, overriding, and moderation. This taxonomy may also be useful in categorizing different interventions targeted at improving self-control success. To approach these issues, we integrate insights from the traditional self-control literature; insights from cognitive psychology, especially the elaborated intrusion theory of desire (Kavanagh, Andrade, & May, 2005) and executive functioning research; insights from the cognitive neuroscience of reward processing; and insights from the field of emotion regulation (e.g., Gross, 1998)—all of which are highly useful and necessary, in our view, to achieve an optimized understanding of desire and desire regulation.

WHAT IS DESIRE?

Colloquially, the term *desire* can refer to all kinds of wishes and wants. We keep with the more narrow definition of *appetitive desire* as “those motivations that propel us to approach certain stimuli in our environment and engage in activities with them that

provide us with a relative gain in immediate pleasure (including relief from discomfort)” (Hofmann & Nordgren, 2015, p. 5). Appetitive desires are typically rooted in physiological need states, such as for food, alcohol, sex, rest, or acquired through a history of reinforcement learning, as in the case of drugs, media addiction, spending urges, and so forth. Moreover, we use the term *craving* to refer to desires across domains that are particularly high-intensity (e.g., drug craving, food craving). It is also important to note at this point that desires and temptations are not synonymous (Hofmann & Kotabe, 2013; Hofmann & Van Dillen, 2012). Rather, temptations comprise a special subset of desires. To say that somebody is “tempted” by something means that the person has a desire to do *X* on one hand, *and simultaneously* has a good reason not to do *X* (Mele, 2001). Whether a person has reason not to do *X* will depend on whether the behavior implied by the desire conflicts with a person’s background set of endorsed self-regulatory goals, values, or otherwise activated competing motivations (more on this issue below).

In this chapter and elsewhere (Hofmann & Kotabe, 2013), we draw a strong conceptual analogy between desires and emotions. We do so because such an analogy may help us get a better grip on the phenomenon of desire, as well as the various strategies by which it can be regulated. Like emotions, desires are multifaceted phenomena that combine affective, motivational, and cognitive components. Regarding the affective component, desires have a clearly affective component that comprises a phenomenological feeling of “wanting” of varying intensity. The affective component has its primary basis in the in-the-moment computation of reward value that condenses past positive experiences into anticipated positive affect. However, additional (negative) evaluations may be added on top of it, leading to the well-known ambivalence of desire experiences (Kavanagh, Andrade, & May, 2005; van Harreveld, Nohlen, & Schneider, 2015). Furthermore, although enacting or thwarting desires may have certain self-conscious emotional consequences, such as guilt, we view such emotional consequences as separable from the distinct, intrinsic phenomenology of desire, which is grounded in the anticipation of rewarding experiences.

Regarding the motivational component, desires prepare and motivate behavior. Desiring something means wanting to have, consume, or do something that is expected to yield pleasure (or reduce discomfort). For instance, when a person desires an alcoholic beverage, he or she expects that consuming it will bring about a better mood and alleviate distress. Desires motivate people through their promise of pleasure or relief. Moreover, because desires are directed toward certain objects (i.e., things, persons, activities), like emotions, they share a sense of “aboutness” (e.g., being happy, sad, angry, disgusted *about* something) that distinguishes them from more diffuse affective states such as mood (Higgins, 1998).

Regarding the cognitive component, we see desires as closely intertwined with the aforementioned affective and motivational components: According to Kavanagh, Andrade, and May’s (2005) elaboration–intrusion theory of desire, desire is typically accompanied by intrusive thoughts about the object of desire. Such cognitions comprise expectations about the consequences of desire enactment and the feasibility of attaining the desired object, as well as mental simulations and fantasies. These cognitions may be more or less realistic—sometimes astonishingly overoptimistic—with stronger desires typically leading to more biased and distorted cognitions (Kavanagh et al., 2005). Moreover, the interplay between cognition and desire strength is bidirectional and dynamical: As a person mentally elaborates a desire, its strength typically increases, and more and

more mental resources are allocated to it. This is why desires sometimes escalate to the point that they fully crowd out opposing mental representations such as those of self-regulatory goals (Hofmann, Friese, Schmeichel, & Baddeley, 2011; Hofmann & Van Dillen, 2012; Kavanagh et al., 2005).

HOW DOES DESIRE EMERGE, WAX, AND WANE?

What renders some things so attractive that they grab attention, occupy thoughts, and fuel desire? Theories of desire need to address the often complex interplay of stimulus features in the environment and people's inner predispositions (i.e., need states, learning history) that provide the background against which these external stimuli can have their powerful effects. Due to the evolutionarily old nature of these systems, these models should be able to account for relatively automatic processes generated by evolutionarily old reward-processing regions in the brain (e.g., Heatherton & Wagner, 2011). However, they should also be able to represent the idea that desire, once it emerges in consciousness as a feeling of wanting, may develop a different dynamic and be able to affect behavior in qualitatively different terms through escalatory mechanisms (Kavanagh et al., 2005).

Recently, we have attempted to integrate these various aspects into a dynamical model of desire (Hofmann & Van Dillen, 2012, Fig. 2). According to this integration, desire is assumed to emerge in a relatively *automatic* fashion as reward processing centers evaluate external stimuli against the backdrop of internal need states and an individual's learning history (Hofmann, Friese, & Strack, 2009; Hofmann & Van Dillen, 2012). According to the model, strongest reward signals should emerge in the reward-processing center of the brain when relevant stimuli are present and relevant stimulus features are salient, when the respective need state is high, and when there is a long history of past rewarding experiences with the stimulus. The early reward processing may have the potential to bias attention (e.g., Vollstädt-Klein et al., 2012) and to trigger fast, impulsive, and habitual responses that may even happen outside of conscious awareness (e.g., Mogenson, Jones, & Yim, 1980; Winkielman, Berridge, & Wilbarger, 2005). Such impulsive responses may be most impactful in situations where the desired stimulus is already quite close in space and time.

Crucially, however, desire may also gain access to consciousness and thereby deeply influence thinking and planning. In case enough attention is allocated to it, desire may also emerge into consciousness, thus occupying limited working memory resources. As a given desire attracts further attention and desire-related processing, a vicious circle of reprocessing and rumination can result, during which people repeatedly imagine desire enactment and have recurring thoughts about the resulting pleasurable experience. This is a vicious cycle because cognitive elaborations can, in turn, increase the feeling of wanting and the motivational power of desire. As desire becomes more cognitively elaborated in working memory, so does its potential to instigate concrete action plans and behavioral intentions to consume the object of desire. Crucially then, elaborated desires may predispose the organism toward (sometimes problematic) consumption via two important mechanisms. First, elaborated desires may crowd out (i.e., temporarily deactivate) other representations from working memory, leading to a preoccupation with the desire at the expense of everything else, including self-regulatory goals and values (Hofmann et al., 2011; Kemps, Tiggemann, & Grigg, 2008). Second, elaborated desires may instigate

processes of motivated reasoning that license and justify indulgence (e.g., “I deserve a special treat today; others are having their share of cake, too; this is definitely going to be my last cigarette before I quit!”) (De Witt Huberts, Evers, & De Ridder, 2012, 2014; Hofmann & Van Dillen, 2012). Through these cognitive–motivational processes underlying desire escalation, desire can ultimately hijack behavior through the executive mechanisms that otherwise support reasoned action, resulting in passionate behavior that people may later regret.

Of particular interest in understanding the role of waxing (or waning) desire are situational factors that may exacerbate the conscious experience of desire by rendering desire to be experienced more intensely than under normal conditions. For instance, there is some evidence that desires of all sorts are experienced more strongly in a state of alcohol intoxication (Hofmann, Baumeister, et al., 2012). Moreover, resource depletion, a factor hitherto assumed primarily to affect people’s capacity to inhibit desire, has recently been shown to “turn up the volume” on desire and other emotional experiences (Vohs et al., 2012; Wagner & Heatherton, 2013). Furthermore, research is also beginning to address the idea of differential satiation patterns (Redden & Haws, 2013); that is, when consuming an object of desire, how quickly does satiation set in (i.e., preventing overconsumption), and what are the factors that accelerate or decelerate satiation (see Redden, 2015, for a review)?

CURB YOUR ENTHUSIASM: ON THE NEED TO REGULATE UNWANTED DESIRES

If Facebook allowed users to indicate their relationship with their own desires, most would probably pick the (in)famous “It’s complicated.” On the one hand, desires are key motivators, often rooted in evolutionarily old systems that secure one’s own and the species’ survival. On the other hand, the unfettered expression of desire can not only be self-harming (as in excessive food consumption) but also interfere with the freedom and well-being of fellow citizens. The capacity to regulate desire is a prerequisite for participating in society, and those who chronically fail to regulate their desires such as aggressive and sexual urges often find themselves removed from free society. Not surprisingly, legal, religious, and educational systems are all involved in the regulation of ostensibly problematic desires, attempting to establish a balance between individual liberty and collective interests (including public safety, order, and health). Or, to express the problem with striking clarity: “The right to swing my fist ends where the other man’s nose begins” (Oliver Wendell Holmes).

Legal, religious, and educational systems promote norms of desire regulation, punishing those who cross the boundaries of what is considered proper conduct. Even beyond those institutionalized normative influences, there are often additional moral, health-related, or financial considerations that keep desires in check. According to moral foundations theory (Graham et al., 2013), for instance, morality is based on several core moral principles: care (“Don’t harm other people”); fairness (“Don’t pursue your own advantage in disproportionate ways”); loyalty (“Don’t betray your ingroup”); authority (“Don’t disrespect laws, rules, and authority figures”); and sanctity (“Don’t do something ‘impure’ or ‘indecent’”). Another core moral principle may be honesty (“Don’t manipulate the truth”; Hofmann, Wisneski, Brandt, & Skitka, 2014). Each of these principles can

serve as a moral reason for desire regulation. A case in point is sexual infidelity brought about by strong sexual attraction. Sexual infidelity may result in harm (e.g., the emotional harm felt by the partner upon finding out), fairness violations (one partner unfairly pursuing his or her self-interest), betrayal (being disloyal to one's partner), subversion of moral authority (e.g., violation of religious norms promoting monogamy), degradation (doing something "impure"), and/or dishonesty (due to the lying typically involved), depending on the specific constellation of moral values and principles activated when judging the rightness or wrongness of the deed.

How often do people experience conflicts with other goals when experiencing desire? In the Everyday Temptations Study, we sought to address empirically the notion of conflicting desire, collecting a large number of everyday desire experiences (Hofmann, Baumeister, et al., 2012). We found that 53.2% of all desires reported were rated as not conflicting at all, 14.7% as mildly conflicting, 12.4% as somewhat conflicting, 10.9% as quite conflicting, and 8.8% as highly conflicting. Hence, people appear to experience a nontrivial portion of their desires as potentially problematic (if enacted). Accordingly, people indicated that they had attempted to resist their desire on 42% of occasions. In terms of self-regulatory success, they successfully managed not to enact about 83% of the time, with a lower likelihood of success for strong rather than weak desires (Hofmann, Baumeister, et al., 2012).

The Everyday Temptations Study also assessed information on the goals people reported as conflicting with their desires and proposed a taxonomy of five broad types of conflicting goals (Hofmann, Vohs, & Baumeister, 2012; see Table 5.1). In decreasing order of frequency, people reported (1) *time-use goals* (29%; e.g., the goal to use one's time efficiently, not to delay things, to get things done); (2) *achievement-related goals* (28%; e.g., academic and work-related goals); (3) *health goals* (23% of reported goals; e.g., the goal to eat healthily, to increase one's bodily fitness, to reduce the risk of infections); (4) *social goals* (11%; e.g., the goal to improve or maintain one's social appearance, social recognition, or to conform to moral values and beliefs); and (5) *abstinence/restraint goals* (9%; e.g., the goal to save money, to end a dependency, to remain faithful to one's romantic partner). Health and abstinence/restraint goals reflect people's

TABLE 5.1. Distribution Summary of Five Broad Categories of Self-Regulatory Goal Domains and Their Most Conflicting Desire Types in the Everyday Temptations Study (Hofmann, Baumeister, et al., 2012)

Health protection (23%)	Abstinence/restraint (9%)	Achievement-related (28%)	Time-use goals (29%)	Social goals (11%)
Tobacco (47%)	Spending (47%)	Leisure (60%)	Leisure (45%)	Eating (16%)
Alcohol (29%)	Tobacco (28%)	Sleeping (44%)	Sleeping (42%)	Tobacco (13%)
Eating (27%)	Sexual (16%)	Sports (43%)	Media (39%)	Sexual (13%)
Sports (11%)	Alcohol (15%)	Media (40%)	Sports (26%)	Alcohol (11%)
Coffee (10%)	Eating (7%)	Social contact (25%)	Spending (24%)	Leisure (10%)

Note. The lower part of the table lists the five (relatively) most frequently mentioned conflicting desires types for each category. Desire rankings are based on relative frequencies, representing the percentage of desires from a given desire domain that had been reported as conflicting with the respective goal category (e.g., 47% of reported tobacco desires were experienced as conflicting with health protection goals).

knowledge that the unmitigated enactment of certain desires carries bodily risks (e.g., coronary heart disease from consuming too many unhealthy foods, lung cancer from smoking, financial problems from unrestrained spending; see Table 5.1 for the most relevant desire types per goal type). Achievement-related and time-use goals reflect people's awareness that desire enactment may obstruct the attainment of important long-term projects, academic and work goals, or sport aspirations (e.g., surfing the Internet when at work). Finally, social goals reflect people's awareness that desire enactment may impact one's social appearance/reputation and may interfere with one's moral values and beliefs.

In summary, there is a multitude of good reasons why people are often motivated to regulate their desires. An open question for future research is whether some of these reasons are more effective than others. In other words, are there some features of self-regulatory goals—over and above the known effects of goal commitment and goal accessibility—that make desire regulation more effective? For instance, are people more successful at regulating unhealthy eating desires if the opposing goals are moralized as compared to being based simply on concerns for one's own health (Hosey & Risen, 2015)? Recent research suggests that, in line with self-determination theory (Deci & Ryan, 2000), intrinsically/autonomously pursued self-regulatory goals can be more effective in regulating desire than extrinsically pursued goals (Milyavskaya, Inzlicht, Hope, & Koestner, 2015).

Another intriguing question concerns the emotional and cognitive consequences of failures at desire regulation as a function of the conflicting goal. There is some evidence that good self-regulators are happier than poor self-regulators, presumably because they manage or avoid desire–goal conflicts more effectively (Hofmann, Luhmann, Fisher, Vohs, & Baumeister, 2014). This raises the issue of the emotional net effect of enacting problematic desire (temptation). It has been shown that enactment of conflicting as compared to unproblematic desire may result in lower gains in momentary feelings of happiness, which we termed the *spoiled pleasure* of acting on temptation (Hofmann, Kotabe, & Luhmann, 2013). The spoiled pleasure effect seems to be due to the triggering of self-conscious emotions, such as guilt (Hofmann, Kotabe, et al., 2013). An open question is whether the magnitude of this reduction in the overall pleasure derived from enacting conflicting desire is moderated by features such as whether the opposing goal is of a moral nature. For scholars interested in consumer welfare (e.g., Thaler & Sunstein, 2009), this is a central question and one that requires a complicated analysis of trade-offs.

DESIRE REGULATION

Given that desire is sometimes problematic, how can desire be effectively self-regulated in line with higher-order goals and values? We propose that there are roughly three main types of desire regulation mechanisms: those that constrain the emergence of desire, those that help to down-regulate desire experience (i.e., desire intensity), and those that enable inhibition or overriding of the action tendency implied by the desire (see Table 5.2). These strategies can be further distinguished and subdivided according to whether they are primarily preventive or interventive in nature (Hofmann & Kotabe, 2012). *Preventive (or anticipatory) desire regulation* encompasses the idea that people do not only deal with desire in the here and now but they also use the capacity for foresight and simulation (Baumeister, Masicampo, & Vohs, 2011) to shape (i.e., constrain or entirely

TABLE 5.2. Summary of Key Strategies of Desire Regulation

General purpose	Mode	Specific strategy examples
Constraining emergence of desire	Preventive	Situation selection/avoidance Stimulus control/avoidance Early-stage distraction
Down-regulation of desire experience	Interventive	Cognitive reappraisal Acceptance/mindfulness Suppression
Inhibition/overriding of desire-related behavior	Preventive	Precommitment Implementation intentions Training willpower
	Interventive	Behavioral inhibition Overriding Moderation

Note. Strategies are organized by whether their main general purpose lies in (1) constraining desire so as to reduce the likelihood of triggering (strong) desire, (2) down-regulating the subjective experience of desire, or (3) inhibiting, overriding, or otherwise reducing the impact of desire on behavior, and by whether they are preventive or interventive in nature (see main text for more details).

eliminate) future desire experiences. By applying preventive strategies at an earlier point in time, people may influence, at a later point in time, (1) the extent to which problematic desire will emerge, (2) their motivation to resist (e.g., through precommitment), (3) their self-control ability (e.g., through training), and (4) the range of available behavioral options to enact problematic desire (e.g., how much cash they can spend on desirable things) (Hofmann & Kotabe, 2012). *Interventive self-control*, in contrast, refers to mechanisms and strategies applied in the moment of experiencing the desire, in situations in which a problematic desire has already emerged and now regulatory action needs to be taken.

Constraining the Emergence of Desire

The first class of desire regulation strategies encompasses early-stage strategies that may prevent an individual from experiencing an unwelcome desire. This class represents the fact that people can play an active part with regard to the types of situations and stimuli they encounter in their day-to-day lives. If successful, these strategies typically render middle- and late-stage desire regulation unnecessary. It should be noted, though, that these preventive strategies may require considerable foresight, understanding, and experience concerning which situations and stimuli are likely to trigger problematic desire. As people extract lessons from their past behavior (Baumeister, Vohs, DeWall, & Zhang, 2007), they may become increasingly better at avoiding problematic desire.

Situation Selection and Stimulus Control

The most effective strategy to prevent desire is to avoid exposure to tempting situations or stimuli altogether, through strategies of situation selection and stimulus control (Mahoney

& Thoresen, 1972). Based on the assumption that external stimuli play a seminal role in the generation of desire (Hofmann & Van Dillen, 2012), such strategies can greatly alter the odds that people will experience temptation in the first place (Fujita, 2011; Hofmann & Kotabe, 2012). Situation and stimulus-control techniques may not only be applied by the self-regulator directly (e.g., keeping one's refrigerator free of alcohol) but also may be imposed through so-called "nudges" (Thaler & Sunstein, 2009) which have become a major area of interest at the intersection of public policy and health. The use of situation and stimulus control can be seen, for example, in "no smoking" policies at restaurants and at school cafeterias that primarily offer healthy options (e.g., Hanks, Just, Smith, & Wansink, 2012). Because situation and stimulus control are not always feasible, however—such as when one cannot escape a temptation-rich environment—they cannot be the only means of effective desire regulation.

Early-Stage Distraction

Another, more proximal, mechanism than situation and stimulus control that appears to constrain the potential for desire experience is early-stage distraction. The underlying idea is that people may sometimes be so focused on a given current goal or activity (e.g., reading a very engaging novel) that tempting stimuli in their environment no longer capture enough attention that would otherwise lead to the conscious representation (and reprocessing) of desire in working memory. Indeed, recent research has shown that cognitively demanding tasks (unrelated to the temptation at hand) can reduce or eliminate the experience of desire (Kemps, Tiggemann, & Christianson, 2008; Van Dillen, Papies, & Hofmann, 2013). Accordingly, more applied work has shown that early-stage distraction may therefore have high potential as a craving intervention (Florsheim, Heavin, Tiffany, Colvin, & Hiraoka, 2008; Skorka-Brown, Andrade, & May, 2014). However, this strategy may only work to the extent that such powerful distractors can be easily found and are applied *before* strong cravings emerge; some research suggests possible detrimental effects of distraction at later stages (Frieze, Hofmann, & Wänke, 2008; Shiv & Fedorikhin, 1999). Also note that cognitive load and prior self-control exertion (ego depletion) do not appear to have functionally equivalent effects; research by Vohs and colleagues (2012) suggests that prior self-control exertion intensifies desire experiences (see also Wagner, Altman, Boswell, Kelley, & Heatherton, 2013), in contrast to the aforementioned cognitive load studies (Kemps et al., 2008; Van Dillen et al., 2013).

Down-Regulation of Desire Experience

The second class of desire-regulation strategies encompasses those that may *down-regulate* desire. In this case, desire is experienced and a prepotent action tendency may be activated, but the focus of regulation is on the desire experience rather than on the prepotent action tendency. The idea is that certain regulatory strategies may be more or less effective at reducing the intensity of the experienced desire. Just as a growing fire can be reduced in its power through the right strategy (e.g., repeatedly pouring buckets of water over it), and eventually be extinguished, desire may be reduced below a critical level and eventually fade as the individual employs the right mental strategy. This analogy implies that there may be dysfunctional regulatory strategies as well (e.g., suppression).

Cognitive Reappraisal

One way to down-regulate desire can be brought about through strategies that modify how a tempting stimulus is appraised. *Reappraisal* is the term used to indicate mental strategies that alter how people perceive an event, idea, or feeling (see also Gross, 1998). Walter Mischel's groundbreaking work on delay of gratification has shown that young children are better able to resist immediate rewards if they learn to reappraise these rewards in nonconsummatory ways (Mischel & Baker, 1975). Presumably, such strategies can reduce the immediate appeal of tempting stimuli. Recent research applying this idea in adults has demonstrated that cognitive reappraisal can have a profound impact on affective reactions to tempting stimuli. For instance, having people imagine tempting stimuli in nonconsummatory ways appears to reduce people's automatic evaluation of these stimuli (Hofmann, Deutsch, Lancaster, & Banaji, 2010). Research using various reappraisal techniques, such as thinking about the negative consequences of enacting desire (Hollmann et al., 2012; Kober et al., 2010) or a combination of reappraisal techniques (Giuliani, Mann, Tomiyama, & Berkman, 2014), provides converging evidence that cognitive reappraisal is generally effective in down-regulating self-reported desires and cravings (see also Berkman, Chapter 24, this volume).

Acceptance

A second promising strategy for down-regulating problematic desire is *acceptance*, which refers to the ability to refrain from judging and controlling (i.e., suppressing) inner experiences such as desires and cravings (Forman et al., 2007; Lacaille et al., 2014). Acceptance is also at the heart of the concept of mindfulness (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). With acceptance, the individual is encouraged simply to observe his or her feelings and accept their presence rather than trying to control or eliminate them (Jenkins & Tapper, 2014). To be clear, this strategy is not as simple as saying, for instance, "It's fine to desire to kill someone." Rather, the key is that one tries to accept having a certain desire without necessarily acting on it. Accepting desires and cravings in a nonjudgmental way, and seeing them as fleeting mental states instead of trying to suppress them, may make it easier for people to decouple themselves mentally from the maladaptive vicious circle of reprocessing and rumination (Kavanagh et al., 2005). The overall evidence suggests that acceptance may help people to regulate their cravings and desires better across a number of domains (Alberts, Mulken, Smeets, & Thewissen, 2010; Westbrook et al., 2013), although effects were not always consistent across studies or dependent on further moderators (e.g., Jenkins & Tapper, 2014; Moffitt, Brinkworth, Noakes, & Mohr, 2012).

Suppression

If accepting a desire may facilitate desire regulation, how does the opposite strategy fare? Is the willful suppression or negation of cravings an effective desire regulation strategy? The bulk of the literature on appetitive thought suppression suggests that it is not (Barnes & Tantleff-Dunn, 2010; Erskine, 2008; Johnston, Bulik, & Anstiss, 1999; Mann & Ward, 2001), as indicated by maladaptive outcomes such as heightened levels of craving and binge behavior. Hence, thought suppression may backfire (Wegner, 1994). According

to Wegner's theory, when trying actively to suppress something, attention may be repeatedly redirected toward the very mental content one tries to avoid. This feature of suppression may contribute to keeping the desire-processing loop alive, or even leading to the hyperaccessibility of desire-related thoughts.

Inhibition/Overriding

The third class of desire regulation strategies encompasses those abilities and strategies that enable the effective *inhibition* or *overriding* of the desire-related behavior. In this case, a problematic desire is experienced, and a prepotent action tendency is activated. The focus of this strategy is on preventing or limiting the impact of the action tendency on actual behavior (rather than on down-regulating the desire). There are two varieties of this strategy. One is inhibition and overriding as a preventive, late-stage strategy, as it is traditionally understood. Another is the notion of moderation.

Behavioral Inhibition

The basic assumption underlying inhibition is that either through automatic activation or hijacked executive mechanisms (typically used for self-regulation; see previous discussion), desire may activate prepotent action tendencies. Unless inhibited, these tendencies may be expressed in overt behavior once a certain threshold of activation is reached (Norman & Shallice, 1986; Strack & Deutsch, 2004). As an intervention strategy, inhibition requires that the individual manage to keep that prepotent action tendency from influencing behavior for as long as the tempting episode lasts. Thus, for successful inhibition to take place, the individual needs to be *both* motivated enough to recruit inhibitory functions *and* possess enough inhibitory capacity to keep the activation of desire-related action tendencies below the critical threshold (Kotabe & Hofmann, 2015). The fact that both motivation and ability need to be present in order for this strategy to be effective means that it is often a difficult endeavor.

A wealth of cognitive experimental research has linked the capacity aspect of inhibition and response overriding to executive functioning (for a review, see Hofmann, Schmeichel, et al., 2012). Poor executive functioning, especially poor inhibitory control capacity (Miyake, Friedman, Emerson, Witzki, & Howerter, 2000), has been implicated in a large number of impulse control problems, ranging from dietary failures (Hofmann, Adriaanse, Vohs, & Baumeister, 2014; Nederkoorn, Houben, Hofmann, Roefs, & Jansen, 2010) to drug use and abuse (Berkman, Falk, & Lieberman, 2011; Nigg et al., 2006), to inappropriate social responding (von Hippel & Gonsalkorale, 2005), to sexual cheating in romantic relationships (Pronk, Karremans, & Wigboldus, 2011). Moreover, many studies across these diverse domains have demonstrated that people low in behavioral inhibition are more strongly influenced by prepotent action tendencies than those high in inhibition (e.g., Hofmann, Friese, & Roefs, 2009; Houben & Wiers, 2009; Nederkoorn et al., 2010; Payne, 2005), providing more evidence for the underlying mechanism. Furthermore, a range of situational factors such as cognitive load (Friese et al., 2008), prior self-control exertion (Baumeister et al., 1998; Hofmann, Vohs, et al., 2012; Vohs & Heatherton, 2000), environmental or social stressors (Inzlicht, McKay, & Aronson, 2006), and alcohol intoxication may result in temporary reductions in inhibitory control

(Hagger et al., 2010; Lavie, Hirst, de Fockert, & Viding, 2004; Richeson et al., 2003; Schoofs, Preuss, & Wolf, 2008). Hence, temporary reductions in executive functioning may be one (of several) possible underlying mechanisms mediating the effects of these situational “risk” factors on desire regulation (Hofmann, Schmeichel, et al., 2012).

Overriding

Whereas inhibition can be framed as a “do not” self-regulatory mindset, the notion of overriding goes one step further (Baumeister & Heatherton, 1996); Here, the individual attempts to substitute the problematic, desire-related behavior with a more acceptable behavior (i.e., deactivation of the prepotent action tendency *and* selection of an alternative scheme of action). Overriding thus implies that an alternative action tendency is being (co-activated). This strategy can thus be linked to a “do instead” self-regulatory mindset. Unfortunately, it is empirically challenging to tease apart inhibition and overriding, and clearly demarcate the two strategies. Overriding may be implied and facilitate desire regulation when people are faced with competing options (e.g., the choice between an unhealthy and healthy food option) and forced to choose between the two, as compared to situations where they are only faced with a given temptation. It has also been postulated that one feature of good self-regulators may lie in the spontaneous activation of overriding goals and their associated behavioral means when temptation is encountered (Fishbach, Friedman, & Kruglanski, 2003). The more committed people are to the goals that oppose a given problematic desire, the more highly activated overriding goals should be in tempting situations. However, because successful overriding interventions presumably depend on the availability and accessibility of *concrete* behavioral schemas, we would predict that factors that boost the activation of concrete behavioral means may be more decisive than factors that only increase commitment to an overarching, abstract goal. Below we discuss one preventive strategy—implementation intentions—that serves to illustrate how the mind may be preprogrammed in such a way that desire-related behaviors may be effectively overridden by alternative courses of action when a person is faced with a tempting desire.

Moderation

A special case that often appears to be overlooked in models of self-regulation and is not well understood at this point is the issue of moderation: Rather than thinking about desire enactment as an all-or-nothing thing, people may give in to a tempting desire *but no further* than what they consider to be a reasonable amount of desire enactment in light of their goals and values. For instance, a dieter may decide to consume no more than two scoops of chocolate ice cream per week, or a driver may limit her alcohol intake to one beer per night.

Conceptually, moderation is distinct from the inhibition or overriding of a prepotent action tendency: Whereas inhibition/overriding occurs before that tendency has been executed, moderation implies that the desire is enacted to some extent before inhibition or overriding sets in. From an outsider’s perspective, moderation may therefore often look like self-regulatory failure when, in reality, the person may be following a more long-term “master plan” of balancing desire enactment and self-regulatory goal attainment in a given domain. Such a strategy may better optimize overall long-term well-being than

either under- or overregulation might. The difficulty with moderation, of course, lies in actually sticking with the preset boundary (e.g., “just one bite”; “just one drink”; “just one kiss”) once one has begun to harvest the pleasure of desire enactment. Rather, once the reward appetite is whetted (Wadhwa, Shiv, & Nowlis, 2008), motivation may take a critical shift from the best of (stopping) intentions to continued savoring, thus rendering moderation a potentially risky regulatory strategy (Baumeister, Heatherton, & Tice, 1994).

Preventive Strategies Promoting Inhibition

We have described how people may intervene with desire enactment through inhibition and overriding. However, next to these in-the-moment strategies, people may also undertake preventive steps that increase their odds at successfully inhibiting or overriding problematic desire. Here, we present a nonexhaustive list of three such preventive strategies, precommitment, implementation intentions, and the long-term training of inhibitory capacity.

PRECOMMITMENT

People sometimes employ so-called “precommitment” devices or self-contracts (Thaler & Sunstein, 2009). For instance, people may publicly disclose their better intentions to close others or even on websites such as *stickk.com* (designed to help people achieve their long-term goals), so that they can be made accountable if they give in. Presumably, public vows make it harder to disengage from self-control because anticipated disapproval from others can act as a reinforcement. A related preventive technique includes commitment contracts that reward sticking to one’s goals and/or punish giving in to temptation through prearranged penalties (Schelling, 1984) such as donating money to the campaign of a political candidate from the opposite camp. Through these strategies, people can increase the stakes at hand, which may boost their goal commitment, and hence their motivation to draw on inhibition and overriding in preventing desire enactment.

IMPLEMENTATION INTENTIONS

We have argued that successful overriding can hinge on the availability and accessibility of behavioral means associated with self-regulatory goals. The influential strategy of implementation intentions (Gollwitzer, 1999) achieves precisely that. *Implementation intentions* consist of concrete if–then formulations that connect a certain triggering situation (e.g., “If I order something for dinner at a restaurant”) with a concrete behavior (e.g., “then I will choose a vegetarian meal”). Implementation intentions work to strengthen the association between the specific situational cue and the intended response (Webb & Sheeran, 2007). Some work suggests that even critical inner states such as unwanted cravings may serve as a situational cue for the formation of effective implementation intentions to counteract them (Achtziger, Gollwitzer, & Sheeran, 2008). From a meta-analytical stance, implementation intentions have been proven to be highly effective across a large number of studies and domains (Gollwitzer & Sheeran, 2006), rendering implementation intentions a robust preventive strategy to increase the odds that desire-related behaviors are successfully overridden in critical situations under which they occur.

TRAINING INHIBITION

A third preventive strategy involves improving the basic cognitive capacities required for effective desire regulation in the long run. One line of research has established that regular self-regulatory exercises, such as managing study habits, money management, or sticking to an exercise regimen, indicate positive transfer effects on the regulation of other domains and laboratory measures of self-control (Muraven, Baumeister, & Tice, 1999; Oaten & Cheng, 2006a, 2006b, 2007). Relatedly, people motivated to improve their capacity for inhibition may participate in mental training programs specifically intended to improve inhibitory control (e.g., Houben, Wiers, & Jansen, 2011; see also Berkman, Chapter 24, this volume). However, such strategies may be limited in that they hinge on people's motivation to recruit the trained functions in tempting situations. A second, perhaps more direct, way may be to tighten the link between desire-related cues and inhibitory processes, with the goal of making response inhibition the dominant, habitual response upon stimulus encounter. For instance, Houben, Nederkoorn, Wiers, and Jansen (2011) found that participants trained to inhibit responses toward alcohol stimuli in a computer-based training task (a modified go/no-go task) showed a subsequent reduction in weekly alcohol intake, whereas those trained to go along with their responses toward alcohol stimuli showed a relative increase. Similar results have been obtained in the eating domain (Houben & Jansen, 2011), and with different response inhibition interventions (e.g., Veling, Aarts, & Stroebe, 2013).

SUMMARY AND CONCLUSION

Appetitive desires are very common; people spend about half of their waking time desiring certain things (Hofmann, Baumeister, et al., 2012). They are deeply connected to the very needs that have secured the survival of the species over millennia. Yet with desire comes the potential for mental conflict and the need to regulate in accordance with individual, social, and societal enactment constraints. Whatever the source of such inner conflict, humans are, by and large, remarkably effective desire regulators (Hofmann, Baumeister, et al., 2012). At the same time, there is room for improvement, as a quick look into contemporary societal problems such as overeating, overdrinking, smoking, or sexually transmitted diseases confirms.

We have argued that effective desire regulation can take many forms and unfold at various time points. Desire regulation strategies can roughly be classified into early-stage strategies that proactively constrain desire experiences; middle-stage strategies that support the effective down-regulation of consciously experienced desire; and late-stage strategies that involve the inhibition, overriding, or moderation of desire-related behavior. As psychological insights into desire and desire regulation mature, new treatment methods and technologies will surely emerge. Applied research is likely to profit from these insights and will make progress in helping people best deal with the more troubling aspects of the jungle of human desires.

For sure, a life without desire would probably not be worth living. Yet desire most certainly can be the beginning of disastrous ends (Schroeder, 2007). Part of what it means to be a successful, well-adapted human being is to find a well-calibrated balance

between joyful enactment and wise or necessary restraint. This double-edged nature of desire makes it so fascinating, and ripe for inquiry by behavioral scientists.

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CHAPTER 6

The Role of Habits in Self-Control

WENDY WOOD

Lack of exercise is a significant risk factor for a number of debilitating lifestyle diseases, including diabetes, cancer, cardiovascular diseases, and chronic lung diseases. However, most adults fall short of meeting U.S. physical activity guidelines. In 2012, fully 46% failed to meet either aerobic or muscle-strengthening guidelines, and only 20% accomplished both of these goals (Centers for Disease Control and Prevention, 2014). Exercise represents a classic self-control dilemma. Despite its many long-term benefits for health and well-being, maintaining an exercise program can require considerable time, is physically taxing, and involves sometimes costly expenditures (e.g., gym membership). Given these short-term costs, it is no surprise that most people do not meet even the minimum requirement for health. However, some people are able to exercise continually and maintain high levels of fitness over time. How do they succeed at this kind of repeated self-control challenge?

One answer comes from Armitage's (2005) classic study of the psychological processes behind new members' gym use. As would be expected, most participants in this study were not very successful at maintaining their exercise program. On average, they used the gym only 1.6 times during the 12 weeks after joining. However, 29% of the new members bucked this trend and consistently used the gym twice a week for 3 months. By evaluating how initial gym use influenced subsequent visits, Armitage showed that the first 5 weeks after joining were critical. Apparently, members who regularly used the gym during these initial weeks formed habits that they then just repeated during the subsequent weeks. It is interesting that, after taking habit strength into account, Armitage's (2005) predictive models did not find that persistence was greater among participants with more favorable attitudes or behavioral intentions to use the gym when they initially joined.

In this chapter, I evaluate how habits contribute to effective self-control and enable people to persistently perform desired behaviors despite temptations and challenges to act otherwise. To begin, I offer a definition of habits based on the social cognitive model of habits developed in our laboratory (Wood & Neal, 2007; Wood & Rünger, 2016). I then review evidence for the classic model of self-control, in which people exert inhibitory resources to prevent bad, unwanted habits. Despite the substantial research supporting

this antagonistic relation between habits and self-control, emerging research also suggests that habits can be a means of effective self-control; that is, much like the new gym members in Armitage's (2005) study, people effectively pursue goals by forming habits that enable them to enact desired responses automatically. Finally, I consider yet another way that habits contribute to self-regulation. This involves informing people's inferences about their goals and intentions. That is, self-regulation does not always proceed through control of behavior but sometimes through behavior itself changing people's goals and desires.

THE NATURE OF HABITS

Habits develop as people repeat a behavior (braking while driving) in a particular context (red light), typically as they are pursuing a goal (trying to get to work). Through repetition, people learn covariations between the behavior and features of the performance context. These covariations are then represented in memory in the form of context–response associations. Habit representations in memory contain not only information related to response execution but also information about the sensations and perceptions associated with carrying out the response (Hommel 2009).

With repetition, habit associations become strengthened to the point that perception of context cues automatically brings the response to mind. A variety of cues might trigger habit performance, including aspects of physical environments, other people, and preceding actions in a sequence (Ji & Wood, 2007). Sometimes people deliberately expose themselves to habit cues, such as when intentionally sitting at a computer in order to activate thoughts of work. However, cue exposure is often inadvertent, such as when a chance sighting of an often-used fast-food outlet activates thoughts of eating.

The automatic activation of a habit response in memory was demonstrated in a study with habitual runners, sporadic runners, and nonrunners (Neal, Wood, Labrecque, & Lally, 2012). Each participant nominated the physical location in which they typically ran (or would run in the case of nonrunners). The nominated locations were then used as primes in a subsequent word recognition task (lexical decision). In the task, after being primed with the location in which they typically ran, participants with strong running habits were faster to identify the words *running* and *jogging*. Presumably, their prior running experience had allowed them to develop stronger context–response associations than did weakly habitual runners or nonrunners.

Once habits have formed, they are triggered largely by context cues and tied less closely to motivations and goals. This pattern was demonstrated in Neal and colleagues' (2012) word recognition study. When primed by the goals that they claimed motivated them to run, strongly habitual runners were not faster to identify running words. Instead, the idea of running had become associated with contexts for those with strong habits. However, for occasional runners who were still developing habits, thoughts of motivating goals did bring ideas of running to mind, suggesting that goals are important guides for habit formation.

For many researchers, insensitivity to rewards and goals is a defining feature of habits, and furthermore differentiates habits from more goal-directed responding (e.g., Dickinson, 1985). A standard practice to determine whether a behavior is habitual or goal-directed is to change the value of the outcome of the behavior or change the

behavior–outcome contingency. If people halt a behavior when they do not like the outcome—or the outcome does not occur, then the behavior is considered to be goal-directed. Continued repetition regardless of the outcome, by contrast, indicates habitual responding. In a laboratory study by Tricomi, Balleine, and O’Doherty (2009), for example, participants learned to respond to one image for candy and to a different image for potato chips. After extensive training at this food-choice task, participants ate one of the foods until they were sated, and thereby the attractiveness of this food reward was *devalued*. When tested again, participants continued to make choices to both images, despite the fact that they reported no longer wanting the food associated with one of the images (see also Gillan, Otto, Phelps, & Daw, 2015; Hogarth, Chase, & Baes, 2012). Thus, participants continued to make the habitual choice, despite that they no longer wanted the food generated by that response.

Outcome insensitivity of habits was also demonstrated in a field experiment that targeted a naturalistic habit—popcorn eating at the movie theater (Neal, Wood, Wu, & Kurlander, 2011). Participants in the study were given a bag of popcorn that was either freshly made or stale. They generally reported disliking the stale popcorn, but this preference only influenced participants who typically did not eat popcorn at the movie theater. Participants with strong popcorn-eating habits consumed almost equal amounts of fresh and stale popcorn. A different picture emerged when participants ate popcorn while watching music videos in a conference room. The unusual setting did not bring to mind popcorn-eating habits that had been acquired in the context of a movie theater. Consequently, when in the laboratory, even participants with strong cinema-popcorn habits were sensitive to the taste of popcorn and ate little of the stale popcorn.

The direct activation of habits by context cues yields a guide to behavior that differs in important ways from other automatic, implicit processes (Evans, 2008). For example, the priming of goals, attitudes, or concepts can activate a range of responses, and is not limited to the repetition of a particular well-learned response (see Wood, Labrecque, Lin, & Rünger, 2014). Even strongly desired goals that stably characterize people’s motives do not necessarily yield stability in the particular means of goal pursuit. Instead, goals are marked by *equifinality*, which means that most goals can be achieved through multiple behavioral means. Furthermore, unlike habits, automated goals (e.g., implementation intentions) influence behavior primarily to the extent that they are consistent with people’s explicit motivations (Sheeran, Webb, & Gollwitzer, 2005).

In summary, key attributes of habits are that they develop through associative learning as people repeatedly perform actions in daily life. Although goals and rewards are important for habit formation, once context–response associations have formed in memory, the readily available response reduces sensitivity to changes in goals and outcomes of the response. The automaticity behind habit performance differs in a number of features from the more flexible automation of goal pursuit, especially in that habit performance involves repetition of a particular response.

SELF-CONTROL INVOLVES INHIBITING UNWANTED HABITUAL RESPONSES

Most research on habits in self-control has broadly followed the conceptualization of a Stroop task in which habits are the incorrect automated response (i.e., reading word

meaning) that participants try to control in order to respond correctly (i.e., reporting font color). If people catch themselves in time, they can inhibit the habitual response. In this antagonistic role, habit performance represents a failure of executive control. The considerable research in this tradition, focusing on habit inhibition and change, is understandable given the potential for bad habits to pose threats to health, happiness, and financial well-being.

Several highly influential models of self-control were built on this approach, in which goal pursuit proceeds through control of habits and other unwanted responses. According to one model, voluntary acts such as self-control draw on a finite resource that is analogous to the folk-psychology concept of willpower (e.g., Bertrams, Baumeister, Englert, & Furley, 2015). In this analysis, people vary in their chronic levels of willpower; in addition, their available levels fluctuate as willpower is depleted with use and replenished with rest. Also relevant to understanding self-control is Metcalfe and Mischel's (1999) classic hot-cool system of impulse control that identified strategies children and adults use to control stimulus-based actions effectively. Although this model emphasized the control of impulsive, emotionally evocative responses, it also identified different control strategies relevant to understanding how unwanted habits are reconciled with goal pursuit.

The different strategies people use to exert self-control were illustrated in experience sampling research of people's everyday attempts to inhibit unwanted thoughts, feelings, and actions (Quinn, Pascoe, Wood, & Neal, 2010). Of the unwanted responses identified in these studies, about 12% were strongly habitual, in that they were performed almost daily and usually in the same context. Another 38% of the responses that participants were trying to inhibit represented temptations that arose from hot, emotional stimuli that would provide immediate gratification but longer-term regret. Given the different cueing mechanisms behind habits and temptations, the spontaneous self-regulatory strategies that effectively controlled one kind of response were not necessarily effective at controlling the other; that is, participants were most successful at resisting temptations when they removed the tempting stimulus or limited their exposure to it (Quinn et al., 2010). By contrast, stimulus control as a self-regulatory strategy provided little traction over unwanted habits. Because habits are often acquired nonintentionally, people frequently lack insight into the causal relationship between context cues and the habitual responses that they trigger. Therefore, the relevant context cues, unlike tempting stimuli, would not be easily identifiable. Instead, participants in Quinn and colleagues' (2010) study were most successful at controlling unwanted habits when they monitored their behavior closely and prevented the unwanted habit response from being elicited. However, even with this *vigilant monitoring* self-control strategy, participants were only moderately successful at suppressing unwanted habit responses.

In summary, the traditional approach to studying habits and self-control involves understanding how people inhibit the performance of unwanted habits in order to meet their long-term goals. Although people are sometimes able to exert this kind of control over their behavior, daily life can work to lock people into habit performance and impede more effortful, controlled attempts to pursue goals. As explained in the next section, people are likely to carry out the habitual response in mind when they lack the motivation or self-control strength to reject that response or to choose an alternative one (or no response).

HABITS PERSIST WHEN PEOPLE LACK SELF-CONTROL

A cottage industry of research has developed to identify the many factors that reduce people's deliberative control over goal pursuit and lead them to fall back on habitual responding. Distraction, cognitive decline with age, time pressure, and limited task ability all tend to impair executive functioning and increase the likelihood of habit performance. For example, for participants performing a probabilistic categorization task, being distracted by simultaneously performing a demanding task increased their use of stimulus-response strategies over rule-based ones (Foerde, Knowlton, & Poldrack, 2006). Distraction also increased habitual responding in a multi-stage decision task (Otto, Gershman, Markman, & Daw, 2013). In addition, older adults and those with lower cognitive control abilities were less able to leverage higher-order goal representations in order to overcome habitual solutions to a variety of tasks (de Wit, van de Vijver, & Ridderinkhof, 2014; Otto, Skatova, Madlon-Kay, & Daw, 2015). In like manner, participants who possessed low spatial perspective-taking ability used more habitual navigation strategies and less goal-directed ones when repeatedly traversing a virtual maze (Marchette, Bakker, & Shelton, 2011). A full review of the many factors that tip the balance toward habitual responding, away from goal pursuit, is beyond the scope of this chapter, and here I provide just a brief review of research on the effects of reduced willpower and increased stress.

Willpower

Many deliberative actions, especially inhibiting a habit and making a decision to act in an alternative way, require willpower. When willpower resources have been drained by previously performing a task that required executive control, people fall back on their habits and other automated responses (Hagger, Wood, Stiff, & Chatzisarantis, 2010; although see Carter, Kofler, Forster, & McCullough, 2015). Reflecting this process, participants who had first performed a demanding task were less able to modify their habitual levels of self-disclosure to suit situational demands (Vohs, Baumeister, & Cicarocco, 2005). Thus, when depleted, participants who typically would not self-disclose fell back into this habitual pattern even when greater disclosure was socially appropriate. This link between diminished willpower and a resurgence of undesired habits is supported by a wealth of empirical data. For example, on days with high self-control demands, underage social drinkers were more likely to become intoxicated and to violate self-imposed limits on their alcohol intake (Muraven, Collins, & Neinhaus, 2002). Importantly, higher self-control demands did not increase participants' urge to drink or lead them to abandon their plans to drink less. This suggests that in their depleted state, people did not acquire new goals, they just had difficulty adhering to their old ones, and thus fell back on their drinking habits.

Depletion boosts performance of not only bad habits that are inconsistent with goals but also good habits that are goal-consistent; that is, depletion may decrease people's motivation and ability to deviate from good habits, just as they do bad ones. When depleted, people might, for example, decide not to vary from a good habit of jogging after work and pass up an opportunity to go to a movie or try something novel, such as a new restaurant that opened in their neighborhood. The tendency for depletion to boost both good and bad habit performance was demonstrated in a quasi-experimental

study in which MBA students made snack choices before or after a difficult midterm examination (Neal et al. 2013). Because completing a difficult examination requires self-control strength, students choosing after the examination fell back on their own habits in selecting the snacks. Moreover, supporting the habit boost for both good and bad habits, depletion increased habitual choices for both healthful (fruit, nuts) and unhealthful (chocolate, cookies) snacks. In another study that manipulated depletion, Neal and colleagues' (2013) participants performed a number of everyday behaviors with their nondominant hand—a task that drains self-control resources because it requires resisting the impulse to use the dominant hand. When self-control was drained in this way, participants were more likely to fall back on performing strongly habitual behaviors, some of which were in line with their personal goals, and others that challenged goals.

Stress

The experience of acute, as well as chronic, stress can increase people's reliance on habits (Schwabe & Wolf, 2013). Stress decreases people's ability to thoughtfully control their actions and thereby boosts habit performance. For example, Schwabe and Wolf (2010) first trained participants to choose either chocolate milk or orange juice in an experimental task. Then they devalued the drink reward by providing participants with as much chocolate pudding or oranges as they wanted—which reduced their desire for the milk or juice (respectively). Although they no longer wanted the relevant drink, participants who had been stressed with a combination of physical and psychosocial stressors (immersing a hand into ice water while being monitored by a stranger and videotaped) continued to choose it habitually. For example, stressed participants trained to choose chocolate milk continued to select it even after eating lots of chocolate pudding. Thus, when stressed, participants fell back on their old habits even when they no longer desired the food reward.

The stress-induced shift toward habits can be traced to the ways that stress impedes deliberate action control. In sequential decision-making tasks, acute stress selectively attenuated goal pursuit and promoted habit performance in vulnerable participants—those with low working-memory capacity (Otto, Raio, & Chiang, 2013) or high levels of chronic stress (Radenbach, Reiter, Engert, Sjoerds, Villringer et al., 2015). Similarly, in a study of visual classification learning, stressed participants were biased toward relying on a habit-linked learning strategy at the expense of explicit learning (Schwabe & Wolf, 2012). These results may reflect simply the breakdown of higher-order decision-making functions under stress, or they may indicate a strategic shift in people's allocation of cognitive resources, so that they fall back on habits and other strategies to prevent unreliable performance.

Along with impeding deliberate thought, stress also might promote habit acquisition. At this point, such a possibility is just that, a possibility. Research with rodents suggests that stress can, under specific conditions, facilitate habit learning (Dias-Ferreira et al., 2009). The evidence of stress effects on human habit learning, however, has been mixed (Guenzel, Wolf, & Schwabe, 2014a, 2014b), and further research is needed to clarify whether habits do form more quickly under stress.

In summary, a variety of moderating factors determine whether people can exert self-control to inhibit unwanted habits. In research designs that pit habitual responses against deliberate goal pursuit, habits predominate when circumstances limit people's capacity

to deliberate about their actions. Specifically, habits are promoted by circumstances that are distracting, reduce cognitive abilities, heighten stress, and deplete willpower. These factors lower people's capacity to inhibit cued, habitual responses and to make decisions to do something else (or nothing at all).

More generally, research in this area highlights that habits can be beneficial in the sense of rescuing performance. Suggesting this functional role, Schwabe and Wolf (2013) reported that stressed participants performed particularly badly when they stopped relying on their habits and attempted to guide their behavior more thoughtfully. Thus, when threat and pressure derail more thoughtful control over action, habits—although not always the optimal response—provide one that can be readily brought to mind and automatically executed.

EFFECTIVE SELF-CONTROL THROUGH HABIT PERFORMANCE

Given the challenges people experience with unwanted habits that derail goal pursuit, it is easy to overlook that most habitual behaviors are congruent with people's goals (Ouellette & Wood, 1998). One reason for this congruency is that habits often originate in goal-directed behavior. When a goal persists so that an individual consistently performs the same behavior in a specific context, the conditions are met to render the behavior habitual. Delegating behavioral control to the environment then frees up cognitive resources and provides an efficient way to adhere to recurring self-regulatory goals. In addition, habits provide a ready response in situations that render effortful self-control difficult. Thus, as outlined in the prior section, when people are stressed, distracted, or low in willpower, they can fall back on good habits (Neal, Wood, & Drolet, 2013). Presaging this thinking, William James (1914) recommended, "We must make automatic and habitual, as early as possible, as many useful actions as we can" (p. 67).

Emerging evidence from a variety of research areas supports this idea that habits can promote desired goals. Some suggestive support comes from an experience-sampling study in which participants reported on the desires they felt during everyday life (Hofmann, Baumeister, Förster, & Vohs, 2012). Participants with chronically high levels of self-control experienced desires less strongly, had less motivational conflict, and reported less often having to resist desires. The researchers concluded that people with high trait self-control reduced problematic desires by shaping and selecting their environments in a way beneficial for goal pursuit. That is, self-control operated not through inhibiting unwanted responses but instead "via adaptive habits and anticipatory coping" (Hofmann et al., 2012, p. 1331).

Several recent studies have more directly substantiated the link between trait self-control and habits. For example, participants high in trait self-control had weaker habits to snack on unhealthy foods (Adriaanse, Kroese, Gillebaart, & De Ridder, 2014). Across multiple studies, Galla and Duckworth (2015) discovered that higher trait self-control was related to stronger habits for a range of beneficial behaviors, including exercising, eating healthy snacks, getting adequate sleep, and doing homework. In an especially convincing longitudinal study with adolescents, those with higher self-control were more likely to practice good habits; that is, trait self-control measured before a 5-day mindfulness meditation retreat predicted the strength of adolescents' meditation habits assessed in a follow-up survey 3 months later. This finding further corroborates that self-control

is instrumental for developing good habits, and these habits then automatically promote desired outcomes.

Habits shield against the pull of temptations. One of the ways that habits promote goal pursuit is by arming people against desires that conflict with valued goals. In evidence of this process, Galla and Duckworth's (2015) participants with greater self-control were less likely to report effortful inhibition of temptations that ran counter to the beneficial behaviors under investigation. Crucially, habit strength mediated the link between high self-control and the reduced experience of temptations. This latter finding corroborates Hofmann and colleagues' (2012) hypothesis that people with good self-control develop adaptive habits that insulate them against motivational conflicts and problematic desires.

More direct evidence that habits shield against temptations comes from Lin, Wood, and Monterosso's (2015) research showing that the choice between a healthy and an unhealthy snack can be habitually biased toward the healthy alternative. In one study, participants made food choices by moving a joystick to one image to win baby carrots and to a different image to win potato chips. After the initial training phase, participants performed a cognitively demanding task that was designed to reduce self-control capacity and increase reliance on habits. Participants then completed a new choice task that pitted the habitual foods against other, novel foods. Thus, they chose between baby carrots and M&Ms or between potato chips and popcorn. The key manipulation was whether these choices were made in the presence of the habit pictorial cue from the training phase or a novel image. As predicted, the presence of a habit cue increased the likelihood of choosing the associated outcome, so that participants continued to make the habitual response. Thus, they made the healthy habitual choice of baby carrots over M&M's, as well as making a less healthy habitual choice of potato chips over popcorn. This study then indicates that people with healthy habits automatically make the beneficial choice even when tempted to act in less healthy ways.

Mechanisms by Which Self-Control Promotes Habit Performance

An important challenge for future research is to uncover the psychological mechanisms that link higher self-control with beneficial habits. Some insight comes from a recent meta-analysis of task performance (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012). Specifically, trait self-control was more strongly related to behaviors classified as automatic (e.g., habitual condom use) than to those deemed controlled (e.g., quitting smoking). This was true for both desired and undesired behaviors. In other words, people with strong self-control excelled at developing good habits, as well as at breaking bad habits. It may be, then, that self-control guides the initial formation of desired habits. When people set out to acquire a new routine behavior (e.g., going to the gym every other day), high levels of self-control might shield the new behavior against conflicting impulses and motivations, along with the cueing of old, unwanted habits. Consistent with this idea, some studies indicate that people high in conscientiousness are especially adept at habit formation (e.g., Vishwanath, 2015). If they enact a new desired behavior more frequently and regularly, then it is more likely to become habitual over time.

In daily life, self-control might also promote habit formation and performance by guiding self-selection into contexts likely to cue desired behaviors. For example, healthy people (with a low body mass index [BMI]) appear to choose their homes in part based

on opportunities to exercise, and these environments in turn promote healthy behaviors (Plantinga & Bernell, 2007). Thus, home-buyers with lower BMIs were more likely to prefer to move to a pedestrian neighborhood, and moving to a more walkable neighborhood tended to protect against weight gain (Eid, Overman, Puga, & Turner, 2008). Individuals with lower BMIs were also more likely to own a dog, especially one that they walked themselves (Coleman et al., 2008). Although this research did not directly assess self-control, it demonstrates the power of our living environments to shape behaviors that promote desired outcomes—or the reverse. An interesting question for future research is whether people with high self-control are especially likely to select into contexts that promote desired outcomes.

Another possible mechanism explaining the relation between self-control and habit performance in daily life is that high self-control enables people to structure their immediate environments to cue desired habits. For example, the homes of normal weight (vs. obese) preschoolers provided more opportunities to act in healthful ways (e.g., accessible fresh vegetables, physical activity options, children's bedrooms without TVs; Boles, Scharf, Filigno, Saelens, & Stark, 2013). Also, patrons with lower BMIs at all-you-can-eat Chinese buffets limited consumption by using chopsticks and putting napkins on their laps, along with sitting with their sides or backs to the buffet (Wansink & Payne, 2012). Although this research did not directly assess self-control, it is consistent with the idea that people shape the contexts in which they live and may thereby automate behaviors that lead to desired outcomes.

In summary, by automating behavior into habits, people can achieve goals reliably and with little effort. Those who are effective at self-control especially appear to meet their goals in this way. Greater self-control might enable people to form new habits successfully, as well as to shape and choose their environments to cue desired responses.

INFERRING SELF-REGULATORY GOALS CONSISTENT WITH HABITS

In this chapter I have argued that successful long-term self-regulation involves habitually engaging in actions that correspond with valued long-term goals. Specifically, people exert self-control to inhibit unwanted habits, and they repeat goal-directed actions in stable contexts so as to form desired habits. In this section, I argue further that habits interface with self-regulatory goals through the inferences that people make about their habitual behavior (Wood & Rünger, 2016).

People often have to infer the reasons why they perform habitual behaviors. Despite awareness of the performance of many everyday habitual responses—the route they take to work, the last time they brushed their teeth—people are largely unaware of the cueing mechanism that activates habits. Given this limited introspective access, they are in the position of generating explanations for habitual responses post hoc. According to classic social psychology theories, in cases when internal cues to action are weak, ambiguous, or uninterpretable, people infer what their motivations must be from observing their behavior and external cues (Bem, 1972). The simple frequency of habit performance, however, might lead to erroneous inferences of strong, consistent motives. Suggesting this pattern, participants with stronger habits were more certain about their behavioral intentions and perceived the behavior as guided more by their goals than did those with weaker habits, when in fact the opposite was true—intentions and goals were particularly

poor predictors of strongly habitual behaviors (Ji & Wood, 2007; Neal et al., 2012). Such inferences were also evident among Armitage's (2005) new gym members mentioned at the beginning of this chapter. The more that participants went to the gym during the 3 months of the study, the more that their intentions to exercise increased in favorability and their judgments of behavioral control strengthened (holding initial intentions and control constant). This is interesting because, after the fifth week of the study, intentions became epiphenomena and were not predictors of gym attendance. Nonetheless, inferences that goals motivate habit performance may be correct in a historical sense because people may accurately remember the goals that initially guided habit formation.

People make inferences about potential goals that motivate a range of habits, even habits of addiction. According to Everitt and Robbins (2005), addicts' experiences of compulsively wanting a drug might not be a precursor of consumption but a post hoc rationalization of drug-use habits. Similarly, obsessive-compulsive disorders may originate in excessive habit formation. In this view, irrational beliefs about threats are inferred as a consequence of a compulsive reliance on habits (Gillan & Robbins, 2014). Although people appear to infer intentionality in this way for a wide variety of habits, sometimes such inferences are not plausible. When a habit is clearly inconsistent with current goals, people might just label the inconsistency and not infer a corresponding motive (e.g., explaining, "I can't help it; it's just a habit").

Goal inferences are sparked by not only the simple frequency of habit performance but also the positive affect associated with many habits. Habits are likely to be favored due to the ease with which they can be performed in comparison with alternatives. As an illustration, consumers appear to value using existing products and services over new ones because of the difficulty of mastering new skills (e.g., Murray & Häubl, 2007). Habits also are likely to be viewed positively due to the fluency, or speed and ease of processing, associated with frequently performed behaviors. High fluency is experienced as positive in part because it signals familiarity over uncertainty and success at processing and understanding, and this positive affect generalizes to current activities (Reber, Schwarz, & Winkielman, 2004). Habit inferences thus exploit a psychological calculus that favors what feels easy because it is well practiced over what feels more difficult because it is new. Being favorably disposed toward habits for these reasons, people might plausibly infer that they intended to perform the response.

Although the inferences that follow habit performance may not be accurate descriptions of the mechanisms generating action, inferences about habits may contribute to well-being. Repeated behaviors, such as students' choice of the same seat in a classroom, heighten their feelings of comfort, confidence, and control, despite the fact that these choices initially might have been largely random (Avni-Babad, 2011). Furthermore, Heintzelman and King (2014) argued that habit performance promotes coherence or comprehensibility of experiences and therefore enhances meaning in life.

In summary, self-regulation of habits, even habits of addiction, may proceed as a result of people shifting their goals and intentions to be consistent with the habits they perform. Although the inference that a habitual behavior was intended is largely erroneous in terms of psychological processes, these inferences have an intuitive plausibility for high-frequency behaviors. Such inferences are further promoted by the switching costs of deviating, the fluency of habit performance, and the potential benefits of habit performance for well-being.

CONCLUSION

In this chapter, I have outlined three ways that habits contribute to self-control. The first, traditional view is that people exert self-control in order to inhibit unwanted habits and pursue desired outcomes. Considerable time and money have been devoted to programs designed to increase self-control over poor lifestyle habits, addictions, and compulsions, so that people can purposely guide their behavior. Yet emerging research suggests a second approach in which habits often promote goal pursuit and are furthermore an especially effective means of self-regulation for people who are good at achieving desired goals. This line of thinking opens new avenues for behavior change interventions that encourage the formation of new, desired habits. In a third process, habits influence self-regulatory goals as people observe their own repeated behaviors and infer that they must have been intended, which is further augmented by the positive feelings that habit performance can generate. Through these multiple psychological processes, self-regulation is intrinsically intertwined with habitual responses in which control has been outsourced onto the context cues contiguous with past performance.

Although in this chapter, behavior has been termed either habitual or goal-directed, this is actually an oversimplification. In reality, habits integrate with goal pursuit in guiding behavior. Most actions probably reflect aspects of habitual responding, as well as more goal-directedness (Wood & Rünger, 2016). The integration of habits and more goal-oriented behaviors provides a number of advantages for action control. Perhaps most importantly, habit knowledge does not shift readily and is therefore retained even when people change their goals and plans. Also, by outsourcing action control to environmental cues, people have a ready response when distraction, time pressure, lowered willpower, and stress reduce the capacity to deliberate about action and tailor responses to current environments. Furthermore, although people might believe in the effectiveness of effortful goal pursuit over relying on habits (Carden, Wood, Neal, & Pascoe, 2016), habit systems are also smart. By acting habitually, people efficiently capitalize on environmental regularities, even ones of which they may not be consciously aware.

I conclude with a caveat regarding the insight that good habits are an efficient, reliable means of achieving enduring goals. Although repetition intensifies action tendencies so that good habits become even stronger action tendencies, repetition also promotes habituation of experience so that emotional responses diminish (Wood, Quinn, & Kashy, 2002). Weakening unpleasant experiences associated with goal pursuit is of course a good thing—dulled experience of that last mile of running is probably beneficial to the pursuit of fitness. However, weakening of positive experiences, such as dinner with a loved one or an afternoon at the beach, does not contribute to overall life happiness. Thus, wisdom in goal pursuit is knowing what to automate habitually, along with subdued feelings, and what to experience thoughtfully, savor, and enjoy.

ACKNOWLEDGMENTS

This chapter was made possible through the support of a grant from the John Templeton Foundation. The opinions expressed in this publication are my own and do not necessarily reflect the views of the John Templeton Foundation. I thank Michael Ohno for his help in preparing the references.

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PART II

COGNITIVE, PHYSIOLOGICAL, AND NEUROLOGICAL DIMENSIONS OF SELF-REGULATION

CHAPTER 7

The Cognitive Neuroscience of Self-Regulatory Failure

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It is one of the mysteries of human nature that inhibiting a behavior (e.g., not reaching for another piece of cake) can be experienced as more effortful than performing the action that otherwise would be inhibited. The deceptive ease with which people manage to avoid indulging every craving, voicing every thought, or giving in to the vicissitudes of every emotion belies the sheer amount of effort that must be expended to stay in control. Should people's ability to regulate themselves become compromised, the damage to their social lives would be devastating. Even behaviors as trivial as not looking at a mole on an employer's face would become impossible to resist. Although, at first blush, it might seem unfathomable that people could suddenly be robbed of their self-control, the reality is that with certain brain injuries anyone can suffer from the deficits in self-regulation just described.

Although the importance of the brain in enabling self-regulation has long been of interest to neuroscientists and neuropsychologist, many of the other disciplines that study self-regulation (e.g., developmental psychology, educational psychology, social psychology) have long remained agnostic regarding the underlying neural mechanisms that allow self-regulation to occur. In contrast to these disciplines, neuroscientists have long studied the brain mechanisms that underlie elementary forms of motor and cognitive control, generally under the rubric of "executive function." However, this line of research seldom explored how these faculties play out in the sorts of situations that have traditionally been under the purview of social and health psychologists (e.g., desires, prejudice, mood). It is not immediately clear why it took so long for self-regulation researchers to seek out neural mechanisms, as neurologists and neuropsychologists have long recognized the importance of the brain, particularly the frontal lobes, in the organization and regulation of behavior (e.g., Kleist, 1934). Reports of extraordinary cases of dysregulated social behavior following brain injury go back as far as the 19th century (Welt, 1888), and many early neuropsychologists put the prefrontal cortex at the center of their theories of

self-control (Fuster, 1980; Jarvie, 1954). Although neuropsychologists have made great strides in understanding the relationship between brain and behavior, it is often the case that these theories are blind to the social contexts in which most of our thoughts and actions are embedded. It is only recently have researchers begun to apply modern cognitive neuroscience methods to the problem of how the brain enables self-regulation, as well as what happens in the brain when self-regulation fails.

In this chapter we present a brief overview of the functional neuroanatomy involved in self-regulation in social and emotional domains, focusing on neuropsychological research that elegantly demonstrates the dramatic failures of self-regulation that can occur result from damage to specific brain regions. Following this, we turn to studies of the neural substrates of self-regulation and self-regulation failure across three domains: moods and emotions, thoughts and prejudices, and appetitive behaviors (e.g., desires and temptations). Finally, we review recent neuroscience-based models of self-regulation failure.

NEUROPSYCHOLOGICAL INSIGHTS INTO THE FUNCTIONAL ORGANIZATION OF SELF-REGULATION

When it comes to the neural substrates of self-regulation, no region has been more consistently implicated than the prefrontal cortex (PFC). The PFC supports a host of mental operations that fall under the rubric of *executive function* (e.g., working memory, response inhibition, attentional selection, decision making, planning), enabling organisms to adaptively adjust their behavior to external demands and internal goals (Miller & Cohen, 2001). The most widely accepted definition of PFC is that it is the portion of the frontal lobe that lies anterior to primary and secondary motor cortex. The PFC, unlike other regions of the brain, is unique in that it shares connections with a wide range of systems involved in generating and modulating behavior (e.g., motor and sensory systems, subcortical regions involved in emotion and reward, and medial temporal regions involved in learning and memory).

Evidence that the PFC plays a critical role in organizing and controlling behavior stretches back as far as the mid-19th century (although less systematic accounts can be traced back to the 14th century; e.g., Lanfranchi, 1315). Early case reports of patients with damage to the PFC revealed deficits so bizarre that many doubted their veracity. For example, the famous case of Phineas Gage was initially dismissed as a “Yankee invention” by a noted English surgeon of the time. Early case studies focused on the striking personality changes exhibited by these patients, with many examples of formerly pleasant people becoming profane, egoistic, and insensitive to social norms following damage to the PFC. Reflecting the general tone of these patients’ behavior, one early observer termed this constellation of symptoms *Witzelsucht*, which roughly means facetiousness and refers to a patient’s tendency to make inappropriate jokes (Oppenheim, 1890). Another type of symptom commonly observed after damage to the PFC was a dramatic loss of motivational drive. These patients had great difficulty with spontaneously generating behaviors and lacked initiative to such a degree that they often failed to wash or dress themselves. Early theorists of prefrontal function assumed these two distinct types of self-regulation failure were manifestations of the same underlying “prefrontal syndrome,” but as diagnostic techniques improved and the number of patient studies

increased, it became clear that the different neuropsychological deficits observed in these patients had their origin in damage to distinct regions of the PFC.

While there remains debate concerning the precise anatomical boundaries of the PFC and its subregions, researchers are largely in agreement on three principal subdivision of the PFC: the ventromedial PFC (VMPFC), the lateral PFC (LPFC; dorsal and ventral convexities), and the anterior cingulate cortex (ACC). Knowledge of the underlying pattern of anatomical connectivity between regions of the PFC is essential to understanding how these regions come together to make self-regulation possible. We turn now to an overview of the neuroanatomy and psychological changes wrought by damage to each of these three regions.

Ventromedial Prefrontal Cortex

The VMPFC consists primarily of the inferior aspect of the medial PFC and the orbito-frontal cortex, both of which are cytoarchitecturally similar structures (Ongur & Price, 2000). Patients with damage to the VMPFC have difficulty regulating social, affective, and appetitive behaviors. This is borne out by the connectivity pattern in the VMPFC, which is highly interconnected with subcortical limbic areas, such as the amygdala (Carmichael & Price, 1995). In addition, the VMPFC shares connections with reward-processing regions in the ventral striatum (Haber, Kunishio, Mizobuchi, & Lynd-Balta, 1995), as well as regions involved in appetite and visceral sensation, such as the hypothalamus and the insula (Barbas, Saha, Rempel-Clower, & Ghashghaei, 2003). As a result of its connectivity with brain regions involved in emotion and reward, the VMPFC is thought to be important for the self-regulation of emotional, social, and appetitive behaviors (Beer, Shimamura, & Knight, 2004; Fehr & Camerer, 2007; Hare, Camerer, & Rangel, 2009; Quirk & Beer, 2006).

Prior to the 20th century, there were few systematic studies of the changes in personality and behavior brought about by damage to the PFC. Most early examples are case studies, such as that of Phineas Gage, the American railroad foreman whose tamping iron (an iron bar approximately 3 inches in diameter) was propelled through his cranium when the explosive charge he had been preparing accidentally ignited. A less widely known, but no less compelling, case for social disinhibition following damage the VMPFC was made in 1888 by Leonore Welt, who describes the case of a man who sustained severe head trauma after falling 100 feet from a window. This patient showed personality changes similar to those of Phineas Gage, becoming moody and threatening, and often playing cruel practical jokes on the other patients (Welt, 1888). Shortly after his release from the hospital, the patient succumbed to an unrelated illness and his brain was subject to a postmortem examination. Studying his brain, Welt found evidence of extensive VMPFC damage and posited that this injury was the source of the patient's personality changes. This particular case is important for being the first published report of a brain injury as the basis for poor self-control that was confirmed by postmortem examination. Moreover, it inspired others to consider the importance of the precise location of damage to the etiology of personality changes following brain injury.

Since these early case reports, a large number of studies have confirmed the basic finding of social disinhibition following damage to the VMPFC. While initially neurologists had difficulty arriving at a precise description of the symptoms, focusing on certain aspects of the disorder, such as inappropriate humor and use of profanity (Oppenheim,

1890) or the tendency to boast (Brickner, 1934), display aggression (Rylander, 1939), steal and lie (Kleist, 1934), engage in sexual exhibitionism (Ackerly, 1937), more recently it has been shown that the patients have impaired decision making, preferring risky but disadvantageous outcomes over safer ones (Sanfey, Hastie, Colvin, & Grafman, 2003). Over time neuropsychologists converged on the view that damage to the VMPFC leads to a breakdown in self-control and restraint, with a particular emphasis on failure to obey social norms (Beer et al., 2004; Blumer & Benson, 1975; Jarvie, 1954). Interestingly, these patients do not lack knowledge of common social norms (Saver & Damasio, 1991). There is a problem not of memory but of maintaining control over their behavior in everyday situations.

Lateral Prefrontal Cortex

The LPFC, unlike the VMPFC, has no direct connections to limbic regions involved in emotion; instead the LPFC projects primarily to other regions in the PFC, namely, to secondary motor regions involved in action planning (Petrides & Pandya, 1999), the basal ganglia (Nambu, 2008) as well as the VMPFC and ACC (McDonald, Mascagni, & Guo, 1996). With regard to function, although the LPFC is thought to play an important role in elementary executive processes, such as working memory (Curtis & D'Esposito, 2003), planning (Stuss & Alexander, 2007), response selection (Thompson-Schill, Bedny, & Goldberg, 2005) and inhibition of responses (Aron, Robbins, & Poldrack, 2014), it would appear that the LPFC, through its rich connections with ACC, VMPFC, and secondary motor areas, is principally involved in planning and maintaining behaviors. For self-regulation, this means holding regulatory strategies in mind and ensuring that these are not derailed by distractions, such as when a restrained eater suddenly finds him- or herself ambushed by appetizing foods. Thus, the LPFC is thought to be vital for supporting self-regulation in multiple domains (Cohen & Lieberman, 2010).

Patients suffering from damage to lateral portions of the PFC present a very different symptomatology than do patients with VMPFC damage. These patients display profound difficulties in planning behavior and inhibiting goal-irrelevant distractions. One early case illustrating these deficits was described by noted Canadian neurosurgeon Wilder Penfield and is of a patient who underwent a neurosurgical resection involving lateral portions of the PFC. Following recovery, it was noted that the patient demonstrated much difficulty playing games that involved the maintenance of multiple goals in memory, such as bridge (Penfield & Evans, 1935). Moreover, the patient appeared to lose all initiative, displaying a profound apathy toward seeking employment. This case is remarkably similar to one reported half a century later, in which a college student, having recovered from damage to the right PFC, repeatedly failed classes and eventually dropped out of college. He later reported that despite understanding the material, he simply could not muster the interest it would take to be successful (Stuss & Benson, 1986).

Unlike patients with damage to the VMPFC, patients with LPFC damage have no problem engaging in social interactions or understanding social and emotional cues (Bar-On, Tranel, Denburg, & Bechara, 2003). Their deficits are more in line with the core faculties of what has come to be known as *executive function* (Miller & Cohen, 2001), and their difficulty in organizing and regulating behavior can be traced to deficits in working memory, task switching, and inhibitory control. Accordingly, these patients have difficulty in tasks that have changing demands, and they often persevere in behaviors

that have become irrelevant to the current goals of the task (Barceló & Knight, 2002; Milner, 1963). These patients also perform poorly on tasks relying on inhibitory control. For instance, patients with LPFC damage are impaired on the Stroop task (Perret, 1974; Vendrell et al., 1995), in which they have to read the name of a color word printed in a conflicting ink color (e.g., the word *red* printed in blue ink). These patients also have difficulty generating novel items, such as nonverbalizable designs, and tend to perseverate on the same type of design throughout the task (Jones-Gotman & Milner, 1977).

Perhaps the best overall example of the constellation of deficits exhibited by patients with LPFC damage comes from observing their performance on everyday tasks outside the laboratory. In a cleverly designed study, Shallice and Burgess (1991) instructed patients to perform an array of real-world errands (e.g., shopping for items on a list, asking for directions, and meeting someone at a specified time) while being unobtrusively tailed by two observers who made note of their performance. Patients showed a remarkable inability to complete even the most rudimentary daily errands; for instance, patients failed to purchase items on their list, entered the same shop multiple times, and even left a shop without paying (Shallice & Burgess, 1991). This clever, real-world neuropsychological test serves to illustrate how the many facets of LPFC function must work together to allow us to accomplish even the most mundane of goal-directed behaviors.

More recently, studies using transcranial magnetic stimulation, which can cause local disruptions of neural activity within a brain region, have shown that inactivation of the LPFC can lead to increased impulsiveness and risky decision making (Chambers et al., 2006; Knoch, Pascual-Leone, Meyer, Treyer, & Fehr, 2006). Conversely, activating (instead of inhibiting) these same regions using a technique known as direct current stimulation, produces the opposite effect. Rather than impairing the ability to engage in self-control, direct current stimulation appears to improve self-control, as evidenced by reduced impulsive behavior during financial decision-making tasks (Fecteau et al., 2007; Jacobson, Javitt, & Lavidor, 2011).

Anterior Cingulate Cortex

The ACC is the rostral portion of cingulate cortex, resting above the corpus callosum. It is interconnected with a wide range of brain structures involved in cognition, emotion, and motor execution. However, unlike other regions of the PFC, the ACC receives little input from regions involved in sensory processing (Carmichael & Price, 1995). The ACC is intimately connected to the LPFC and VMPFC, and the adjacent motor cortex. In addition, the ACC shares many important connections with limbic regions involved in emotion, and ventral striatal regions implicated in reward processing (Ongur, An, & Price, 1998; Vogt & Pandya, 1987). In many ways the ACC sits at the anatomical crossroads of cognitive control, affective control, motor planning, and arousal, and is therefore ideally suited to exert an influence over these regions in response to environmental demands (Paus, 2001).

Knowledge of the cognitive and behavioral effects of ACC damage is constrained by the relative paucity of patients with pure focal damage to the ACC. It is uncommon for this region to be damaged in closed-head injuries, and damage caused by strokes tends to encroach upon surrounding cortex (e.g., the medial PFC and secondary motor cortices). Of the few case studies of patients with focal ACC damage, their symptoms are marked by general apathy, blunted affect, and difficulty in maintaining goal-directed behavior

(Cohen, Kaplan, Moser, Jenkins, & Wilkinson, 1999; Cohen, Kaplan, Zuffante, et al., 1999; Cohen, McCrae, & Phillips, 1990; Laplane, Degos, Baulac, & Gray, 1981; Wilson & Chang, 1974). Family members report that these patients appear to have lost their “drive” and frequently note patients’ dramatic loss of interest in activities and hobbies they formerly found pleasurable (Cohen, Kaplan, Moser, et al., 1999; Tow & Whitty, 1953).

Given the paucity of patients with focal ACC damage, much of the theorizing concerning ACC function is built on recent findings from cognitive neuroscience. One of the most consistent findings from brain activation studies is that the ACC is involved in detecting conflict among competing responses and monitoring for errors in performance (Carter et al., 1998; Gehring & Knight, 2000; MacDonald, Cohen, Stenger, & Carter, 2000). This has led many to theorize that the primary role of the ACC is to detect situations in which response conflict is likely, then to signal the need for increased cognitive control, such as when overriding habitual behaviors or overcoming temptations (Botvinick, Braver, Barch, Carter, & Cohen, 2001; Kerns et al., 2004; Paus, 2001; Peterson et al., 1999). Moreover, it is hypothesized that under situations of cognitive conflict, the ACC communicates directly with the LPFC to bring current behavior in line with overarching goals (Ridderinkhof, Ullsperger, Crone, & Nieuwenhuis, 2004).

THE NEURAL BASIS OF SELF-REGULATORY FAILURE

In the previous section, we reviewed neuropsychological case studies demonstrating the roles of VMPFC, LPFC, and ACC in self-regulation. This research demonstrates that damage to any one of these regions can have profound effects on a person’s ability to regulate behaviors across a variety of domains, from following social norms to carrying out mundane, everyday tasks. The ability to maintain our goals in mind, to correct for errors in performance and, ultimately, to bring our thoughts and behaviors in line with our intentions, relies on the complex interplay between each of the aforementioned PFC regions. This ability to remain in control of our behavior is proposed to rely on a balance between self-control capacity and the strength of impulses and desires. Self-regulation can therefore fail when faced with a strong desire or when the individual’s self-control capacity is reduced or the motivation to engage in effortful control is lacking (Heatherton & Wagner, 2011). Careful study of the deficits exhibited by patients with focal brain damage can give us important insights into the underlying cognitive operations that these damaged regions normally support. However, to understand how the healthy PFC enables self-regulation and what happens in the brain when self-regulation fails, we must turn to the study of healthy populations and the methods of cognitive neuroscience. In the following section we examine how these methods have been used to investigate the neural substrates of self-regulation and self-regulation failure in three separate domains: emotions, thoughts and stereotypes, and appetitive behaviors.

Neural Bases of Emotion Regulation

Keeping emotions in check is a vital part of maintaining harmonious social relationships. Were our ability to do so suddenly knocked out, our relationships would likely turn very ugly indeed. Research on the neural substrates of this complex ability has honed in on a model of emotion regulation involving top-down regulation by the PFC of limbic regions

involved in affect (Davidson, Putnam, & Larson, 2000; Ochsner & Gross, 2005). A consistent finding across a wide range of studies is an inverse correlation between the PFC and activity in the amygdala, a limbic region sensitive to emotionally arousing stimuli. The precise region of PFC involved in modulating the amygdala varies across studies but is invariably either the LPFC (Hariri, Mattay, Tessitore, Fera, & Weinberger, 2003; Ochsner, Bunge, Gross, & Gabrieli, 2002; Ochsner et al., 2004) or the VMPFC (Johnstone, van Reekum, Urry, Kalin, & Davidson, 2007; Urry et al., 2006). In light of the earlier discussion of the anatomical connectivity of these two regions, specifically regarding the fact that the LPFC has no direct connections to limbic regions, it would appear that the LPFC exerts its regulatory influence indirectly. Evidence for this indirect pathway was reported by Johnstone and colleagues (2007), who found that the relationship between LPFC and the amygdala during emotion regulation is mediated by the VMPFC.

Mood disorders, such as major depressive disorder (MDD) and borderline personality disorder (BPD), present interesting cases of impaired emotion regulation. Research on patients with these mood disorders has consistently shown a breakdown in the inverse functional coupling between VMPFC and the amygdala, leading to exaggerated activation of the amygdala in response to negative emotional material (Donegan et al., 2003; Johnstone et al., 2007; Silbersweig et al., 2007). This finding of a dysfunctional VMPFC–amygdala circuit finds additional support in a recent study of patients with BPD, using fludeoxyglucose–positron emission tomography (FDG-PET), a neuroimaging method that allows for the measurement of resting glucose metabolism. In contrast to healthy controls, patients with BPD showed no coupling of metabolism in the VMPFC and amygdala (New et al., 2007). These findings demonstrate that even when patients with BPD are not actively regulating emotions, the normal functional coupling between the VMPFC and amygdala is impaired.

A final example of the uncoupling of this VMPFC–amygdala circuit comes from a study of the deleterious effects of sleep deprivation on emotion regulation. In this research, sleep-deprived and control participants underwent functional magnetic resonance imaging (fMRI) scanning while viewing negative emotional material. As in the patients with mood disorders mentioned earlier, sleep-deprived patients demonstrated an exaggerated amygdala response compared to control participants and impaired functional connectivity between the VMPFC and amygdala (Yoo, Gujar, Hu, Jolesz, & Walker, 2007).

Regulation of Thoughts and Prejudices

Cognitive neuroscientists have long studied the neural basis of response inhibition, relying primarily on tasks such as the go/no-go task, in which certain cues indicate a go response (usually a button press), while others require the participant to inhibit responding. Research using this task has consistently found activation in both the ACC and LPFC (Casey et al., 1997; Kiehl, Liddle, & Hopfinger, 2000; Somerville, Hare, & Casey, 2011). The ACC in particular is thought to be involved in response competition between conflicting cues, and in monitoring for errors in performance, while activity in the LPFC reflects the actual inhibition of responses during the no-go trials (Liddle, Kiehl, & Smith, 2001). Surprisingly, few attempts have been made to apply this framework to the problem of thought suppression.

In perhaps the first study to examine the neural substrates of actively suppressing thoughts, Wyland, Kelley, Macrae, Gordon, and Heatherton (2003) found increased ACC activity during periods of active thought suppression compared to periods of

unrestrained thought. One problem with interpreting these results is that because subjects were not instructed to report thought intrusions during the suppression period, it is unclear whether ACC activity was related to failures of thought suppression or was instead signaling the need for additional cognitive control (see Botvinick et al., 2001). To parse out these two interpretations, Mitchell and colleagues (2007) conducted a similar study. However, this time, participants were instructed to respond whenever they experienced intrusions of a prespecified thought. Results from this study are in agreement with the previously described research on response inhibition, demonstrating increased activity in the LPFC during periods of thought suppression, while the ACC was found to respond only during instances of thought intrusions. These findings provide converging evidence that the ACC monitors for conflict, while the LPFC is involved in actively regulating and suppressing thoughts (Mitchell et al., 2007).

Controlling attitudes and prejudices differs from thought regulation in that stereotypes are often automatically activated upon encountering outgroup members (Devine, 1989; Devine, Plant, Amodio, Harmon-Jones, & Vance, 2002; Fiske, 1998; Greenwald, McGhee, & Schwartz, 1998; Payne, 2001). Moreover, outgroup members, particularly racial outgroup members, are often perceived as threatening (Brewer, 1999; cf. Ackerman et al., 2006). Research examining the neural correlates of prejudice has largely focused on prefrontal top-down regulation of amygdala activity to members of a racial outgroup, although similar findings exist for members of stigmatized groups, such as unattractive people and the obese (Krendl, Macrae, Kelley, Fugelsang, & Heatherton, 2006). An important factor to keep in mind when reviewing this research is that people differ in implicit racial attitudes, and this difference has been shown to moderate amygdala activity in response to racial outgroup members (Cunningham et al., 2004; Phelps et al., 2000). An excellent example of this comes from a study examining the depleting effects of interracial interactions on the propensity to recruit control regions of the PFC when evaluating racial outgroup members. In this study, participants engaged in an interracial interaction with a black confederate, in which they were asked to discuss racially charged topics. Following the interaction, participants completed a Stroop task. Interestingly, participants with more negative implicit attitudes toward blacks showed decreased performance on the Stroop task, indicating that, for them, the interracial interaction was cognitively depleting. Participants also participated in an ostensibly unrelated fMRI study in which they viewed black and white faces. As with other similar studies (e.g., Cunningham et al., 2004), they showed increased recruitment of the LPFC and ACC when viewing black faces. More importantly, activity in these regions was positively correlated with both participants' scores on the Implicit Association Test (IAT) and with their Stroop interference scores (Richeson et al., 2003). These results suggest that for those with fewer implicit attitudes toward blacks, there is less need to recruit PFC regions involved in cognitive control to override stereotypes that they simply do not seem to have.

Control of Cravings and Appetitive Behaviors

As noted earlier, the VMPFC and ACC share many reciprocal connections with midbrain regions that are important for reward (e.g., nucleus accumbens). The nucleus accumbens, along with the ventral tegmental area (VTA), form part of what is known as the *mesolimbic dopamine system*. Both animal neurophysiology and human neuroimaging work have shown that a seemingly universal feature of rewarding stimuli, be they natural rewards or

drugs of abuse, is that they activate dopamine release in the nucleus accumbens (Carelli, Ijames, & Crumling, 2000; Di Chiara & Imperato, 1988; Pfaus et al., 1990) or, in the case of neuroimaging work, lead to increased activation in this same region (Berns, McClure, Pagnoni, & Montague, 2001; Breiter et al., 1997; O'Doherty, Dayan, Friston, Critchley, & Dolan, 2003). This holds true even when participants are simply viewing photographic "cues" of rewarding stimuli, such as attractive members of the opposite sex (Cloutier, Heatherton, Whalen, & Kelley, 2008), food images (Demos, Heatherton, & Kelley, 2012; Wagner, Boswell, Kelley, & Heatherton, 2012) or images of drugs (David et al., 2007; Garavan et al., 2000; Myrick et al., 2008). This paradigm, given the name *cue reactivity*, has become an important tool in research on the neural correlates of craving and control in drug addicts (Childress et al., 1999; Garavan et al., 2000; Maas et al., 1998; Wexler et al., 2001), smokers (David et al., 2007; Due, Huettel, Hall, & Rubin, 2002; Wagner, Dal Cin, Sargent, Kelley, & Heatherton, 2011), and obese persons (Rothe-mund et al., 2007; Stoeckel et al., 2008). For instance, in dieters, cue reactivity to foods is prospectively correlated with future weight gain over the following 6-month period (Demos et al., 2012) and in another study has been shown to be associated with daily food desires, as measured by experience sampling (Lopez, Hofmann, Wagner, Kelley, & Heatherton, 2014). Within the domain of smoking, cue reactivity to smoking cues predicts the degree to which smokers attempting to quit are able to stay abstinent (Janes et al., 2010). In addition, research on people's ability to delay gratification (e.g., Mischel, Shoda, & Rodriguez, 1989) has shown that people who had trouble delaying gratification during childhood demonstrated greater brain cue reactivity to appetitive stimuli over 40 years later (Casey et al., 2011).

What happens when participants try to inhibit their response to food or drug cues? As might be expected from results in other domains, self-regulation of appetitive desires recruits PFC control systems regardless of whether the rewarding stimulus is food (Stoeckel et al., 2008), erotic images (Beauregard, Levesque, & Bourgouin, 2001), cigarettes (Brody et al., 2007; David et al., 2005; Kober et al., 2010), drugs (Garavan et al., 2000; Wrase et al., 2002), or money (Delgado, Gillis, & Phelps, 2008). Moreover, activity in these regions appears to be related to whether people are successful at inhibiting cravings. For example, successful dieters have been shown to recruit the LPFC spontaneously when viewing images of appetizing foods, whereas unsuccessful dieters do not (DelParigi et al., 2007). This finding suggests that what makes these dieters successful is that they appear to recruit regulatory regions spontaneously in response to food cues, and that this automatic regulation strategy helps to control food cravings.

A well-known finding in research on restrained eating is that forcing chronic dieters to break their diet, usually by having them consume a high-calorie milkshake "preload," can lead to bouts of unrestrained eating (Heatherton, Herman, & Polivy, 1991, 1992; Heatherton, Polivy, Herman, & Baumeister, 1993; Herman & Mack, 1975). Theories of drug addiction suggest that the reason why drug addicts fail to control their consumption is that midbrain reward areas become hypersensitized to drug cues (Stoeckel et al., 2008) and are uncoupled from top-down control regions in the PFC (Bechara, 2005; Koob & Le Moal, 1997, 2008). This notion was examined in a study that compared cue reactivity to appetizing foods in restrained and unrestrained eaters, half of which drank a high-calorie milkshake preload, effectively breaking the restrained eaters' diets. Restrained eaters whose diets were broken by the milkshake preload demonstrated increased food-cue-related activity in the nucleus accumbens compared to both unrestrained eaters and restrained eaters whose diet had not been broken (Demos, Kelley, & Heatherton, 2011),

a finding that mirrors the earlier behavioral studies (e.g., Heatherton et al., 1991, 1992; Herman & Mack, 1975).

NEGATIVE AFFECT AND SOCIAL DISTRESS

In the previous section we reviewed the role of prefrontal brain regions in the regulation of emotion. In this section, we instead turn the tables on the PFC and examine research suggesting that emotions can serve as a catalyst for self-regulation failure (for a larger review, see Wagner & Heatherton, 2013a). The experience of emotional and social distress has often been cited as precursor to self-regulation failures in domains such as binge eating (Haedt-Matt & Keel, 2011), drinking (Witkiewitz & Villarroel, 2009), and gambling (Raviv, 1993). Experimental inductions of negative affect and social distress have similarly found that these may lead to increased consumption of unhealthy foods, reduced persistence on tasks, impulsive decision making, and even to aggressive behavior toward others (Baumeister, DeWall, Ciarocco, & Twenge, 2005; Heatherton, Striepe, & Wittenberg, 1998; Lerner, Li, & Weber, 2013; Oaten, Williams, Jones, & Zadro, 2008; Twenge, Baumeister, Tice, & Stucke, 2001).

How does negative affect lead to impaired self-regulation? A number of mechanisms have been proposed, many of which center on the notion that experiencing negative affect causes a shift in current goals, such that the individual becomes engaged in affect regulation at the expense of other forms of self-control (Tice, Bratslavsky, & Baumeister, 2001). Alternatively, people may engage in misregulation, deciding instead to attempt to ameliorate their mood, which can occur at the expense of their long-term goals, such as when an abstinent drinker decides to have a drink in order to improve his or her mood after receiving bad news. Another potential mechanism comes from research suggesting that negative affect may increase the strength of desires, rendering them more difficult to control. For instance, experiencing negative affect has been associated with increased craving for carbohydrate-rich foods (Christensen & Pettijohn, 2001) and, among smokers, increases their reported pleasure from smoking a cigarette (Zinser, Baker, Sherman, & Cannon, 1992). Other work suggests that rewards such as money may increase in value in so far as they are perceived as a means of relieving the negative affective state (e.g., Duclos, Wan, & Jiang, 2013).

Functional neuroimaging studies have similarly shown that emotional distress may heighten reward cue reactivity and impair self-regulation. For instance, research has shown that social distress is associated with increased reward cue reactivity to appetitive positive and appetitive images (Chester & DeWall, 2014) and increased risk-taking behavior, in conjunction with reduced lateral PFC activity, during a driving simulation task (Peake, Dishion, Stormshak, Moore, & Pfeifer, 2013). Similarly, among dieters, emotional distress has been shown to increase reward cue-reactivity to appetizing foods (Killgore & Yurgelun-Todd, 2006; Wagner et al., 2012).

SELF-REGULATORY DEPLETION

Successful regulation of thoughts, emotions, and cravings relies on a common system of prefrontal control regions that comprise the ACC, the LPFC, and the VMPFC. Although

we addressed each of these domains in isolation, there is ample evidence that self-regulation relies on a domain-general resource that can become depleted by successive attempts at self-regulation (Baumeister & Heatherton, 1996; Muraven & Baumeister, 2000; Vohs & Heatherton, 2000). The view that self-regulation is a resource-limited system that can become temporarily exhausted through use has come to be known as the *strength model of self-regulation* (Baumeister & Heatherton, 1996). Over the years this model has received considerable empirical support (for a meta-analysis, see Hagger, Wood, Stiff, & Chatzisarantis, 2010); in addition, research using experience sampling has shown that the disinhibiting effects of depletion also appear to obtain in real-world settings, in that the likelihood of reporting a failure to self-regulate increases as a function of the number of prior acts of self-regulation that participants have attempted (Hofmann, Vohs, & Baumeister, 2012). For instance, research has shown that when people engage in a prior effortful self-regulation task, they subsequently become more likely to consume tempting foods (Vohs & Heatherton, 2000), pay attention to rewards (Schmeichel, Harmon-Jones, & Harmon-Jones, 2010), and show impaired emotion regulation (Schmeichel, 2007).

In our chapter in the previous edition of this handbook, we could only speculate on how depletion affects brain mechanisms involved in self-regulation. However, in the intervening time, a number of researchers have turned to the methods of cognitive neuroscience in an attempt to understand how self-regulatory depletion undermines self-regulation. Consistent with behavioral results, these studies have demonstrated that following effortful self-regulation, people show impairments on effortful self-regulation tasks such as the Stroop task, and these performance decrements in one study were associated with a reduced error-related negativity signal originating in the ACC and thought to be involved in conflict monitoring (Inzlicht & Gutsell, 2007). Other research, using functional neuroimaging, has shown that depletion leads to reduced recruitment of the LPFC during self-regulation tasks (Frieze, Binder, Luechinger, Boesiger, & Rasch, 2013; Hedgcock, Vohs, & Rao, 2012; Persson, Larsson, & Reuter-Lorenz, 2013). For instance, in work by Frieze and colleagues (2013), participants first completed a difficult or easy emotion suppression tasks, followed by the Stroop task, all while undergoing fMRI. The results of this study showed that participants in the depletion condition demonstrated increased right LPFC activity during the thought suppression task, and, in the same region, they subsequently showed underrecruitment of this region (relative to nondepleted participations) during the Stroop task. Together, these and other findings suggest that the performance decrements observed on subsequent tasks result from a failure to engage self-control systems following depletion. Moreover, they raise the interesting possibility that the aftereffect of depletion on top-down control will be most pronounced in brain regions involved in both the depletion and subsequent self-control task (e.g., Frieze et al. 2013).

These last few studies highlight a role for the PFC in self-regulatory depletion during more cognitive tasks, but what happens when people seek to inhibit their desires or regulate their emotions (i.e., so called “hot” cognition; Metcalfe & Mischel, 1999)? Prior behavioral research suggests that another possible aftereffect of self-regulatory depletion is increased attention toward rewards (Schmeichel et al., 2010). Given that self-regulation often involves a balance between impulses and self-control, another possible route through which depletion can bring about self-regulation failure is by changing the strength of impulses directly. Two functional neuroimaging studies lend partial support to this notion by showing that, following a self-regulatory depletion task, people

show exaggerated amygdala reactivity to aversive emotional scenes (Wagner & Heatherton, 2013b), and dieters show increase reward cue reactivity to images of appetizing foods (Wagner, Altman, Boswell, Kelley, & Heatherton, 2013). Moreover, in both cases, depleted subjects also showed reduced functional connectivity between the amygdala and VMPFC on the one hand (Wagner & Heatherton, 2013b), and reward-related regions and the LPFC on the other (Wagner et al., 2013). These studies are consistent with the notion that self-regulatory depletion may have independent effects on desire strength; however, they also support a model whereby self-regulation impairments may come about as a result of a reduced coupling between regions important for reward and reward regulation, such as the LPFC (Delgado et al., 2008; Kober et al., 2010; Somerville et al., 2011), or between limbic regions and prefrontal areas involved in emotion regulation, such as the VMPFC (Johnstone et al., 2007; Somerville et al., 2013). This reduced functional connectivity, then, may be responsible for the observation that self-regulatory depletion leads to enhanced emotional and reward-related cue reactivity.

CONCLUSIONS

Failure to maintain control over one's thoughts, emotions, and desires can result in disastrous consequences for the individual. Patients with focal damage to the PFC present an extreme case of what life would be like without the ability to regulate our behaviors. Neuropsychological case studies have provided essential clues to the cognitive operations subserved by the PFC. However, understanding the complex interplay between regions of the PFC involved in regulating behavior and those regions that signal motivational relevance or emotional states necessitates a cognitive neuroscience approach. In this chapter we have focused on three distinct regions of the PFC and how findings from cognitive neuroscience shed light on their role in self-regulation, as well as what happens when self-regulation breaks down. First is the VMPFC, which shares important reciprocal connections with subcortical regions involved in emotion and reward, and is critical for regulating behavior in social, affective, and appetitive domains. Second is the LPFC, which, with its important role in core aspects of executive function (e.g., working memory), is necessary for planning behavior and maintaining regulatory goals. Third is the ACC, a region that is richly interconnected with cognitive, affective, and motor regions; monitors our performance; and signals the need for recruiting control systems to regulate our behavior.

In this chapter we have reviewed recent work examining the brain basis of self-regulation failure across multiple domains. The general framework that emerges from this research is that lapses in control may result from a failure to recruit lateral prefrontal regions involved in self-control that are necessary to complete a task or inhibit a response. Another route through which self-regulation failure can occur is when these same lateral prefrontal regions fail to adequately keep in check stimulus-driven cortical and subcortical responses associated with emotion, threat, and reward. Thus, what the research suggests is that the two classic components of self-control (top-down control vs. impulse strength) can be approximately mapped onto brain systems that are important for cognitive control on the one hand, and onto brain regions involved in subjective value and reward on the other. Although there is surely more complexity to how the brain enables self-regulation, the results thus far point to the importance of prefrontal control systems in monitoring behavior, signaling the need for control, and engaging in effortful inhibition. However,

just as important appears to be the sensitivity of the brain's reward system, individual differences that are predictive of real-world self-regulation failures (e.g., Lopez et al., 2014). It appears that when it comes to understanding how self-regulation is related to brain function, it is important to maintain a balanced view.

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CHAPTER 8

Pause and Plan

The Physiology of Self-Regulation

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Self-regulation is not a new concept to health psychologists, who have long been concerned with how people change, control, and maintain health behaviors, as well as other factors, such as emotion and social interaction, that contribute to physical health (e.g., Matarazzo, 1980). However, the idea that self-regulation has physiological correlates is relatively new. Other motivational and emotional states affect physiology directly. For example, many people are familiar with the “fight-or-flight” physiological profile, which includes increases in heart rate and cardiac output (the amount of blood circulated from the heart per unit time). Vascular changes redirect blood to the heart and large vessels and away from visceral organs (e.g., kidneys, digestive organs). These cardiovascular changes are hypothesized to support physical demands of fighting or fleeing. Other changes (e.g., in the immune system) may also occur to address sequelae such as wounding (Segerstrom & Miller, 2004). “Fight-or-flight” changes occur in the absence of actual physical effort, for example, during acute stressors such as public speaking or mental arithmetic, and can therefore reflect preparatory physiological changes in response to psychological cues.

Physiological effects of some acute stressors, however, do not entirely conform to the “fight-or-flight” profile. Mirror tracing, for example, requires a person to trace the outline of a figure by using its reflection in an adjacent mirror, challenges visuomotor integration, and is associated with increased heart rate but not cardiac output (e.g., Hurwitz et al., 1993). Different challenges, therefore, may elicit different physiological profiles. In this chapter, we propose that challenges and circumstances that engage self-regulatory effort may be characterized by a profile that involves down-regulation of a number of physiological systems. We call this profile “pause and plan” (Segerstrom, Hardy, Evans, & Winters, 2011) because it occurs under conditions in which a person is required to act thoughtfully and carefully rather than thoughtlessly or impulsively, that

is, to self-regulate. Although self-regulating and responding to stress may both seem difficult, the primary demand of pausing and planning is the opposite of that in fighting or fleeing: to inhibit impulse or action rather than acting quickly. Therefore, the accompanying physiology may also be different, particularly with regard to conserving versus expending energy.

In this chapter, we review evidence for changes during self-regulation in the immune system, heart, and liver. We then consider why these changes might occur, drawing on two theories from physiology: ecological immunology and central governor theory. Finally, we consider future directions in this emerging body of theory and evidence. For example, although to date there is evidence only for involvement of the immune system, heart, and liver in “pause and plan,” it is possible that other systems may also be included.

PHYSIOLOGICAL CHANGES DURING SELF-REGULATION

Changes in the Immune System

Some of the earliest evidence for physiological consequences of self-regulation came from studies of dispositional optimism and the immune system, although these findings were not immediately recognized as relevant to self-regulation. In these studies, dispositional optimists, who expect generally bright futures, had higher immune parameters than their pessimistic counterparts under “ordinary” circumstances, but *lower* immune parameters under “difficult” circumstances.

The immune parameters involved were those that protect against viruses and other intracellular pathogens (i.e., cellular immunity). The number of cytotoxic T cells in blood may represent the readiness of the cellular branch of the immune system to fight pathogens such as viruses. Natural killer cell cytotoxicity (NKCC) represents the ability of natural killer cells taken from blood to kill their cellular targets *in vitro*. In contrast, delayed-type hypersensitivity (DTH) testing represents the ability of cellular immunity to respond to a challenge *in vivo*. A small amount of dead virus or yeast is injected into the skin; a red swelling (or *induration*) that resembles a bug bite typically results. The more immune cells that infiltrate the skin and respond to the challenge, the larger the induration.

The first study to find an interaction between optimism and circumstances was a laboratory study that exposed young men to controllable or uncontrollable noise. Among men exposed to controllable noise or no noise, higher optimism correlated with higher cellular immune function (NKCC). However, among men who were exposed to uncontrollable noise, the opposite was true: Higher optimism correlated with lower cellular immune function (Sieber et al., 1992).

Naturalistic studies that followed found similar interactions. Among women experiencing persistent stressors (> 1 week), higher optimism correlated with lower numbers of cytotoxic T cells and lower function (NKCC). This relationship was not found during brief stressors (< 1 week; Cohen et al., 1999). Higher optimism was associated with poorer cellular immune function (smaller DTH indurations) among law students who experienced high goal conflict but with better function (larger DTH indurations) among students who experienced low goal conflict. This finding replicated across three independent samples (Segerstrom, 2001, 2006).

Cortisol, a metabolic hormone, has the general physiological effect of mobilizing energetic substrates, such as glucose, and of suppressing energetic use by some systems, including the immune system. It is a particularly potent suppressor of the cellular immune system. It is often called a “stress hormone” because it facilitates this energetic shift during fight or flight. However, it can be elevated under a number of circumstances that call for more available energy (e.g., sleep deprivation; Leproult, Copinschi, Buxton, & Van Cauter, 1997). High optimism in combination with high self-awareness predicted both longer persistence on difficult anagrams and higher cortisol during the recovery period (Solberg Nes, Segerstrom, & Sephton, 2005).

Interpretation of these findings initially focused on expectancy violation: Because optimists expect things to go well, experiences of uncontrollability, prolonged stress, or goal conflict could be especially upsetting to them. For example, people “who, by personal disposition, tend to expect positive and controllable outcomes are the most stressed when the actual outcome is contrary to their expectations” (Sieber et al., 1992, p. 154). However, there was also evidence to suggest that this interpretation is not correct. First, if positive thoughts increase vulnerability to stress, then negative thoughts should decrease vulnerability to stress. In fact, negative thought styles—neuroticism, for example—increase vulnerability to stress (e.g., Bolger & Schilling, 1991). Second, in explicit tests of expectancy violation, optimists were not more stressed than pessimists after receiving bad news (e.g., Litt, Tennen, Affleck, & Klock, 1992). Likewise, negative affect could not consistently account for the effects of optimism on cellular immune function in law students, suggesting that being upset by expectancy violation was not the root cause of these effects (Segerstrom, 2001, 2006). Therefore, a second interpretation was advanced: that optimists in these studies were more actively engaged with their goals and were using more active coping strategies; that is, they were engaging in more active self-regulation. This strategy could be more physiologically taxing in the short term but more adaptive in the long term for achieving goals and resolving stressors (Segerstrom, 2001, 2005, 2006).

Another laboratory study supported the interpretation that optimists were engaging in more active self-regulation than pessimists, and that this difference accounted for the immunological effects of stressors (Segerstrom, Castañeda, & Spencer, 2003). Law and medical students either rested or completed a difficult mental arithmetic task. If they rested, higher optimism was associated with better cellular immune function (larger DTH indurations), but if they performed the difficult task, higher optimism was associated with worse function. The analysis was then repeated, replacing optimism with either neuroticism or conscientiousness. A parallel interaction with neuroticism was not found, indicating that generally positive or negative thoughts and feelings were not driving the effect. A parallel interaction with conscientiousness was found, indicating that optimists’ engagement and persistence—that is, their self-regulatory effort when faced with difficulty—was likely to be driving the effect.

In summary, the studies of optimism (and conscientiousness) and cellular immune parameters suggest an immunological cost to self-regulatory effort. It is important to note that this cost is small and is evident in the context of no or minor immunological challenge (e.g., the skin test used for DTH). The relationship is likely to be quite different in the context of a major immunological challenge. For example, fever results when the brain responds to signals of infection and inflammation. Therefore, fever indicates that the brain “knows” about a major immune challenge. Fever is accompanied by behavioral

changes including passivity, apathy, and withdrawal, which are thought to conserve energy for the demands of the immune response (Dantzer, 2001). Therefore, the link between effort and immunity can be dramatically different depending on the degree of immunological challenge. In some cases, effort may trump immune responses; in others, immune responses may trump effort.

Changes in the Cardiovascular System

Self-regulation is accompanied by not only by immunological changes but also cardiovascular ones. In particular, heart rate (HR) often slows during self-regulation, an effect mediated by the parasympathetic nervous system and one that extends “pause and plan” physiology from the immune system to the heart. To understand how self-regulation is related to the heart, it is first important to understand the role of the autonomic system. The heart is innervated by both sympathetic and parasympathetic branches of the autonomic nervous system. Parasympathetic activation slows down HR, and sympathetic activation speeds it up. HR is determined by the balance of input from these two branches (Berntson, Cacioppo, & Quigley, 1991, 1993). The heart is normally under substantial parasympathetic control; without it, resting human heart rate would be around 100 beats per minute (bpm) rather than the actual resting HR of 60–80 bpm. Parasympathetic input acts more quickly than sympathetic input, so HR can increase more quickly in response to demand by withdrawing parasympathetic activity, much in the same way that a race car driver starts a race by removing the brake rather than pressing the gas. Therefore, ongoing parasympathetic control of the heart allows for quick, flexible responses via reduction of the “vagal brake” (McCraty & Shaffer, 2015).

HR increases and decreases with each breath in a pattern known as respiratory sinus arrhythmia, which is largely determined by parasympathetic input. Respiratory sinus arrhythmia can be quantified using a number of measures (see Bernston et al., 1997; Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996); one of the most common measures uses spectral analysis to quantify HR changes falling within the frequency of respiration (9–24 cycles per minute). This high-frequency heart rate variability (HRV) is a reliable and valid indicator of parasympathetic nervous system activity (for a review, see Thayer, Hansen, Saus-Rose, & Johnsen, 2009). Higher HRV correlates with lower HR and reflects stronger application of the “vagal brake.”

The overlap in brain areas involved in self-regulation and parasympathetic autonomic control suggests the possibility of using HRV as a biomarker for self-regulatory effort. Neurovisceral integration theory proposes a network of brain areas that integrate autonomic, psychological, neuroendocrine, and behavioral responses (McCraty & Shaffer, 2015; Thayer et al., 2009; Thayer & Lane, 2009). This network includes the prefrontal cortex, cingulate cortex, and amygdala, which are also activated during tasks of self-regulation and executive cognitive functioning (Heatherton & Wagner, 2011; Thayer et al., 2009). The prefrontal cortex has received particular attention as an area associated both with maintaining heart rate and rhythm and exerting self-regulatory control (Critchley, Corfield, Chandler, Mathias, & Dolan, 2000; Gianaros, Van Der Veen, & Jennings, 2004; Heatherton & Wagner, 2011; Lane et al., 2009). When brain regions such as prefrontal cortex are engaged to meet a self-regulatory challenge, this activation creates “inhibitory spillover” and facilitates other self-regulatory tasks going on at

the same time (e.g., resisting tempting but unhealthy food while also inhibiting emotion expression; Tuk, Zhang, & Sweldens, 2015). Inhibitory spillover could also facilitate parasympathetic inhibition of HR during self-regulation.

To test the associations between self-regulatory effort, HR, and HRV, young adult participants were randomly assigned to eating carrots instead of chocolate (high self-regulatory effort) or eating chocolates instead of carrots (low self-regulatory effort). Participants in the high self-regulation condition had slower HR and higher HRV during the task compared with those in the low self-regulation condition. The cardiac effects of high stress (speaking while being pressured and criticized by the experimenter) versus low stress (relaxation) were different. Participants in the high-stress condition had faster HR and lower HRV during the task than those in the low stress condition (Segerstrom & Solberg Nes, 2007). Taken together, these findings demonstrate that (1) self-regulation and stress are physiologically distinguishable, with self-regulation associated with parasympathetic activation and stress associated with parasympathetic withdrawal, and (2) increases in HRV may serve as an index of self-regulatory effort.

In another study supporting changes in HRV as a marker of self-regulatory effort, women were randomly paired into groups and asked to discuss an upsetting film. One member of the dyad was instructed to suppress her negative emotions, whereas the other was instructed to reappraise them—both tasks that require self-regulatory effort. Women attempting to suppress or reappraise their negative emotions demonstrated increases in HRV during the task, providing evidence that parasympathetic activity increases during self-regulation (Butler, Wilhelm, & Gross, 2006). In another dyadic study, wives' HRV increased during discussion of a topic of marital conflict with their husbands, which was interpreted by the authors as reflecting wives' self-regulatory effort in managing negative affect in the relationship. This interpretation was supported by these wives' higher affiliative behavior during the discussion (Smith et al., 2011).

Other work has further replicated and extended the association between self-regulation and HRV. Larger increases in HRV during a stress recall task correlated with higher self-reported ratings of attentive engagement (Cribbet, Williams, Gunn, & Rau, 2011). In a smoking cessation intervention, larger increases in HRV during meditation predicted lower cigarette use 17 weeks later (Libby, Worhunsky, Pilver, & Brewer, 2012). For these smokers, increases in HRV during meditation may have reflected the ability to recruit self-regulatory strength appropriately, which assisted in smoking cessation. In contrast, in alcohol-dependent participants, larger increases in HRV during the presentation of cued alcohol cues predicted *increased* risk of relapse at 6-months follow up (Garland, Franken, & Howard, 2012). In this context, increases in HRV during alcohol cues may have reflected the degree to which the cues required self-regulation for that person, perhaps because they elicited cravings or intrusive thoughts about drinking. In turn, this reaction to cues or the self-regulatory fatigue that could result over time might eventually lead to relapse. More research into the predictive value of HRV changes in the context of substance use is needed to test these interpretations.

Interesting converging evidence comes from studies of HR during speech in people who stutter. In people who do not stutter, reading aloud or speaking can be arousing, stressful, or both, and typically results in increased HR. One might intuitively predict that people who stutter would find this type of task more arousing or stressful because they also have to control their stuttering. However, compared with people who do not stutter, people who stutter have a much *smaller* increase in HR when reading aloud or

speaking, a difference as large as 20 bpm. This counterintuitive finding inspired some creative but probably incorrect interpretations (e.g., stuttering serves a cathartic function for the stutterer's anxiety; Alm, 2004). The emergent findings relative to the cardiac correlates of "pause and plan" might instead suggest that people who stutter exert considerable self-regulatory effort when speaking.

Some studies have failed to replicate the relationship between self-regulatory activity and increased HRV. In one study, undergraduates were randomly assigned to thought suppression (high self-regulatory effort) or rote memorization (low self-regulatory effort). HR increased significantly during the low self-regulation condition, but not in the high self-regulation condition, consistent with "pause and plan" inhibition of HR. However, there were no differences in HRV (Segerstrom et al., 2012). Both tasks were rated by the participants as moderately stressful. Stress increases sympathetic activity and reduces parasympathetic activity, and co-occurring stress may change the association between self-regulation and autonomic control of the heart. Another study also used thought suppression to manipulate self-regulatory effort. Thought suppression decreased subsequent persistence in solving anagrams, suggesting self-regulatory effort during thought suppression and subsequent self-regulatory fatigue, but there were no differences in HRV between the groups during the task (Reynard, Gevirtz, Berlow, Brown, & Boutelle, 2011). These findings speak to the importance of ensuring that when investigating the physiological correlates of self-regulation, self-regulatory effort manipulations are as "pure" as possible; that is, they may be experienced as effortful but should not also evoke stress or negative affect, which have their own autonomic effects.

Baseline HRV and Self-Regulatory Ability

Although it is not necessarily evidence for "pause and plan," tonic resting HRV appears to be a biomarker for trait-like self-regulatory ability. Higher resting HRV predicted how long participants persisted in attempting to solve an impossible anagram (Reynard et al., 2011; Segerstrom & Solberg Nes, 2007). It also was associated with better marital quality (Smith et al., 2011), better emotional control (Geisler, Vennwald, Kubiak, & Weber, 2010; Gyurak & Ayduk, 2008), more positive emotionality (Kok & Fredrickson, 2010; Oveis et al., 2009), better executive cognitive functioning, and a number of other outcomes that rely on trait self-regulatory ability (Geisler, Kubiak, Siewert, & Weber, 2013). On the contrary, resting HRV is lower in conditions that are in part characterized by poor self-regulatory ability, including borderline personality disorder (Weinberg, Klonsky, & Hajcak, 2009), depression (Kemp, Quintana, Felmingham, Matthews, & Jelinek, 2012), anxiety (Chalmers, Quintana, Maree, Abbott, & Kemp, 2014), and chronic pain conditions (Solberg Nes, Carlson, Crofford, de Leeuw, & Segerstrom, 2010; Solberg Nes, Roach, & Segerstrom, 2009). These findings cumulatively suggest that higher resting HRV can index trait self-regulatory ability.

Other Systems

Slowing of the immune and cardiovascular systems suggests that the body can enter an energetically conservative state during self-regulation (see the next section, "Theoretical Perspectives on Physiological Change," for more on why this might be the case). If so, then other systems should also be affected. Figure 8.1 shows the basal metabolic demand

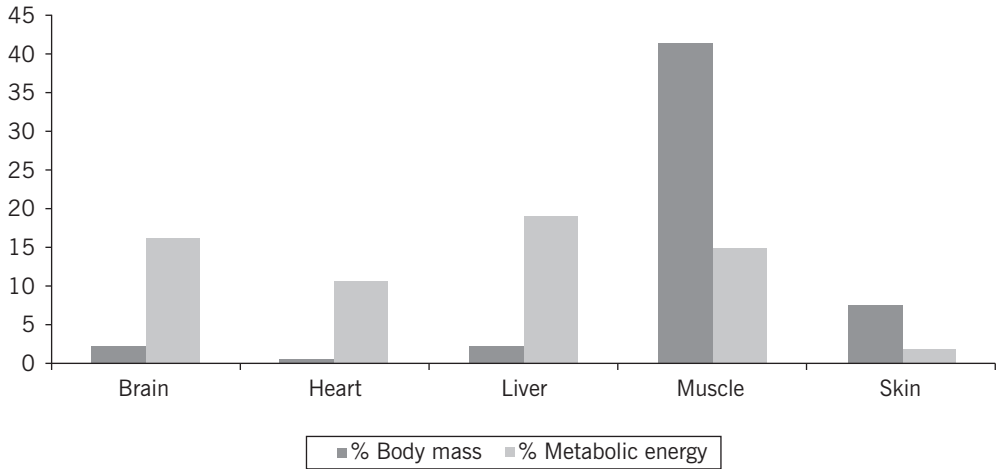


FIGURE 8.1. Mass and metabolic demand of five organs as a percentage of total body mass and metabolic demand.

of five organs: brain, heart, liver, muscle, and skin (Elia, 1992). Note that although muscle and (to a lesser degree) skin comprise a large proportion of body mass, their resting metabolic demands are relatively low. In contrast, the brain, heart, and liver have higher metabolic demands relative to body mass. The liver in particular provides an interesting target for the metabolic conservation that characterizes “pause and plan.” The liver consumes a high degree of metabolic energy (like the brain and heart), but it is not necessary to maintain liver activity at a consistently high level to support life (in contrast with brain and cardiac activity).

Liver activity can be assessed indirectly by alcohol metabolism. A small percentage of alcohol is metabolized by the stomach, but over 90% is metabolized in the liver. In a within-subjects design, young men were dosed with a small amount of alcohol (enough to create a blood alcohol concentration of approximately .03%), then performed a series of tasks that had either low self-regulatory demand or high self-regulatory demand. Alcohol metabolism (i.e., decrease in blood alcohol over time) was slower during the high-demand version of the tasks, particularly among men who were low in trait self-control. Men with low trait self-control also found the high-demand tasks more difficult than did men with high trait self-control, and perceived self-regulatory demand mediated the effect of the manipulation on alcohol metabolism (Eisenlohr-Moul, Fillmore, & Segerstrom, 2012).

THEORETICAL PERSPECTIVES ON PHYSIOLOGICAL CHANGE DURING SELF-REGULATION

Ecological Immunology

The field of ecological immunology offers potential insight into the relationship between self-regulatory effort and changes in the immune system. In addition, the principles of ecological immunology (for reviews, see Demas & Carlton, 2015; Segerstrom, 2007, 2010) might fruitfully explain changes in other organs, such as the liver. Both ecological

immunology and central governor theory (see below) draw heavily on the premise that the body regulates itself *as if* energy and other physiological resources are limited. Although modern humans (at least in industrialized societies) have access to abundant food sources, this was not always the case in our evolutionary history. As such, it is important to remember that “pause and plan” physiology may not serve a modern function but is instead a remnant of adaptation to our evolutionary environment.

The basic premises of ecological immunology are that (1) there are costs, as well as benefits, to immunity, including energetic costs, and (2) the environmental context determines the relative importance of these costs and benefits. Immunity is just one of an organism’s possible priorities in any given context; others might include pursuit of new resource opportunities. “Optimal” immunity depends on current demands on the immune system, as well as the opportunity costs associated with directing physiological resources to the immune system rather than putting them to other use. For example, laboratory mice offered opportunities to acquire resources such as mates or nest boxes had more severe parasitic infections than mice with no such opportunities (Barnard & Behnke, 2001). These data can be interpreted as redistribution of physiological resources. When demands on the immune system are low and other opportunities are present, physiological resources may be directed away from immunity, toward other uses. Although immunity may be reduced in an absolute sense, it may in fact be at an “optimal” level for the organism. In contrast, when demands on the immune system are high, physiological resources may be directed away from other uses and toward immunity. This redistribution is effected via the motivational shifts associated with sickness behavior (e.g., lethargy, withdrawal, anhedonia).

Finally, these adaptations appear to be designed to protect energetic and other physiological resources rather than respond to shortages. As demonstrated in the mouse studies, immunological changes occur in the presence of signals of opportunity, not just in the pursuit of those opportunities (Smith, Barnard, & Behnke, 1996). Lessels (2008) argued that it is “better to shut it [the immune system] down in an orderly fashion that allows remaining resources to be used to maximum effect than to starve it into inactivity” (p. 1593). In other words, proactive suppression of immune activity in response to cues about an important alternative use of resources is more adaptive than reactive suppression after resources have been depleted.

Central Governor Theory

A similar perspective on energy use and conservation can inform interpretation of “pause and plan” physiology (Evans, Boggero, & Segerstrom, 2015). Central governor theory (Noakes, 1997), which comes from exercise physiology, asserts that physical fatigue is due not to the depletion of any particular substrate; it occurs instead to prevent excessive physical exertion and actual depletion of physiological substrates that could lead to permanent injury or death (Noakes, St. Clair Gibson, & Lambert, 2005; Noakes, 1997). In other words, the body responds as if resources are limited, even when they may not be. Based on feedback from a number of physiological inputs (e.g., metabolic rate and fuel reserves), as well as psychological inputs (e.g., motivational states), a mechanism in the central nervous system produces a level of subjective fatigue that increases as the estimated limits of homeostatic stability are approached (Gibson & Noakes, 2004; Noakes et al., 2005).

There is a striking similarity between the phenomenon of self-regulatory fatigue and theories of physical fatigue that consider physiological substrates (Hermansen & Osnes, 1972; Hill, Long, & Lupton, 1924; Noakes, 1997; Sahlin, Harris, Nylinde, & Hultman, 1976). Importantly, there is little evidence that depletion of physiological substrates causes exercise-induced exhaustion or self-regulatory failure. For example, it has been assumed that improvement in exercise performance due to consumption of glucose is due to increased availability of glucose to depleted muscles, but swishing a glucose drink in the mouth without swallowing it leads to improvements in exercise performance (Chambers, Bridge, & Jones, 2009; Rollo & Williams, 2011). This suggests that improvement in performance is due not to the actual availability of glucose, but rather to the signal that there will be additional energetic substrates available (Chambers et al., 2009). Consistent with the central governor model of physical fatigue, self-regulatory fatigue is likely due not to a depletion of substrates, but rather a dynamic mechanism in the central nervous system that continuously updates estimates of current workload, energy reserves, anticipated work demands, and goal importance. The output of this central nervous system mechanism is the level of subjective fatigue, willingness to continue on a task, or both.

Central governor theory is similar to ecological immunology in that both integrate inputs from physiology, resources, and motivation to understand why, in the absence of resource depletion, some systems function at less than full capacity. In central governor theory, fatigue leads to effort below what physiological resources can support; in ecological immunology, motivation and effort can lead to immunological function below what physiological resources can support. The energetically conservative changes that have been observed during “pause and plan” are most likely not caused by resource depletion but by resource regulation.

Glucose

If “pause and plan” physiological changes reflect an energetically conservative state, then it might follow that there would also be changes in a major energetic substrate: glucose. Glucose is a key energy source for all systems in the body and is necessary for a variety of cognitive functions (Donohoe & Benton, 1999; Sieber & Traystman, 1992). Because people are more prone to self-regulatory failure following tasks that require self-regulation (i.e., overriding dominant responses), the hypothesis was advanced that self-regulation must rely on a limited fuel source that is temporarily depleted by acts of self-regulation, particularly glucose.

Initial evidence suggested that tasks requiring self-regulation reduced levels of blood glucose relative to tasks that did not, and that replenishing glucose with a glucose-laden drink versus an artificially sweetened one resulted in better performance on subsequent self-regulatory tasks (Gailliot et al., 2007). However, only the latter finding is robust. Although the initial studies reported lower blood glucose after a self-regulation task relative to a different task, support for the first proposal would require an absolute decline relative to baseline. There have been a host of other critiques. The amount of energy used by the brain to complete a single cognitive task is so small that it is unlikely to cause measureable decreases in blood glucose: on the order of less than 1 calorie over 5 minutes (Kurzban, 2010). The sensitivity of the measurement instruments may also have been too low to detect the changes that were reported (Beedie & Lane, 2011; Clarke & Sokoloff, 1998). The studies failed to control for cardiovascular and other peripheral physiological

changes that occur in response to self-regulatory tasks and could be expected to affect glucose consumption in the body as a whole (e.g., Eisenlohr-Moul et al., 2012; Kennedy & Scholey, 2000; Scholey, Harper, & Kennedy, 2001; Segerstrom, Smith, & Eisenlohr-Moul, 2011). Finally, the proposal that blood glucose is the resource for self-regulation cannot account for the findings that performance on some tasks, such as those involving response time, actually improves after vigorous exercise, which decreases blood glucose (Hillman, Erickson, & Kramer, 2008; Hillman et al., 2009; Kurzban, 2010; Tomporowski, 2003).

In contrast, several follow-up studies bolster the second idea, that drinks containing glucose could prevent or undo self-regulatory fatigue. Consuming a sugary versus artificially sweetened drink prior to an attention regulation task prevented self-regulatory fatigue in subsequent tasks (willingness to volunteer: DeWall, Baumeister, Gailliot, & Maner, 2008; making rational choices: Masicampo & Baumeister, 2008). Similarly, consuming a sugary drink correlated with lower levels of prejudice (Gailliot, Peruche, Plant, & Baumeister, 2009). A meta-analysis reported that glucose supplementation yielded a large, homogeneous effect size of $d = 0.75$ (Hagger, Wood, Stiff, & Chatzisarantis, 2010). Interestingly, glucose administration also prevented self-regulatory fatigue in dogs. Dogs persisted longer on a food discovery task after receiving sugar (vs. sugar-free placebo), suggesting that this effect may not be specific to humans (Miller, Pattison, DeWall, Rayburn-Reeves, & Zentall, 2010).

As with the studies of physical performance, introducing glucose to the oral cavity without ingestion (i.e., glucose swish) results in improved self-regulation performance on a subsequent self-regulation task, suggesting that it is not glucose per se that improves performance but instead the neural signal of glucose availability (Chambers et al., 2009; Molden et al., 2012; Sanders, Shirk, Burgin, & Martin, 2012). Most likely, this neural signal is one of the inputs to the central governor. Although self-regulation does not itself create glucose loss or depletion, when the central governor receives a signal that more physical resources are available, fatigue is ameliorated.

CONCLUSION AND FUTURE DIRECTIONS

When people are faced with situations or tasks that require them to self-regulate, there is evidence that the cellular immune system is suppressed, the heart slows, and liver metabolism is reduced. We hypothesize that these changes occur not because there is a frank deficit in substrates such as glucose, but because human physiology is characterized by conservation. Pausing and planning do not involve concurrent metabolic demands, in contrast, for example, with the cardiac and muscle activity associated with fighting or fleeing. The one exception might be the brain, which is a highly metabolically active organ. There is increased activation of frontal regions during self-regulation that may indicate increased metabolic demands, but these demands are extremely small in caloric terms (Heatherton & Wagner, 2011; Kurzban, 2010). A more likely hypothesis is that conservation occurs in recognition of low current metabolic demands and/or the anticipation of future demands once plans are put into action. In other words, systems in the body become less metabolically active during periods when it might be unnecessary or wasteful to operate them at higher capacity.

The “pause and plan” profile to date extends to the immune system, heart, and liver. However, if there is a generalized down-regulation of metabolism in the periphery, other systems may also be involved, such as digestive and reproductive organs. Metabolic down-regulation may also be affected mechanically: It is reasonable to hypothesize that physical activity (e.g., fidgeting) might decrease during self-regulation. In nonhuman animals, the freezing response occurs during “situations involving potential or poorly understood threat characteristics” that require further appraisal before the appropriate action is clear (Blanchard & Blanchard, 1989, p. 80). Both “pause and plan” and the freezing response are characterized by reductions in heart rate, and both may also be associated with motor inhibition.

Understanding the pathways by which “pause and plan” is effected is an important future direction for research in this area. The parasympathetic nervous system may account for heart rate inhibition (Segerstrom et al., 2012). Cortisol can suppress metabolic activity in a number of systems, including cellular immunity, and may be higher during self-regulatory challenge (Sapolsky, 2004; Solberg Nes et al., 2005). Other neuroendocrine products that broadly regulate metabolism include leptin and ghrelin: Leptin up-regulates metabolism, and ghrelin down-regulates it (Frayn, 2010). Therefore, one hypothesis is that self-regulation may be associated with decreases in circulating leptin, increases in circulating ghrelin, or both.

Finally, when considered individually, some of the changes in the “pause and plan” profile could be considered healthy (e.g., higher HRV and lower HR), whereas others might be considered risky (e.g., suppressed immunity). There are cases in which “pause and plan” might be detrimental to health. People whose immune systems cannot recover from suppression, such as older adults or people infected with HIV, might suffer adverse long-term consequences (Segerstrom, 2010). However, for most people, under most circumstances, any costs of “pause and plan” should be considered temporary and incurred in the service of long-term benefits. For example, in the short term, people who are more optimistic may be more immunosuppressed while meeting self-regulatory challenges (Cohen et al., 1999; Segerstrom, 2001, 2006). However, in the long term, optimists enjoy health advantages, including longer survival (Segerstrom, 2011). These long-term advantages may derive from the effects of self-regulating, such as healthier behavior, or it may be that the physiological changes during “pause and plan” are themselves adaptive for long-term health. As we learn more about the big picture of physiological change during self-regulation, the adaptiveness of this response should become clearer.

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CHAPTER 9

Consensus versus Anarchy in the Senate of the Mind

On the Roles of High-Level versus Low-Level Construal in Self-Control

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Broadly defined, *self-regulation* refers to the process or processes by which people adopt and manage various goals and standards for their thoughts, feelings, and behavior, and ensure that these goals and standards are met (e.g., Carver & Scheier, 1982, 1990). Self-regulation involves numerous challenges that include deciding which goals to pursue, planning how to pursue these goals, implementing these plans, protecting goals from competing concerns, and deciding whether to continue or abandon goals following successes and failures (e.g., Gollwitzer, 1990; Mann, de Ridder, & Fujita, 2013). In this chapter, we examine a specific self-regulatory challenge, namely, that of self-control, and discuss the psychological means by which people address this challenge. People experience a self-control conflict when the availability of small rewards in their more immediate and proximal environment (e.g., a piece of cake) tempts them to abandon more distal yet more valued rewards (weight loss). In essence, the self-control conflict presents a dual-motive or dual-goal conflict: People are motivated to attain both the proximal and distal outcomes but must choose one over the other. Self-control requires prioritizing more valued, distal outcomes over smaller yet immediate ones (e.g., Ainslie, 1975; Fujita, 2011; Metcalfe & Mischel, 1999; Mischel, Shoda, & Rodriguez, 1989; Rachlin, 2000; Thaler & Shefrin, 1981). Self-control is critical to achieving many of the goals that people value, such as losing weight, saving for retirement, getting good grades, and remaining faithful to romantic partners. We review research that illuminates abstraction or high-level (vs. low-level) construal as a critical psychological process in helping people address this dual-motive conflict.

ON CONTROL

People self-regulate because they want control over their thoughts, feelings, and behavior. Self-control failures are interesting because they appear to represent dramatic instances of being unable to control one's psychological and behavioral responses to stimuli. Proximal temptations prompt people to lose control of their thoughts, feelings, and behavior under the very conditions in which they need that control the most. But what precisely is meant by the term *control*? For example, when dieters choose to eat chocolate cake, even if such actions are contrary to their weight loss goals, they are still initiating those actions, such as lifting the fork and chewing, that are necessary to eat. Is this not some form of control?

We suggest that a central feature of control is *principled structure* (Fujita, Trope, Cunningham, & Liberman, 2014), or a system of organizing various (and potentially competing) elements into a framework based on priorities, not unlike a business organization chart. *Structure* implies a top-down process, in which various constituent elements are integrated and work together to support and sustain the whole. Psychologically, the top-down nature of control requires creating hierarchies structured around one's global goals and values. These hierarchies make clear how each element relates to others within the structure to advance one's priorities. Central to the process of hierarchies is the understanding that some elements are more rather than less critical than others. Elements that weaken the integrity of the whole must be subordinated in favor of those that support or sustain the whole. Hierarchies help people to appreciate the relationships between elements, promoting an understanding of those elements that are central versus those that are more incidental to their goals and values.

People or processes that are "out of control" are those that lack structure. Influence emerges from a more chaotic and fragmented process. Rather than integrate elements in a top-down fashion, elements are processed in an isolated, bottom-up fashion, without reference to global goals. Attention is directed to those elements that happen to be most salient at any given moment. This sensitivity and reactivity to the demands of the present may be functional in some cases because they facilitate efficient detection of and responses to subtly shifting circumstances. They also, however, involve costs, in that people are more vulnerable to external influences and susceptible to responses that are inconsistent with their goals and values.

To use an analogy, control operates like a well-functioning democracy. In a democracy, there are rules on how to propose, discuss, and determine legislation. Individual elements, much like individual senators in a senate, have the opportunity to be heard, but special interest groups should not dominate policy to the detriment of the whole. Policy is driven by the goals of society as a whole, and individual laws are assembled into a hierarchy based on their relation to the big-picture motivations of the entire governed body. Senators band together into voting blocs based on their stance on the issues, and different coalitions (made up of different members) exist for different policies. Governance is well ordered and based on established priorities. It is not necessary that all senators agree on the desired outcome, but it is necessary that they accept the decisions of the senate and acknowledge that such decisions represent its collective will, provided that those decisions resulted from the rule of law. Lack of control is most similar to *anarchy*, or governance without a centralized decision-making body, without mechanisms to determine

decision-making procedures, and without a clear set of goals and priorities that represent the collective will of the governed body. Policies are not set by principles; they are instead determined by which individual element can drown out other opinions. Because such governance lacks structure, policies are chaotic and are not directed toward overarching goals.

PRINCIPLED STRUCTURE IN SELF-CONTROL

Proximal temptations represent threats to the structure and order necessary for control because they have the potential to motivate thoughts, feelings, and behaviors that do not align with the priorities people have set for themselves. Metaphorically, proximal temptations represent a threat of anarchy to the senate of the mind. Control requires subordinating motivations in the moment to the broader whole. To illustrate, consider the example of a dieter who has an opportunity to eat a donut. Choosing not to eat the donut may lead to highly valued outcomes in the future, including weight loss and the attainment of other valued ends (e.g., appearance, health, self-esteem), but eating the donut will lead to the less valuable yet immediate gratification of hunger and taste buds. Although eating the donut may be desirable, the perspective of the whole suggests that the dieter should subordinate the attainment of that reward in favor of the attainment of more valuable distal ends. The dieter's evaluation of the donut may shift depending on whether he or she processes it in a controlled, top-down manner or an out-of-control, bottom-up manner. The former leads to a summary evaluation of the donut as a sinful diet buster, whereas the latter leads to a summary evaluation of the donut as a delicious and desirable treat. Note that control may promote different goals for different people. For some hedonists, for example, control may necessitate subordinating the risks of overeating in favor of attaining hedonic enjoyment. Control is not defined by the goals people pursue; rather, it is defined by the principled structuring of various motivations and the organization of behavior (see Rawn & Vohs, 2011). Therefore, what is self-control success for one person may be self-control failure for another.

A CONSTRUAL-LEVEL THEORETIC APPROACH TO SELF-CONTROL

Research on self-control suggests that cognitive abstraction is a critical mechanism to instantiate structure, or control. *Abstraction* is a reductive process by which people extract the essential aspects and gist of objects or events, while ignoring superficial, surface-level features (Reyna, 2012; Reyna & Brainerd, 2011; Trope & Liberman, 2010). For example, in categorization, abstraction allows one to see beyond the idiosyncratic features that distinguish one individual from another to identify the defining and core features that are common across individuals (Medin & Ortony, 1989; Rosch & Mervis, 1975). A body of literature on construal-level theory documents the role of abstraction in successful self-control. *Construal-level theory* (Trope & Liberman, 2010) posits that informational inputs are subjectively construed on a continuum of abstraction (from low to high levels of abstraction). Much research evidence suggests that it is a subjective understanding of the world, rather than any of its objective features, that influences decisions and behaviors (e.g., Griffin & Ross, 1991). For example, a football fan may perceive

his team's play as a "hard hit," whereas a fan of the opposing team may construe the same maneuver as a "dirty play" (Hastorf & Cantril, 1954). Construal-level theory holds that construal level varies between individuals (i.e., some people have a chronic tendency to construe at high levels of abstraction), as well as within an individual across contexts.

Central to construal-level theory is the notion of psychological distance (e.g., Liberman & Trope, 2008; Liberman, Trope, & Stephan, 2007; Trope & Liberman, 2010). Low-level construal uses the here and now of direct experience as a de facto reference point. When events are psychologically proximal, people tend to have rich, contextual details available. People process such information in a way that extracts the peripheral, situation-specific features that separate each unique event from similar others—a process referred to as *low-level construal*. As events recede from the here and now, such unique information often becomes unavailable. Lacking specific details, people engage in *high-level construal*, focusing on the primary, central, decontextualized features of events that tend not to vary across instances. High-level construal therefore facilitates processing of information that is removed from the here and now. Research has identified a number of dimensions along which events may be considered distal or proximal, including time (now vs. later), space (here vs. there), social distance (me vs. other), and hypotheticality (likely vs. unlikely). Thus, high-level construal is a functional psychological response to the challenges presented by distant events, in that it allows people to think about content that extends beyond one's immediate sensory and perceptual capacities (Ledgerwood, Trope, & Liberman, 2010; Liberman & Trope, 2008; Trope & Liberman, 2010). Low-level construal, by contrast, allows people to immerse themselves into the details of the here and now, and to respond to the idiosyncratic contingencies of the present.

To demonstrate the tendency to process near and far events at low- and high-level construal, respectively, consider the example of thinking about how you will spend your day tomorrow versus 10 years from tomorrow. In the absence of specific information for the distant future, individuals must engage in high-level construal, imagining only the most abstract, essential elements of how they typically spend their day: eating meals, going to work, caring for their children, and interacting with family, friends, and colleagues. When these same individuals consider how they will spend their day tomorrow, on the other hand, they can engage in low-level construal, incorporating secondary, peripheral details to form unique representations of a singular event. They may imagine that tomorrow will entail an egg-white omelet breakfast, an 11:00 A.M. department meeting, and a 2:00 P.M. parent-teacher conference at their child's elementary school. This association between proximal/low-level construal and distal/high-level construal becomes so overlearned that individuals generally process in this manner even when the amount and type of details are held constant across psychological distance (i.e., even when they have very detailed knowledge about a distal event).

That people engage in high-level construal (vs. low-level construal) to represent distant (vs. proximal) events has important consequences for decision making and behavior. For example, when people consider temporally distant situations, they categorize objects into fewer, broader categories and tend to infer that singular behaviors are indicative of broad, dispositional traits on the part of the actor (Trope & Liberman, 2010). This focus on broad categories of events facilitates sensitivity to the broader implications of singular behaviors. Thus, people are more likely to behave in a manner consistent with their own broad values when engaged in high-level construal (Eyal, Sagristano, Liberman, & Trope, 2009; Torelli & Kaikati, 2009).

As it is relevant to our later discussion, it should be noted that experimental procedures make it possible to induce high- versus low-level construal more directly in a laboratory setting, without having to manipulate distance. These procedures are useful when investigators interested in studying construal level need to control experimentally for aspects of distance unrelated to construal, such as the potential decreased motivational relevance of an event as it is removed from direct experience. One such direct experimental manipulation of construal level is called a *why/how task*. Participants are presented with a behavior (e.g., getting good grades) and are then asked either why (e.g., to get a good job after college) or how (e.g., by studying in the library) they would engage in that behavior. This task reliably induces more abstract “mindsets” in participants who complete the “why” version of the task than the “how” version of the task. These mindsets then carry over into subsequent, unrelated tasks (Freitas, Gollwitzer, & Trope, 2004; Fujita, Trope, Liberman, & Levin-Sagi, 2006). In other words, participants start off by thinking abstractly (vs. concretely) about one particular goal (e.g., getting good grades) and continue thinking abstractly (vs. concretely) about other unrelated events.

Construal Levels and Control

Construal level theory suggests that people lose control of their behavior in the presence of temptations because they have engaged in low-level construal (Fujita, 2008; Fujita & Carnevale, 2012). Temptations present in direct experience promote low-level construal, which in turn enhances immersion in the concrete, salient details of the here and now. This immersion may lead people to lose sight of the overall whole, and lead them to engage in behavior that is inconsistent with their broader goals and values. Thus, in the senate of the mind, low-level construal may promote the kind of bottom-up processing that undermines control, ceding influence to whatever faction is most vocal. Construal-level theory suggests that people’s self-control would be enhanced if they were able instead to engage in high-level construal. The focus on broader, schematic wholes engendered by high-level construal should enhance structure. In the senate of the mind, then, high-level construal represents cognitive processing that facilitates the will of the consensus. It is the difference between setting policies based on consensus (in the case of high-level construal) and determining policies based on the opinion of whoever is able to snatch up the gavel following a free-for-all battle royal (in the case of low-level construal). A thorough body of research literature documents the positive influence of high-level construal in situations in which people are tempted by proximal temptations and must exert self-control.

Supporting Evidence

Temporal Discounting

Initial evidence that high-level construal promotes self-control came out of work on *temporal discounting*, or the tendency to devalue rewards as they become more temporally distant (Ainslie, 1975). Temporal discounting tasks involve a choice between a smaller reward available in the near future (e.g., \$30 tomorrow) and a larger reward in the more distant future (e.g., \$40 in 3 months). The larger the amount an individual would require in order to choose the larger, later amount over the smaller, sooner amount, the steeper his or her discounting rate. Steeper discounting rates are indicative of poor self-control

because they involve forgoing a more valued but delayed outcome in favor of a less valued but more instantaneous outcome.

High-level construal has been shown to reduce discounting rates. In one experiment, Fujita and his colleagues (2006) induced differences in construal level, then asked participants to complete a discounting task. To induce differences in construal, Fujita and colleagues used the “why/how” construal manipulation described earlier. Participants in the high-level (vs. low-level) condition were asked to think about why (vs. how) they would engage in getting good grades. These high- versus low-level construal mindsets carried over to the subsequent discounting task in which participants indicated how much more they would pay to receive a consumer good now versus 6 months from now. Participants in the high-level construal mindset manipulation indicated smaller differences in willingness to pay now versus later, or reduced discounting rates, suggesting improved self-control. Other studies have found similar results using similar methods. For example, Malkoc, Zauberman, and Bettman (2010) found that participants in a high-level construal condition were willing to wait longer to receive a consumer good (i.e., a camera) in order to save money on its purchase price. Participants in the low-level construal condition, on the other hand, were willing to pay a premium to receive the camera immediately. This experiment, too, suggests that greater abstraction led to reduced temporal discounting (see also Aggarwal & Zhao, 2015; Joshi & Fast, 2013; Maglio, Trope, & Liberman, 2013; Pronin, Olivola, & Kennedy, 2008; Slepian, Masicampo, & Ambady, 2015).

Choice and Behavior

Research suggests that high-level construal also improves self-control by producing choices and behaviors that are consistent with global goals. In one experiment, Fujita and Han (2009) recruited female undergraduates, a group typically concerned with weight loss. Participants first completed a construal-level manipulation procedure known as the *category/exemplar task* (Fujita et al., 2006). In this task, participants are presented with a list of everyday objects (e.g., dog, actor). Those in the low-level construal condition are asked to generate subordinate exemplars of those objects (e.g., poodle, Tom Hanks), whereas those in the high-level condition are asked to generate superordinate categories for those objects (e.g., animal, profession). As in the previously described why/how task, the category/exemplar task induces high- and low-level construal mindsets, which carry over into subsequent tasks. After the construal-level manipulation, participants indicated whether they would prefer an apple or a candy bar as a snack. Those in the high-level construal condition were more likely to choose the healthy apple over the unhealthy candy bar, suggesting enhanced self-control.

High-level construal has also been shown to improve self-control in choices that involve *internalities*, or choices in which the value of alternatives depends on choice frequencies (Pick-Alony, Liberman, & Trope, 2014). For example, touch typing involves an initial cost to typing speed, but through practice, becomes more efficient than looking at the keyboard. People tend to underweigh the effect of the repeated nature of such choices, and therefore tend to prefer the alternative with the immediate payout at the expense of maximizing overall returns, a process known as *melioration* (Herrnstein, Loewenstein, Prelect, & Vaughan, 1993). Such behavior constitutes self-control failure because

a larger, long-term reward is sacrificed for a smaller, short-term reward. High-level (vs. low-level) construal promotes choices that maximize overall (vs. immediate) returns, suggesting enhanced self-control (Pick-Alony et al., 2014).

Additional work has examined manipulating construal level as the basis of interventions to increase various health behaviors. Sweeney and Freitas (2014), for example, developed an intervention based on the previously described why/how task to increase physical exercise. Participants with behavioral intentions to exercise more did indeed engage in more physical activity over a 1-week period following the high-level relative to low-level construal intervention. Chiou, Wu, and Chang (2013) report that a smoking cessation intervention similarly based on the why/how task significantly reduced smoking behavior. Thus, high-level relative to low-level construal appears to promote self-control across a variety of behaviors.

Defensive Information Search and Processing

One common self-control conflict involves the manner in which people gather and process information about themselves (e.g., Trope & Neter, 1994). Self-relevant information, particularly when it highlights people's deficiencies and weaknesses, can present a motivational conflict. On the one hand, negative feedback is valuable in that it helps to diagnose those areas that are in need of improvement. On the other hand, such information also carries affective costs. The opportunity to receive negative, self-relevant feedback presents people with a self-control conflict: Although the improvements made possible by negative feedback are more valuable in the long-term, research suggests that people are often tempted to ignore and dismiss negative feedback in a defensive effort to avoid short-term emotional pain (e.g., Ditto & Lopez, 1992; Howell & Shepperd, 2012; Sherman, Nelson, & Steele, 2000; Trope & Neter, 1994).

Research examining the impact of construal level has demonstrated that high-level (relative to low-level) construal can reduce defensiveness and increase willingness to expose oneself to negative feedback. Freitas, Salovey, and Liberman (2001) presented participants with an opportunity to receive feedback about their social intelligence that either emphasized their strengths (information that promotes self-enhancement) or liabilities (information that can be used to promote self-improvement). They manipulated low-level versus high-level construal by having participants imagine receiving this feedback in the near versus distant future, respectively. Participants engaged in high-level construal expressed greater interest in receiving negative feedback than those engaged in low-level construal, suggesting enhanced self-control.

High-level construal also appears to increase acceptance of negative information after exposure. For example, in one experiment, after inducing differences in construal level, Belding, Naufel, and Fujita (2015) presented sun-tanners with information about the health risks of ultraviolet exposure. This information is ego-threatening in the short term because it suggests that tanners engage in risky behavior, but useful in the long term for promoting better health. Tanners in the high-level construal condition were more likely to acknowledge their skin cancer risk, seek out information about how to improve their skin health, and express greater motivation to change their future behavior. This, too, suggests that high-level construal leads people to emphasize long-term over short-term outcomes in their behavioral decisions (see also Agrawal & Wan, 2009).

Dissent

Just as people must decide whether to accept threatening information, they also must decide whether to voice opinions that others may perceive as threatening. Individuals face a self-control conflict when they must decide whether to express group dissent. Such decisions constitute a self-control conflict because they involve competing motives to conform to existing group norms (a motive that promotes short-term group stability goals at the cost of long-term group improvement) or to advance group change (a motive that promotes long-term group improvement goals at the cost of short-term group stability; Packer, Fujita, & Chasteen, 2014). Dissent, therefore, has short-term costs for both the individual (i.e., rejection and isolation) and the group as a whole (i.e., cohesion and effectiveness), but long-term benefits. While dissent may certainly be caused by motives other than desire for group improvement, those who care deeply about the group and are motivated to work for its long-term success face a self-control conflict regarding whether to challenge existing group norms.

There is evidence that engaging in high-level construal increases the likelihood that people will pursue long-term change goals by expressing views that challenge group norms. Participants induced to engage in high- versus low-level construal via a category/exemplar task reported greater willingness to express ingroup criticism publicly (Packer, Fujita, & Herman., 2013; Packer et al., 2014). High-level construal, however, does not lead everyone to dissent all of the time. High-level construal increases the expression of dissent only among those who are highly identified with the group and not among those who do not care strongly about their group identity. These findings suggest that high-level construal increases self-control in dissent conflicts.

Ego Depletion

Additional evidence of the role of high-level construal in self-control comes from research examining *ego depletion*—an apparent diminished capacity to exert self-control following a previous act of self-control (Muraven & Baumeister, 2000). In a classic demonstration of ego depletion effects, research participants first successfully engaged in self-control behavior by eating radishes instead of cookies, while another group of participants was permitted to eat the far tastier cookies. Those who exerted self-control on the first task—eating radishes instead of cookies—displayed reduced ability to engage in self-control behavior on a subsequent task that also required self-control, to persist on a challenging problem-solving task (Baumeister, Bratslavsky, Muraven, & Tice, 1998). Research suggests, however, that high-level construal can mitigate such ego depletion effects. For example, when a construal-level manipulation comes between two self-control tasks, those induced to engage in low-level construal show the typical ego depletion effect, while those induced to engage in high-level construal do not (Agrawal & Wan, 2009; Schmeichel & Vohs, 2009; see also Bruyneel & Dewitte, 2012).

Beyond Effortful Reactive Inhibition

Many theoretical models describe self-control as overriding an impulsive response (for a review, see Fujita, 2011). These models suggest that cues in the immediate environment provoke thoughts, feelings, and behaviors that promote securing more immediate,

tempting rewards. They describe self-control as an effortful process of inhibiting these impulses. Whereas impulses are hypothesized to operate without conscious intention and effort, overriding these impulses is believed to require conscious intention and sufficient cognitive and motivational resources. Thus, the essence of many theoretical models is that self-control entails processes that are reactive, consciously initiated, and demanding of one's conscious cognitive resources. The construal-based approach that we advance, however, makes no such assumptions about the nature of self-control. If anything, more recent research questions whether such reactive effortful overriding of impulses is even necessary for successful self-control. Instead, this work suggests that self-control can be proactive (rather than reactive) and operate without conscious initiation and resources. These alternative means of self-control, moreover, are more evident when people are engaged in high-level rather than low-level construal.

Prospective (or Proactive) Self-Control

Prospective self-control refers to those processes whereby people engage in precommitment strategies to strengthen their self-control in anticipation of a self-control conflict (Fujita & Carnevale, 2012). This proactive strategy involves heading off self-control conflicts before they develop and is contrasted with various reactive strategies whereby individuals resolve self-control conflicts at the point at which they can no longer avoid them. For example, a binge drinker may stop after one drink, successfully overcoming the urge to overindulge, or he or she may avoid the bar altogether, thus resolving the conflict before it begins. The first strategy is reactive, while the second is proactive. Odysseus utilized prospective self-control when he tied himself to his ship's mast to resist the Sirens' song. Less mythical humans use a similar strategy when they choose to walk the long way home rather than take the route that passes by an irresistible bakery. Another prospective strategy involves self-imposed punishment (Ainslie, 1975). For example, many people make use of "Christmas club accounts" to save money for gifts (e.g., Thaler & Shefrin, 1981). These accounts pay no interest but entail a monetary penalty for early withdrawal. Such an account confers no financial advantage, but it deters withdrawal of earmarked money for anything other than its intended purpose. By committing to a punishment for self-control failure, people increase failure's costs and their own motivation to succeed in a self-control conflict by choosing the larger, distal reward.

Research has shown that high-level construal increases the tendency to use prospective self-control strategies such as self-imposed punishment (e.g., Fujita & Roberts, 2010; Rogers & Bazerman, 2008). Fujita and Roberts (2010), for example, first induced participants to engage in high-level or low-level construal. Participants were then given the opportunity to receive feedback about their cognitive skills. This feedback was described as highly diagnostic and useful, motivating participants to pursue it. The cognitive assessment and feedback, however, were inconveniently scheduled for the middle of the night. Participants therefore anticipated a self-control conflict between the long-term benefits of receiving the feedback and the short-term costs associated with the inconvenient scheduling procedures (e.g., Fujita et al., 2006; Trope & Fishbach, 2000). Participants were asked to report how much of a monetary penalty they would be willing to pay if they did not attend their scheduled session as a measure of prospective self-control. Those in the high-level construal condition, as compared to those in the low-level construal condition, imposed larger cancellation fees on themselves. These findings suggest that high-level

construal leads to greater self-punishment for self-control failure, a strategy that is effective in protecting long-term goals from short-term temptations.

Change in Meaning

Shifting construals may shift the meaning of the reward structure. Returning to our metaphor of the senate of the mind, what something means from the perspective of a given faction can differ dramatically from the perspective of the consensus. For example, the same dieter may construe the same donut as either a tasty and delicious treat or as a sinful diet-buster. The former evaluation may lead the dieter to self-control failure while the latter evaluation may lead to self-control success. In this way, changing construals may change evaluations of the proximal and distal goal in ways that favor pursuit of the latter.

Research supports this notion that construal level influences attitudes and evaluations of temptations and goals. Experiments using implicit measures of evaluative associations—people's readiness to associate goals and temptations with positivity and negativity—suggest that high-level, as compared to low-level construal promotes shifts in meaning that can be helpful for self-control success. For example, Fujita and Han (2009) induced participants to high- versus low-level construal using a category/exemplar task. After this manipulation, participants completed an Implicit Association Test (IAT) in which they were asked to sort various words into categories as rapidly and as accurately as possible by pressing a key on their computer keyboard. The words varied along two category dimensions: healthy and unhealthy foods (*apples* vs. *candy bars*) and positive and negative (*rainbow* vs. *murder*). Half of the words belonged to the categories of candy bar versus apple (e.g., *Snickers*, *Red Delicious*), whereas the other half belonged to the categories of positive versus negative (e.g., *rainbow*, *murder*). Faster responding when two categories are paired (e.g., apples and positivity) indicates stronger associations between those categories. This task also presents a self-control conflict for those concerned with healthful eating because candy bars are generally considered tastier than apples (a short-term reward), while apples have fewer calories and contribute to health (a long-term reward). Participants induced to a high-level construal mindset had stronger associations between temptations and negativity than those induced to low-level construal. These changes in evaluative association suggest a fundamental shift in meaning of stimuli related to self-control conflicts.

Nonconscious Initiation of Self-Control

Evidence that construal levels impact self-control without requiring conscious deliberation and effort comes from research examining associations between temptations and goals that are asymmetrical. Research has indicated that people's self-control benefits from a pattern of cognitive associations whereby the activation of temptation concepts activates overriding distal goals, but the activation of distal goals does not reciprocally activate temptations (Fishbach, Friedman, & Kruglanski, 2003). In other words, whereas being presented with a slice of chocolate cake should activate the goal of healthy eating for a dieter, thinking of the goal of dieting is less likely to trigger thoughts of chocolate cake. Such asymmetrical associations are highly functional for effective self-control because they bias associations in favor of the distal goal rather than the proximal temptation (Fishbach et al., 2003; Papies, Stroebe, & Aarts, 2008).

Research suggests that high-level construal promotes such asymmetrical temptation–goal associations. Fujita and Sasota (2011) manipulated construal and asked participants to complete a lexical decision task, a reaction-time-based measure that assesses strength of association between concepts. For example, to test the impact of activating goals on the activation of temptations, participants first saw a prime word that was either related to dieting temptations (e.g., *fries*, *nachos*) or unrelated to dieting (e.g., *horse*, *square*), followed by a letter string that was either a nonword, a neutral word, or a word related to dieting (e.g., *broccoli*, *carrot*). Participants indicated as quickly as possible (via a button press) whether the letter string was a word or a nonword. Faster responses on trials in which participants saw temptations primes and dieting letter strings indicate stronger temptation–goal associations. Critically, the initial prime word was presented for only 350 milliseconds—an amount of time considered too short for consciously initiated reactions (Neely, 1977). Those engaged in high-level relative to the low-level construal were faster to identify dieting-related words as words when they were preceded by temptation primes, but they were slower to identify temptation letter strings when they were preceded by dieting primes. This unique pattern of results suggests that high-level construal facilitated strategic asymmetries in goal-temptations associations, whereas low-level construal did not. Furthermore, as the primes were presented too briefly to trigger consciously initiated reactions, these strategic asymmetries appear to be initiated at a nonconscious level.

SELF-CONTROL VERSUS SELF-REGULATION

It would be a mistake to suggest that high-level construal is always superior to low-level construal in self-regulation. As noted earlier, self-control is only one specific self-regulatory challenge people must address. Self-regulation involves numerous other challenges, such as selecting goals, implementing plans to achieve them, and deciding whether to continue pursuit of a goal in the wake of positive or negative feedback (e.g., Gollwitzer, 1990). Although high-level construal may be beneficial for successfully resolving self-control dilemmas, it does not necessarily play the same role in other self-regulation challenges.

Consider, for example, a golfer attempting to sink a putt. This behavior requires careful regulation of hand–eye coordination and body movement to serve an athletics goal. This behavior does not, however, involve a self-control conflict because there is no conflict between short-term and long-term motives. The golfer has no competing motivation to miss the shot (Fujita, 2011). High-level, relative to low-level, construal should be expected to have little or no impact on behavior in this instance. If anything, high-level construal may even have deleterious impact on the golfer's performance, as it may highlight the magnitude of the event and cause "choking" (i.e., underperformance due to pressure; Baumeister, 1984; Beilock & Carr, 2001).

Indeed, research instead suggests that many skilled performance tasks, particularly those that require sensitivity to subtle details in one's immediate environment, are enhanced by low-level rather than high-level construal. In one study, following a construal-level induction, participants were presented with a type of vigilance task that required them to identify details that were missing or out of place in a series of visual scenes (Wakslak, Trope, Liberman, & Alony, 2006). Those induced to low-level rather than high-level construal were more likely to identify correctly those details that were

amiss. In another study, participants were presented with a list of related words (e.g., *door, glass, curtain, ledge, frame*) that were strongly associated with a nonlisted “lure” (e.g., *window*). Research suggests that there is a tendency for people to recognize the lure falsely as having been presented when tested in a subsequent memory test (Roediger & McDermott, 1995). Whereas those induced to engage in high-level construal were more likely to falsely recognize the nonlisted lures, those induced to engage in low-level construal were more likely to remember verbatim what words were actually presented. This again suggests that when the self-regulatory challenge at hand is to be immersed in one’s immediate environment (rather than to transcend it in order to resolve a dual-motive conflict), low-level rather than high-level construal may enhance self-regulation (see also Schmeichel, Vohs, & Duke, 2011; Wan & Agrawal, 2009).

As a second example of a self-regulatory task for which low-level construal may be superior to high-level construal, consider the *planning fallacy*—the tendency for people to underestimate the time it will take to complete a task, even though they have performed similar tasks in the past that have taken longer (e.g., Kahneman & Tversky, 1979; for a review, see Buehler, Griffin, & Peetz, 2010). Research suggests that one source of error in the planning fallacy is the failure to “unpack” the specific behaviors necessary to accomplish a given task (e.g., Kruger & Evans, 2004). A focus on the end-state goal leads people to neglect the various means in which one must engage to complete the task, leading to misprediction about the time necessary to achieve the end. Thus, whereas the goal or ends focus of high-level construal should exacerbate the planning fallacy, the specific means focus of low-level construal should reduce it—a finding supported by empirical research (e.g., Buehler et al., 2010; Pham & Taylor, 1999).

One final example of a self-regulatory task for which low-level construal may be more adaptive than high-level construal is responding to setbacks or failures. When one has fallen short of one’s goals, one can attribute that failure to something specific to a given situation or, more broadly, to some characteristic about oneself. The latter relative to the former may undermine motivation and lead to poorer outcomes (e.g., Abramson, Seligman, & Teasdale, 1978). One might therefore expect that engaging in high-level construal—which promotes broader, more dispositional processing of information—might lead to less adaptive responses to goal setbacks and failures relative to low-level construal. Indeed, empirical evidence provides some support for this suggestion. Watkins, Moberly, and Moulds (2008), for example, demonstrated that high-level relative to low-level construal sustains depressive rumination following negative events. Similarly, research by Freund and Hennecke (2012) suggests that dieters engaged in high-level relative to low-level construal may be more likely to give up on weight loss goals after an initial lapse (commonly referred to as the “what the hell” effect; Cochran & Tesser, 1996; Polivy & Herman, 1985). Thus, low-level, relative to high-level, construal may help shield people from overgeneralizing failure and promote resilience in the face of setbacks.

NUDGING CONSTRUAL LEVEL WITH WORDS VERSUS PICTURES

One important future direction of research is to find ways to apply this work on construal level to improve people’s self-control. Many current laboratory-based manipulations of construal level, however, may be too unwieldy for common place adoption. Consider, for example, the artificiality of tasks such as the why/how and category/exemplar tasks. It

would appear unreasonable to have shoppers generate superordinate categories for various objects while walking down an aisle to buy cereal. Given the lack of ecological validity of many of these construal-level inductions, it behooves researchers to develop other ways to “nudge” people to engage in high-level versus low-level construal in situations requiring self-control.

One promising direction is language. Because language is a richly abstract form of representation, it has an inherent relationship with construal level. Pictures, associated with low-level construal, represent specific objects in a singular time and place. They physically resemble the objects they represent and transmit information about how an individual object is distinct from similar objects. This representational process is similar to low-level construal. Words, associated with high-level construal, represent general classes of objects rather than any specific object exemplar. Words do not physically resemble the objects they represent and transmit broad, categorical information that applies to multiple instantiations of the object. This representational process is similar to high-level construal (Rim et al., 2015). Indeed, research has shown that pictures and words facilitate low- and high-level construal, respectively. For example, participants formed fewer, more broadly inclusive categories when instructed to sort objects related to various events (e.g., a camping trip) when those objects were presented as words rather than pictures, indicative of high-level processing (Rim et al., 2015; see also Amit, Wakslak, & Trope, 2013).

A recent study demonstrated the potential efficacy of using words rather than pictures to promote self-control (Carnevale, Fujita, Han, & Amit, 2015). Participants completed an IAT in which they were asked to sort healthy and unhealthy foods into the categories of desserts and vegetables. Half of the participants saw the foods represented as pictures (a low-level construal condition), while the other half saw the same foods represented as words (a high-level construal condition). At the same time, participants were asked to sort positively or negatively valenced words into the categories of positive and negative. Those who were concerned with healthy eating were more likely to associate vegetables with positivity and desserts with negativity than those who did not report a dieting goal. Furthermore, those who valued dieting were more likely to associate healthy vegetables (as opposed to unhealthy desserts) with the goal of weight loss if those foods were presented as words rather than pictures, while dieters were more likely to associate desserts with tastiness if they were presented as pictures rather than words (Carnevale, et al., 2015). These findings suggest that the presentation of choice options in words rather than pictures may systematically impact construal level and thereby nudge people’s self-control decision making.

IMPLICATIONS

Perhaps the most important implication of this work is the central role that subjective construal plays in self-control. Humans are not bound by simple stimulus–response systems. People actively interpret environmental stimuli and respond based on these interpretations (e.g., Griffin & Ross, 1991; Hastorf & Cantril, 1954). Thus, there is no “default” response to temptations or other environmental stimuli because responses are “conditionally automatic”—activated by if–then rules under certain circumstances rather

than rigidly determined (e.g., Bargh, 1989). Construals determine temptation responses because they alter the fundamental meaning of the stimulus. People are more likely to respond to temptations in ways that are good for self-control to the extent that they construe the temptations at a high rather than low level. Situational factors can impact how people construe events (e.g., psychological distance; Trope & Liberman, 2010), but so too can individual differences in cognitive factors and internal motivations (Vallacher & Wegner, 1989). Rather than focus exclusively on the external factors that influence people's self-control, this work highlights the need to understand how people integrate these external and internal influences to inform decisions and behavior.

Another implication worth considering is the role of intrapsychic conflict in the resolution of self-control conflicts. Our metaphor of the senate of the mind to model control suggests that self-control need not be characterized by the intrapsychic conflict that is central to many models of self-control (e.g., Hofmann, Friese, & Strack, 2009; Mischel et al., 1989; Thaler & Shefrin, 1981). Just as interpersonal negotiations may be marked by either antipathy and the belief that one side must lose in order for the other to win or marked by conciliation and a willingness to cede less important points to acquire important points (a process called *logrolling*), an individual may resolve intrapersonal motivational conflicts with or without overt strife. One implication of this is that just as interpersonal trust between parties impacts how conflicts are resolved interpersonally, it may be trust between the various factions in the senate of one's mind that determines how self-control conflicts are resolved. People who are more successful at self-control may be those who are more effective in creating broader coalitions among the various factions in the senate of the mind, and finding a way to appease those in the minority. For example, successful dieters may strategically choose to indulge every now and then as peace offerings to the less powerful coalitions within the mind. In this way, restraint and indulgence may both play important roles in successful self-control over time.

Germane to this point is research indicating that high-level construal leads to greater use of logrolling and search for integrative win-win outcomes in interpersonal negotiation (Henderson & Trope, 2009; Henderson, Trope, & Carnevale, 2006). In one experiment, participants were assigned to negotiation dyads in which both members were instructed to think about the negotiation in either an abstract or a concrete manner (Henderson & Trope, 2009). Dyads in the abstract (high-level construal) condition had better negotiation outcomes, as measured by higher joint gain, and were more likely to use logrolling techniques such as multi-issue negotiation offers. High-level construal presumably facilitates logrolling because the hierarchical structures it creates clarify which issues are high priority and which are relatively low priority. Without such structure, each issue considered has the ability to derail the entire negotiation, no matter how minor in importance or tangential to the overall desired outcome.

Just as construal impacts interpersonal negotiations, it may also impact intrapersonal negotiations as an individual's separate motives may vie for expression. To return to the "senate of the mind," an individual may resolve competing desires within him- or herself by negotiating a settlement that pursues one motivation now and another motivation at a future time. For example, someone who values both weight loss and socializing may decide to eat a salad for dinner on a Tuesday night but enjoy cake at a friend's birthday party on Saturday night. In a well-ordered mental senate, such negotiations will be executed strategically, such that each goal is pursued at the most appropriate time and

with a constant awareness of which goals are primary. Future research should add to the literature on the impact of construals in interpersonal negotiations by examining how construals affect intrapersonal negotiations.

The experience of self-control to many entails the effortful inhibition of temptation impulses (e.g., Hofmann et al., 2009; Metcalfe & Mischel, 1999; Mischel et al., 1989; Muraven & Baumeister, 2000). This perspective suggests that self-control is a reactionary response to a detected problem, one vulnerable to failure from a number of circumstances (Fujita, 2011). Our approach, however, suggests that inhibition is only one of many means people can use to promote self-control. In particular, we suggest that people may use proactive self-control processes to supplement reactive inhibition. Whereas reactive self-control processes focus on how to use goal structures to overcome temptation once one is actually faced with those temptations, proactive self-control processes focus on how to set up one's environment in anticipation of a future self-control conflict in a way that maximizes the chances of self-control success. Both reactive and proactive self-control processes are means toward the same end of achieving valued goals. Those who are most successful may be those who employ both types of processes rather than one to the exclusion of the other (see also Fujita, 2011).

SUMMARY

In this chapter, we have reviewed work highlighting the roles of abstraction and subjective construal in self-control. In the senate of people's minds, more abstract, high-level construals may promote more effective governance by promoting the will of the consensus. By contrast, more concrete, low-level construals may promote less effective governance by empowering independent factions unconstrained by the majority. We have reviewed empirical evidence for the assertion that high-level relative to low-level construal promotes self-control, and have briefly discussed psychological implications. We encourage and look forward to future multidisciplinary dialogue and research that explores these implications.

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CHAPTER 10

Beyond Limited Resources

Self-Control Failure as the Product of Shifting Priorities

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For much of the history of psychology, psychologists have been trying to isolate that skill or ability that predicts important life outcomes such as academic achievement, job success, health, and criminality. For much of this time, the pinpointed factor was general intelligence, which indeed predicts a large array of positive life outcomes (Gottfredson & Deary, 2004; Moffitt, Gabrielli, Mednick, & Schulsinger, 1981; Neisser et al., 1996). More recently, researchers have discovered that self-control also confers many personal and societal benefits, often contributing to positive outcomes as much as or more than intelligence (e.g., Duckworth & Seligman, 2005; Moffitt et al., 2011). For example, self-control fosters the ability to stay on-task when our minds would rather wander; it allows people to restrain momentary desires to reach cherished long-term goals; and it allows groups of people to work together. In short, researchers have discovered that self-control sustains the “better angels” of our nature, allowing us to live the good life (Baumeister, Heatherton, & Tice, 1994; de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012).

DEFINING SELF-CONTROL

Self-control, known colloquially as “willpower” and related to executive function or cognitive control (Robinson, Schmeichel, & Inzlicht, 2010), refers to the mental processes that allow people to override thoughts, emotions, or behaviors that compete with their overarching goals (Baumeister, Vohs, & Tice, 2007). At its heart, self-control is instigated when a person faces a conflict between two competing desires or response tendencies—say, when an ex-smoker is conflicted by the desire to smoke; when a religious Jew is overpowered by the delightful smell of bacon; or even when a study participant is conflicted

between naming the color of a word and reading that word in a Stroop task. Such conflict is subjectively aversive (Saunders, Milyavskaya, & Inzlicht, 2015) and can lead people to inhibit or suppress one set of responses and replace them with the second set (Inzlicht, Bartholow, & Hirsh, 2015). Self-control is thought to be applied when people choose to inhibit their immediate desires (e.g., cigarette smoking, delightful bacon, word reading) and to replace them with behavior that is in line with their long-standing goals. Whereas some theorists have suggested that self-control can be effortless or automatic (de Ridder et al., 2012; Fujita, 2011; Gillebaart & de Ridder, 2015), in our view, effort is the hallmark of self-control, with more effortless varieties of restraint falling under the broader concept of self-regulation (Carver & Scheier, 1998).

Although the topic of self-control (and self-regulation) has been studied for quite some time—Walter Mischel’s famous marshmallow studies, for example, were conducted in the 1960s and 1970s (Mischel, Ebbesen, & Raskoff Zeiss, 1972)—interest in self-control really began to take hold relatively recently. Figure 10.1 illustrates trends for academic publications on self-control from 1986 to 2014, and it clearly shows a spike of interest in the late 1990s and early 2000s. The timing of this spike was not haphazard—it coincided with (and was likely caused by) the arrival of a new and elegant theory by Roy Baumeister and his colleagues called the *resource (or strength) model of self-control* (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister et al., 1994; Baumeister & Heatherton, 1996; Muraven & Baumeister, 2000). The resource model captured the imagination of the field (and the lay public), and it should be credited with bringing to focus an important yet relatively neglected facet of mind.

One of the more striking things we have learned from the resource model is that self-control wanes over time, having an apparent refractory period (Baumeister & Heatherton, 1996; Hofmann, Vohs, & Baumeister, 2012; Muraven & Baumeister, 2000). According to the resource model, self-control is based on some finite resource or energy, such that effortful control has a natural limit, beyond which self-control can no longer be exerted as people find themselves in a state called *ego depletion* (Baumeister et al., 2007).

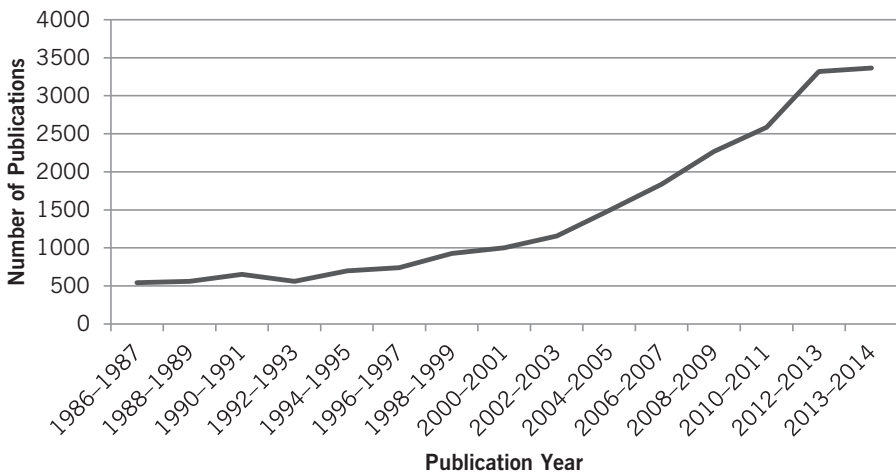


FIGURE 10.1. Self-control publication trends (1986–2014), based on PsycINFO search on March 6, 2015, for all publications using the term *self-control* or *self-regulation* in any search field.

Despite the prominence of the resource model, a precise understanding of how and why self-control wanes over time has been slow to develop, and it is clear that more theoretical and empirical work is needed (Inzlicht & Schmeichel, 2012). Here, we review the resource model of self-control and explore a number of empirical findings that are hard to reconcile with it. In commenting on the resource model, we review an alternative model that has little to do with resources and more to do with shifting priorities and motivations (Inzlicht, Schmeichel, & Macrae, 2014). According to this alternative, self-control wanes over time not because people become *unable* to restrain themselves, but because they are *unwilling* to restrain themselves, choosing to indulge in more leisurely pursuits instead.

THE RESOURCE MODEL OF SELF-CONTROL

The original resource model of self-control suggests that self-control is based on a kind of fuel that powers the will (Baumeister et al., 1998; Baumeister & Heatherton, 1996; Muraven & Baumeister, 2000). This model made two major claims. First, self-control is claimed to draw upon a shared, central resource that underlies a vast array of behaviors. Although, on their surface, many behaviors appear different—snacking on carrots instead of chips, staying calm when hearing bad news, or saving money instead of spending impulsively—deep down they all involve the inhibition of some pressing urge or impulse. Whereas the idea that self-control is domain-general has not been controversial among social psychologists (e.g., Cohen & Lieberman, 2010), this idea is not without detractors, with some theorists suggesting that control might be domain-specific (e.g., Egner, 2008). It is nonetheless fair to say that there is a fair degree of consensus concerning the centrality of self-control for numerous behaviors.

The second major claim of the original resource model is that self-control is based on a limited resource or fuel that is consumed by use: “Self-control seems to rely on a limited energy or strength, such that engaging in a single act of self-control impairs subsequent attempts at self-control, as if some sort of energy had been used up during the initial act” (Gailliot et al., 2007, p. 325). Self-control, according to the resource model, “is best understood as a limited resource that becomes drained with use” (Vohs, Baumeister, & Schmeichel, 2012, p. 943). Engaging self-control is “followed by a period of scarcity, until [the resource] builds up again” (Muraven, Tice, & Baumeister, 1998, p. 775). In short, after initial acts of effortful control, people’s “capacity to exercise further self-control becomes exhausted, leading to decreased performance on subsequent acts of self-control (Hagger, Wood, Stiff, & Chatzisarantis, 2010, p. 496). This model is thought to explain why people tend to eat junk food and sit on the couch after a long day—their self-control fuel is depleted and they simply cannot control themselves any more. To be clear, although more recent versions of the model have revised the strong version of this claim (Baumeister, 2014; see below), the original claim was that self-control wanes over time because self-control resources have become depleted or “spent” (Vohs & Faber, 2007, p. 537).

The main evidence in support of the limited resource model of self-control comes from studies using the sequential task paradigm, whereby exerting effortful control at time 1 impairs self-control performance on a different task at time 2. A meta-analysis of studies published between 1998 and April 2009 revealed that nearly 200 separate studies had used the sequential task paradigm (Hagger et al., 2010). Many more sequential

task studies have been conducted since then. All of these studies suggest that self-control wanes over time (however, see Carter & McCullough, 2014). For example, writing an essay while restricting one's use of certain common letters makes it more difficult to maintain items in working memory, tell the truth, act ethically, and learn simple categorization rules (Gino, Schweitzer, Mead, & Ariely, 2011; Mead, Baumeister, Gino, Schweitzer, & Ariely, 2009; Minda & Rabi, 2015; Schmeichel, 2007).

The sequential task paradigm has been used not only to demonstrate that self-control wanes over time but also to persuade researchers that self-control is limited and relies on a finite resource; that is, despite the fact that the sequential task paradigm remains silent about the precise processes that underlie self-control's refractory period—after all, self-control could wane at time 2 after effortful control at time 1 for a whole host of reasons (Hagger et al., 2010)—researchers have nonetheless concluded from it that self-control is based on a limited resource. To date, however, studies scrutinizing the precise processes via which self-control failure in the sequential task paradigm comes about have been lacking (Inzlicht & Schmeichel, 2012). It is possible that self-control wanes after initial exertion, but for reasons that have little to do with depleted resources.

The primary exception to the paucity of process evidence is research on glucose. In a highly influential paper Gailliot and colleagues (2007) found evidence to suggest that the resource powering the will is not some metaphorical entity but is in fact a simple carbohydrate circulating in the bloodstream that supplies energy to the body and brain, namely, glucose. The studies reported by Gailliot and colleagues supported three important ideas: (1) Self-control exertion leads to measurable drops in circulating blood glucose; (2) blood glucose covaries with and predicts self-control performance; and (3) ingestion of glucose-laden beverages can boost self-control. In combination, these three ideas provide powerful support for the resource model. The reason that self-control wanes after initial bouts of effort is that glucose levels have been depleted. In other words, effortful control literally depletes an essential physical resource that is finite in nature.

The resource model was a real advance in understanding the psychology of self-control. It taught us a number of new things about self-control: Appreciating self-control as a central skill, critical for many life domains, was a real innovation, and recognizing that self-control has a refractory period, waning slowly over time, was a legitimate breakthrough. It is no wonder, then, that the resource model has crossed disciplinary boundaries and is discussed not only in social psychology but also in cognitive psychology and human neuroscience (Heatherton & Wagner, 2011; Persson, Larsson, & Reuter-Lorenz, 2013; Shamosh & Gray, 2007), behavioral economics (Gino et al., 2011), and organizational/consumer behavior (Fennis, Janssen, & Vohs, 2009; Vohs & Faber, 2007). In brief, the resource model captured the imagination of more than a few fields and can be credited with changing the way we think of important societal issues, including, to name only one, intergroup interactions (Apfelbaum & Sommers, 2009; Inzlicht & Kang, 2010; Richeson & Shelton, 2003).

THE REVISED RESOURCE MODEL

Despite the smashing success of the original resource model, it became clear that the model needed to be updated and revised. A few studies, in particular, led resource theorists to revise the model by suggesting that complete resource depletion or exhaustion is

rare, with most instances of ego depletion reflecting only partial and temporary depletion (Baumeister & Vohs, 2007). Ego depletion, in other words, “does not mean that the brain has run out of fuel, as was first proposed” (Baumeister, 2014, p. 314). Instead, the revised resource model suggests that effortful self-control does not fully drain self-control resources until they are exhausted and spent; rather, effortful control is now thought to deplete the resource only partially and only slightly (Baumeister, 2014).

The first studies that led to this revision found evidence that motivational incentives could overturn the typical ego depletion effect. For example, people who were depleted by exertion on an initial task were able to control themselves effectively on a subsequent task if they were offered cash or interpersonal incentives for doing so (Muraven & Slessareva, 2003; see also Moller, Deci, & Ryan, 2006). If self-control resources are completely drained, it is difficult to understand how motivations (or any other sort of psychological stimulants) could possibly have an effect. Hence, a model based on the complete exhaustion of a resource is implausible, justifying the need for a revision to the model, whereby resources are only partly diminished. With this modification, people in a state of ego depletion can still control themselves if they are sufficiently motivated, such as when an important situation arises (Baumeister, 2014).

One powerful motive that is thought to drive how people behave after effortful control is the motive to conserve energy (Baumeister & Vohs, 2007). People are thought to withdraw effort in order to save their energy for some future pressing need or opportunity. Support for conservation of effort comes from evidence that whereas exertion at time 1 can lead to poor self-control at time 2, it leads to even poorer self-control when people expect to perform an additional important task at time 3 (Muraven, Shmueli, & Burkley, 2006). The anticipation of further effort leads people to restrain their current effort (and performance), presumably so that they have enough energy left over to perform the anticipated third task. In short, the revised resource model suggests that effortful control leads to ego depletion because people desire to conserve their limited energy stores.

THEORETICAL PROBLEMS WITH THE RESOURCE MODEL

The revised resource model was an important acknowledgment of some of the shortcomings of the original perspective on limited resources for self-control. The major advance, in our view, was the recognition that the ego depletion effect does not reflect an inability to exercise self-control, but rather reveals a motivated decision not to exercise further self-control without good reason. In this section, we take a more in-depth look at three thorny issues for the resource model before reviewing the process-based model of ego depletion.

What Is the Resource?

The first problem with the resource model is the inability to specify a *plausible* resource that fuels the will. Although there was much excitement about glucose as the physical resource that powers self-control (Gailliot et al., 2007), the glucose findings have proven to be controversial and have been challenged on multiple grounds (Kurzban, 2010; Schimmack, 2012).

First, the idea that self-control can consume inordinate amounts of brain glucose is biologically implausible (Kurzban, 2010). Studies using positron emission tomography, which directly measures localized changes in brain glucose metabolism, suggest that specific mental activities cause a local increase in glucose utilization of no more than 1% above resting levels (Raichle & Mintun, 2006). Mental effort, in other words, consumes very little brain glucose, and the little that it does use is readily circulating in the brain (Hockey, 2013). Confirming this implausibility, a series of experiments assessing carbohydrate metabolism with highly precise measurements repeatedly failed to replicate the finding that exerting self-control reduces levels of blood glucose (Molden et al., 2012).

In short, if exerting self-control does not reliably reduce blood glucose levels, then the idea that glucose is the physical manifestation of the metaphorical resource is in doubt. Revisions of the resource model have adapted to these facts, with new recognition that self-control failure is unlikely to be caused by shortages of blood glucose (Baumeister, 2014). Self-control may nevertheless operate, based on some limited inner resource, but the resource must be something other than glucose. The identity of the resource therefore remains unknown, leading us to wonder whether there is, in fact, a literal resource that powers the will.

Resource-Incompatible Findings

The second intractable problem with the resource perspective concerns findings that are incompatible with a resource account. These findings strain the necessity of a resource concept to explain self-control's refractory period (Inzlicht et al., 2014; Navon, 1984). The growing numbers of incompatible findings are of three varieties. The first variety reveals that self-control can be improved—not diminished—when other self-control tasks are performed in tandem; the second indicates that depletion can be moderated by subjective perceptions and construals; and the third shows that depletion effects can be overcome when some sort of rewarding activity is performed between the two tasks of the sequential task paradigm.

The first variety of resource-incompatible findings comes from provocative new work on the propagation of self-control, which indicates that self-control can be improved when a person performs multiple self-control tasks at the same time (Tuk, Zhang, & Sweldens, 2015; see also Tuk, Trampe, & Warlop, 2011). In one study, for example, participants performed better on a Stroop task, a canonical measure of attentional control, if at the same time they were asked to inhibit their desire to eat tasty potato chips; when they were free to eat as many chips as they liked, in contrast, their Stroop performance suffered (Tuk et al., 2015, Study 5). In another study, participants were successful at curbing their desire to eat potato chips when at the same time they were asked to avoid looking at words popping up on a video of a woman being interviewed; yet they were less successful at curbing their appetites and ate more chips when their attention was free to roam on the salient words in the video (Tuk et al., 2015, Study 4). In short, self-control begets more self-control, at least when engaged concurrently. These findings are also broadly consistent with work on learned industriousness (Converse & Deshon, 2009) and conflict adaptation (Gratton, Coles, & Donchin, 1992; Kleiman, Hassin, & Trope, 2014), whereby short bouts of control have been found to induce mindsets that are conducive to further self-control success.

These sorts of studies are hard to reconcile with a resource account. If self-control truly relies on some limited, slowly replenishing resource that becomes depleted (even partially) after use, then it is difficult to understand how simultaneous acts of self-control can be successful. If self-control resources are consumed with use, or even if they are hoarded for some future pressing need, then how can more demands on this resource produce better control than fewer demands? Increasing the demands on a limited resource should make self-control less likely to succeed, not more. One solution is to conceive of self-control as not being bound to resources, but instead as being based on preferences for and willingness to exert effort (Inzlicht et al., 2014), which might wax and wane based on factors like habituation (Converse & Deshon, 2009) and labor-leisure tradeoffs (Kool & Botvinick, 2014).

The second variety of resource-incompatible findings comes from research showing that changing perceptions and construals can counteract ego depletion. For example, when people perceive themselves as being depleted despite not having engaged in previous cognitive work, they exhibit poor self-control; conversely, when people perceive themselves as having lots of energy and stamina, they show fully intact self-control (Clarkson, Hirt, Jia, & Alexander, 2010). Subjective perceptions of depletion and vitality, then, appear to drive self-control outcomes, although it is important to note that subjective perceptions are driven both by information from the environment and the actual application of effort. Similarly, lay theories about how self-control works and beliefs about whether it is based on a limited resource shape self-control (Job, Dweck, & Walton, 2010). When people believe that self-control wanes over time, they show typical depletion effects; however, when they believe that self-control is renewable, they show no noticeable drops in self-control over time. Furthermore, research suggests that the construal of effort itself can determine whether effort leads to depletion. When people construe an effortful activity as work, they tend to show subsequent failures in control; when they construe the same task as fun and enjoyable, they tend not to show these deficits (Laran & Janiszewski, 2011; Werle, Wansink, & Payne, 2015).

As with the research on the propagation of control, it is difficult to reconcile these studies with the resource model. If self-control fails because of the limits imposed by a real physical resource, then how can subjective perceptions and construals make a difference? According to the revised resource model, people consume some of their self-control resources as they exert themselves, after which they withhold subsequent effort to conserve these real, biologically based resources. Presumably, actual effort depletes actual resources, thereby limiting the further willingness to control. But the previously discussed research makes clear that even the illusion of being depleted can limit self-control (Clarkson et al., 2010), which suggests that the consumption of some physical resource is not needed to explain ego depletion, and that models based on easily shifting priorities and choices may suffice (Inzlicht et al., 2014; Kurzban, Duckworth, Kable, & Myers, 2013).

The third variety of resource-incompatible findings comes from work showing that self-control can be overturned by motivational incentives. We have already discussed how incentivizing self-control can knock out ego depletion (Moller et al., 2006; Muraven & Slessareva, 2003). Whereas this pattern is problematic for the original resource model, it is less problematic for the updated resource model, which makes clear that resources are typically only slightly depleted, allowing people to draw on their reserves and control themselves effectively when they are motivated to do so (Baumeister, 2014).

More problematic, however, is the increasing number of studies showing that the depleting effects of initial bouts of effortful control are undone by additional inputs and incentives (Masicampo, Martin, & Anderson, 2014). For example, in one remarkable study, if depleted smokers smoked one cigarette in the minutes after their initial round of effortful control, they showed no measurable downstream effects on subsequent control; smokers who were not given the opportunity to smoke between the time 1 and time 2 tasks showed the typical self-control decrements characteristic of ego depletion (Heckman, Ditre, & Brandon, 2012). Smoking, in other words, undermines depletion (at least for smokers). Nearly 40 studies in total have documented similar effects (Masicampo et al., 2014). Thus, watching a favorite television program (Derrick, 2013), receiving a surprise gift (Tice, Baumeister, Shmueli, & Muraven, 2007), affirming a core personal value (Schmeichel & Vohs, 2009), gargling with sugar (Hagger & Chatzisarantis, 2013; Molden et al., 2012), briefly meditating (Yusainy & Lawrence, 2015), and even praying (Frieze & Wänke, 2014) have all been found to counteract the typical ego depletion effect.

These sorts of studies are hard to reconcile with the resource model, even with the revised resource model. If depletion is due to people withholding effort in a bid to conserve their limited energies, applying effort only when an important situation arises (Baumeister, 2014), then it is hard to understand how bouts of pleasure and gratification can reverse this depletion. Smoking a cigarette is not likely to make some mundane mirror tracing task any more meaningful or enjoyable (Heckman et al., 2012), and praying does not transform a Stroop task into something more pressing and important (Frieze & Wänke, 2014). If smoking and praying do not transform tasks to become personally meaningful and important, how do they overturn depletion? In brief, if people are only willing to use their resources on meaningful and important things, it is difficult to understand why people would squander them on tasks that have neither of these qualities. What smoking and praying do accomplish, however, is to offset initial mental effort and cognitive work, thereby increasing people's willingness to engage in further work (Kool & Botvinick, 2014). This change in willingness has little to do with conserving limited resources, and more to do with being rewarded and feeling appreciated for one's time and effort (Muraven, Gagné, & Rosman, 2008).

In our view, self-control failure has little to do with resources being fully or partially depleted. Instead, we suggest that it has to do with willingness and motivation to apply effort, with this willingness declining over time (Inzlicht et al., 2014; Inzlicht & Schmeichel, 2012). Willingness to apply effort does not always decline, however, and it can wax and wane depending on countervailing incentives (Kool, McGuire, Rosen, & Botvinick, 2010), construal of effort (Laran & Janiszewski, 2011), and adaptation to effort (Dang, Dewitte, Mao, Xiao, & Shi, 2013; Dewitte, Bruyneel, & Geyskens, 2009).

THE PROCESS MODEL: DEPLETION AS SHIFTING PRIORITIES

The process model of self-control failure—which may be more descriptively called the *shifting priorities model*—integrates research from multiple areas, including work on the aversiveness of control (Botvinick, 2007; Inzlicht et al., 2015; Kool et al., 2010), the opportunity cost model of effort (Kurzban et al., 2013), and the psychology of fatigue (Hockey, 2013). In our view, self-control is not that special; it is not based on some exceptional ability to power through adversity. Instead, we agree with others who liken

self-control to a decision to engage in one course of action over another (Hare, Camerer, & Rangel, 2009; Kurzban et al., 2013; Sullivan, Hutcherson, Harris, & Rangel, 2015). Crucially, decisions about which action or goal to pursue, like many other decisions, are based on factors such as the perceived effort of the action (Kool et al., 2010), opportunity costs for committing to the action (Kurzban et al., 2013), and the dynamically changing value of the action (Kool & Botvinick, 2014).

The model first attempts to address *why* self-control wanes over time. We propose that this temporal dynamic was evolutionarily selected to solve a recurrent problem in animal life (Tooby & Cosmides, 1992): the problem of balancing the needs for exploitation versus exploration, whereby the value of exploiting established sources of reward is pitted against the utility of exploring the environment for other opportunities (Cohen, McClure, & Yu, 2007; Tooby & Cosmides, 2005). Balancing this trade-off involves regulating the extent to which one favors task engagement (exploitation) versus task disengagement (exploration). Knowing when to persevere and when to change course is a balancing act—if the appropriate balance is not maintained, organisms may expend too much effort for too little reward or prematurely give up on an endeavor before some large payoff. The point here is that natural selection would have favored adaptations that minimize opportunity costs caused by a poor decision about whether to engage or to disengage from a task (Kurzban et al., 2013). One such adaptation is making effortful control aversive, so that it has inherent disutility (Kool et al., 2010).

Because effortful control is aversive, people not only tend to avoid it but also their desire to avoid it increases the more time they are engaged in effortful control (Kool & Botvinick, 2014). In other words, the inherent disutility of working to control one's responses accumulates the more one has already engaged in work. This is another way of saying that people increasingly prefer rest and leisure after engaging in effortful control and labor.

From this perspective, self-control's refractory period may be the motivated switching of task priorities, wherein all forms of mental effort become increasingly aversive, making mental leisure increasingly attractive (Job, Bernecker, Miketta, & Friese, 2015). What this means is that depletion may not be about some finite resource being exhausted, but about people's preferences and priorities changing. Specifically, initial bouts of effort may lead people subsequently to prefer engaging in "want-to" goals as opposed to "have-to" goals (Inzlicht et al., 2014); that is, people may experience a shift in motivation away from "have-to" or "ought-to" goals, which are carried out through a sense of obligation and duty, and instead come to prefer "want-to" goals, which are fun, personally enjoyable, and meaningful (Ryan & Deci, 2000; see also Milkman, Rogers, & Bazerman, 2008). Although this motivational shift was originally conceived as primarily influencing subsequent attention (Inzlicht & Schmeichel, 2012) or subsequent attention and emotion (Inzlicht et al., 2014), it likely affects all information-processing modalities (e.g., perception, memory, attention, emotion) given motivation's far reach (Touré-Tillery & Fishbach, 2014). Thus, depletion may affect not only effortful control but also what people pay attention to in their environment, as well as how they perceive, remember, and emotionally react to it (e.g., Schmeichel, Harmon-Jones, & Harmon-Jones, 2010).

Without some countervailing reward to offset the increasing aversiveness of work, people prefer to engage in activities they find more pleasurable (Inzlicht et al., 2014). Thus, self-control can be seen as the product of multiple inputs that either increase or decrease the value of engaging effortful control. Effort appears to have inherent disutility—that

is, effort itself is aversive—but this disutility can be countered by additional sources of value that may lead someone to decide to engage in effortful control, including being self-affirmed (Schmeichel & Vohs, 2009), gargling with sugar (Molden et al., 2012), smoking a cigarette (Heckman et al., 2012), or getting the opportunity to meditate (Yusainy & Lawrence, 2015). The disutility of effortful control can also be countered by framing it as a means toward some inherently fun and enjoyable end, thereby changing the value of effort itself, such as when walking is framed as sightseeing instead of as exercise (Werle et al., 2015). In this light, expectations about how self-control works (Job et al., 2010) and perceptions of fatigue and vitality (Clarkson et al., 2010; Draganich & Erdal, 2014) act as additional inputs that add or subtract value from the decision about whether to apply effort.

STRENGTHS AND WEAKNESSES OF THE PROCESS MODEL

The process model is consistent with the view of self-control as a decision about whether or not to exert effort. It allows multiple inputs to influence this decision, including information about effortfulness, task importance, opportunity costs, countervailing rewards, and task framing. And because it recognizes that the inputs into decision change over time, including the dynamically changing valuation of labor versus leisure, it is not only consistent with the major discovery of the resource model, that self-control wanes over time, but it can also accommodate findings that are difficult to account for with a resource model (e.g., Clarkson et al., 2010; Dang et al., 2013; Heckman et al., 2012).

The process model has the benefit of accounting for the existing literature without reference to the problematic resource concept (Navon, 1984). The resource concept is of little use in explaining why 1 minute of mental effort (Halali, Bereby-Meyer, & Meiran, 2014)—which should have no noticeable impact on a resource—can still have measurable downstream consequences. The process model also makes predictions unanticipated by the resource model, such as effects related to the basic perception of stimuli that have nothing to do with self-control (Schmeichel et al., 2010). Finally, the process model is consistent with, and is indeed based on, modern theories of fatigue that make no reference to energy or resources, but instead are based on motivation (Hockey, 1997, 2013; Hockey & Earle, 2006).

Despite the positives of the process model, the model also has shortcomings. First, there is little direct evidence that depletion is mediated by changes in motivation, priorities, or goals (Baumeister, 2014); that is, the process model makes strong claims about self-control failure being the product of changing motivational priorities (and not depleted resources), yet there is little direct evidence in support of this view. We note that few researchers have bothered to examine this important issue (Inzlicht & Schmeichel, 2012), so the absence of evidence should not be confused with evidence of absence. And results of a few recent studies are very much consistent with the process model. For example, people in a state of depletion appraise their goals as less important and worthwhile, as being less of a priority (vanDellen, Shea, Davisson, Koval, & Fitzsimons, 2014). Similarly, people in a state of depletion report lower levels of commitment to their self-control goals, an effect that can be overcome by reminders of their goal commitment (Walsh, 2014). Thus, more research is accruing to suggest that depletion does indeed change people's appraisal of the importance of their self-control goals, including their

commitment to these goals. Given the clear relationship between goals and motivation (e.g., Kruglanski et al., 2002), we take these recent findings as evidence in favor of the process model. But more work is needed.

A second drawback of the process model—and one that we think confounds some people—is that self-control *feels* limited. The process model suggests that self-control is limitless if motivation and desire are high, but this seems to collide with common sense. After all, people do indeed get fatigued to the point of exhaustion when working on effortful tasks for extended periods, even the ones they enjoy. It is hard for people to sustain effort for long durations, giving credence to the idea that they have run low on energy. For example, air traffic controllers need to expend inordinate amounts of effort to stay vigilant to prevent tragedies, and there is no doubt that they are highly motivated not to make errors. Nevertheless, air traffic controllers do indeed become fatigued, with consequential flagging attention and as a remedy, mandatory leisure breaks.

The process model suggests that this flagging of effort is due to changes in motivation and priorities, and not due to some internal limit on how long effort can be sustained. This seems to fly against conventional wisdom and subjective experience. Yet modern theories of fatigue suggest that this is precisely what happens (Hockey, 2013). Even when people work on important tasks, tasks that they are highly motivated to complete, they can only sustain their effort for so long—this is the exploitation mode to which we referred earlier. The reason for this is that, over time, people become habituated to a task, finding it less interesting or important as they consider other possible tasks and activities that might come to seem more pressing (Kurzban et al., 2013)—this is the exploration mode. An ambitious student studying for a final can sustain her efforts to study in the library for only so long before her desire to eat, check e-mail, socialize with friends, or sleep come to dominate her attention. When she decides to take a break or to stop studying for the day, it is not because her energies are depleted, but because other goals have become more important. Despite self-control really seeming to be limited, we know of no evidence that directly corroborates this view (Hagger et al., 2010).

IS THE REVISED RESOURCE MODEL A MOTIVATIONAL MODEL?

The idea that depletion is typically a slight diminishment of a resource (Baumeister, 2014) is an important turn for the resource model. Unlike the original model, the revised resource model suggests that ego depletion reflects a slight (but not complete) diminishment of a central resource; that is, self-control failures are now recast as efforts to preserve a resource that is only somewhat diminished. If depletion is mostly mild, however, with people having “ample reserves of energy” (Baumeister, 2014, p. 314), why would it lead to self-control failure at all? That is, if people have the resources needed to engage effortful control, what holds them back?

In our view, the revised resource model is hardly different than a model based on changing motivations and priorities (Inzlicht et al., 2014). If people indeed have ample energy (Baumeister, 2014), then the reason that self-control wanes over time is because people decide that some tasks are not sufficiently interesting, important, or worthwhile, and they choose not to apply effort; that is, depletion seems to have turned from a question of inability to a question of unwillingness. If the resource is still ample, then one cannot blame resource unavailability for subsequent self-control failure, at least at the

proximal level. For example, if restraining one's emotions leads people to overeat (Vohs & Heatherton, 2000), yet leaves the resources that power the will mostly intact, can we blame overeating on the unavailability of resources? We believe not.

We do not mean to imply that the resource concept is irrelevant; we simply think it plays no pivotal role as the proximal mediator of ego depletion. The process model—and it seems the revised resource model as well—suggest that the reason people do not control themselves at time 2 is that they do not deem the task at time 2 worthy of their efforts. But why do people generally deem the time 2 task unworthy? The resource model suggests that it is because people are motivated to save their dwindling supplies of self-control energy; in this view, resources are central. People have an idea, be that a lay theory (Job et al., 2010) or one based on actual fact, that their energies are finite, and because of this idea, they may ration it selectively, using it on tasks that they think are worthwhile. So while the revised resource model admits that people selectively use their self-control energies (based on preferences, choices, etc.), it also suggests an ultimate reason for this selectivity: because self-control is limited and eventually runs out. In short, the ultimate cause of depletion is limited resources, which then lead to changes in willingness to use that resource. The process model, in contrast, dispenses with the resource concept altogether.

Like the revised resource model, the process model suggests that the proximal cause of depletion is lack of willingness but, unlike the resource model, it suggests that this unwillingness stems from the desire to balance competing goals and motives (Inzlicht et al., 2014). At any one time, people have a number of goals that they desire to enact (Kruglanski et al., 2002). The problem is that at times these goals conflict, and sometimes choosing one goal precludes choosing another. One solution to competing goals is to have a mechanism in place that prevents people from perseverating on any one goal, so that they can sample other goals, which is to say that evolution needed to build a mechanism that allowed for a switching between task engagement and disengagement or between exploitation and exploration (Cohen et al., 2007; Tooby & Cosmides, 2005). By preventing the accumulation of opportunity costs (Kurzban et al., 2013), such a mechanism would foster intelligent decisions and goal commitments.

The point of all this is to say that the process model and revised resource model are in apparent agreement about the proximal cause of ego depletion: people's lack of willingness to exert more effort. The key difference between the models is the ultimate causes of this change in willingness: The resource model claims that this derives from a motivation to conserve limited resources, whereas the process model claims that it derives from a motivation to balance competing goals. The problem here is that it is often difficult to test different ultimate causes given the distance between the effect and the ultimate cause (e.g., Conway & Schaller, 2002). Nonetheless, there is evidence that is consistent with the conservation of energy account (Giacomantonio, Jordan, Fennis, & Panno, 2014; Muraven et al., 2006), and evidence that is consistent with an account based on switching motivational preferences (Job et al., 2015; Schmeichel et al., 2010), but more research examining these competing ultimate causes is needed.

CONCLUSION

The resource model of self-control should be celebrated. Not only did it bring much needed attention to a neglected area of psychology, it also revealed that self-control has

a refractory period. This finding is a legitimate breakthrough and has been influential in a number of subfields of psychology and beyond. Despite its influence and importance, basic questions remain about how and why ego depletion operates, with the original resource model unable to account for quite a few discrepant findings (Masicampo et al., 2014). These discrepancies have forced researchers to rethink core assumptions and have led to a revision of the original model (Baumeister, 2014) and spawned a number of competing models as well (Dang et al., 2013; Inzlicht et al., 2014; Kurzban et al., 2013). We believe that the revised resource model can successfully accommodate some of the discrepant findings, for example, findings on how motivation can counteract depletion (e.g., Muraven & Slessareva, 2003), but the model has difficulty with others. The resource model (both versions) has real trouble with recent findings that indicate concurrent demands can increase control (Tuk et al., 2015) and those showing that subjective perceptions, expectations, and mindsets drive self-control (Clarkson et al., 2010; Werle et al., 2015). In contrast, modeling self-control as a decision about whether to engage in effort allows self-control to be more flexible and to change based on the various inputs that go into any decision-making process.

Our goal in this chapter was to examine the theoretical underpinnings of the resource model and to focus on areas in which it appears to be lacking. Such a focus should not detract from our legitimate view that the resource model has been a boon to the field. Finding that self-control wanes over time is a real advance. We suspect that it will continue to inspire researchers for years to come.

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CHAPTER 11

The Essential Role of Sleep in Self-Regulation

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Without enough sleep, we all become tall two-year-olds.
—J. J. JENSEN, *Dirt Farmer Wisdom* (2002)

The opening quote reveals an all-too-common personal experience; having not slept well, people seemingly start to resemble toddlers. They may become irritable, distractible, disengaged, or generally more unpredictable than usual. Although these observations echo common human experiences, psychological science has only recently turned its attention to sleep and its role in human functioning. Despite the fact that sleep is essential to physical and psychological restoration, and that its disruption undermines people's ability to engage appropriately with the world, the role of sleep in self-regulation is just beginning to be uncovered. Our purpose in this chapter is to summarize current knowledge on this topic, provide a useful conceptualization of the impact of sleep on self-regulation, and chart a course for addressing the most pertinent questions about their relationship.

In order to link aspects of sleep with self-regulatory processes meaningfully, we adopt an interdisciplinary perspective that draws on biology, sleep medicine, and various areas of psychology (e.g., cognitive, industrial–organizational, social). Sleep has attracted attention from all these areas because it simultaneously touches on biological universals (e.g., all complex species sleep), common medical problems (e.g., insomnia and fatigue), ability to think and perform (e.g., driving when drowsy), and likelihood to restrain unwanted social impulses (e.g., be calm in the face of criticism). As a result, empirical evidence essential to understanding how sleep shapes self-regulation is scattered across diverse fields, and scientific understanding is largely compartmentalized across different disciplines. To address this problem, one chief goal in this chapter is to illuminate the role of sleep in self-regulation by drawing on research from all these areas. Given that sleep is

a phenomenon that is inherently biological yet indispensable for understanding the daily undulation of physical activity and consciousness, such an approach is critical for advancing a scientific understanding of self-regulatory consequences of sleep.

In the pages that follow, we first link self-regulation to executive cognitive functioning and propose *effortful attention* as a key substrate of both processes. Second, we briefly describe the nature of sleep and effects of its disruption, emphasizing the neurocognitive consequences of sleep loss. Third, we review the existing literature that links sleep to self-regulatory outcomes such as task performance, emotion regulation, and social restraint. Fourth, we discuss *how* sleep may impact specific processes (i.e., effortful attention, monitoring, and inhibition) that shape these self-regulatory outcomes. Finally, we consider *why* these influences occur by stressing two distinct conceptual possibilities that link sleep to self-regulation, namely, *capacity* for self-regulation and *priority* of goals to be pursued. We also suggest key directions for this burgeoning area of inquiry. The main theoretical ties considered in this chapter are illustrated in Figure 11.1.

SELF-REGULATION AND EFFORTFUL ATTENTION

Self-regulation (or self-control) occurs when individuals alter their own mental or behavioral responses in order to enhance the likelihood of achieving important goals (Baumeister, Schmeichel, & Vohs, 2007). This process typically requires that individuals have a conscious goal (e.g., losing 10 pounds), evaluate their goal progress (e.g., stand on a scale), and if necessary, adjust their behavior accordingly (e.g., skip the cake) (Carver & Scheier, 1981). Although most behavior can be viewed as goal-directed and regulated in some way, self-control typically describes *conscious* and *effortful* attempts to bring one's behavior in line with important goals and is therefore predicated on a sense of conscious will (Baumeister et al., 2007). Typical targets of control are one's thoughts (e.g., avoiding memories about a friend who angered you), one's emotions (e.g., trying not to feel angry at the friend), and one's behavioral impulses (e.g., not yelling at your friend).

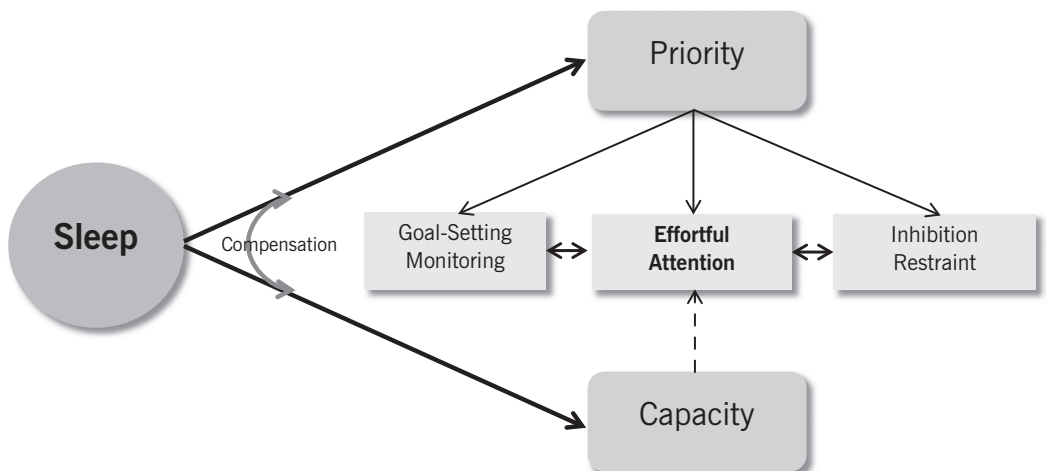


FIGURE 11.1. Key conceptual ties between sleep and self-regulatory processes.

Note that, ultimately, self-control is an attempt to reconcile conflicting urges in order to ensure that the more important, long-term goals are not sacrificed in favor of momentary temptations or obstacles. These maneuvers typically involve effort and a feeling of exertion (Sarter, Gehring, & Kozak, 2006). Ability to self-regulate and the accompanying experience of agency and volition likely evolved because it conferred significant evolutionary advantages; it allowed humans to transcend immediate responding to environmental circumstances and to better maximize long-term gains and survival (Baumeister et al., 2007; Tooby & Cosmides, 2005).

Although self-control is often thought of as regulating one's visceral or emotional impulses, it is intimately connected with *executive cognitive functions* (Hofmann, Schmeichel, & Baddeley, 2012). These functions can be distinguished into three main types of effortful cognitive activity, namely, working memory (i.e., maintaining and updating relevant incoming information), inhibition (i.e., deliberate suppression of undesirable prepotent responses), and shifting (i.e., shifting between different tasks or rules, Miyake et al., 2000). These aspects make the relevance to self-regulation obvious; both involve supervision of goal progress and adjustment toward desired end states. Critically, all the executive functions draw on limited attentional resources (McCabe, Roediger, McDaniel, Balota, & Hambrick, 2010; Posner & Boies, 1972).

However, executive functions have been a traditional focus of cognitive psychologists and neuropsychologists interested in specific features of mental and behavioral performance, whereas self-regulation has been a traditional focus of social and personality psychologists, who are more interested in social behavior, such as resisting temptation, suppressing emotions, and curbing socially undesirable urges. Critically, we propose that both self-regulation and executive function reflect the operation of *effortful attention* (also known as voluntary, directed, or controlled attention). This form of attention is consciously initiated and not tied to a specific external stimulus; rather, it is largely "content-free" and internally motivated (Kahneman, 1973; Kaplan & Berman, 2010; Morecraft, Guela, & Mesulam, 1993). It is also heavily dependent on frontal and parietal regions of the brain and can be contrasted with *involuntary* attention (Sarter et al., 2006), namely, attention that is automatically and effortlessly captured by external stimuli (e.g., hearing your name at a cocktail party). Note that virtually any self-regulatory task requires directed attending to one's goals, means of achieving them, or progress toward their completion.

Thus, effortful attention is the common substrate of both self-regulation and executive functions, forming the chief means by which humans selectively attend to and act on the environment in order to optimize goal achievement (Hoffman et al., 2012; Kaplan & Berman, 2010). Before people can do anything intentionally or invest effort, they first must attend to it. As William James (1892, p. 317) put it, "Volitional effort is an effort of attention." Later on, we draw on this essential role of attentional effort to draw a bridge between neurocognitive consequences of sleep and the impact of sleep on self-regulation.

WHAT IS SLEEP?

People spend much of their lives sleeping—about one-third of it—typically once every night for about eight hours. Sleep can be behaviorally defined as a reversible state of perceptual disengagement from—and unresponsiveness to—the environment. In a human

adult it proceeds in alternating cycles of deep sleep (non-rapid eye movement, NREM) and more active rapid eye movement (REM) sleep associated with dreams (Carskadon & Dement, 2011). Modern neuropsychology reveals that wakefulness and sleep are controlled by an internal biological clock located in the suprachiasmatic nuclei of the hypothalamus. This mechanism controls most physiological activity, including daily (i.e., circadian) rhythms in body temperature, hormone levels, psychomotor vigilance, and affect (Van Dongen & Dinges, 2003).

Although the full purpose of sleep remains a mystery, it plays a vital role in most key bodily functions, such as toxin disposal from the brain, thermoregulation, physical rest and physiological regeneration, and encoding and integration of newly learned information and emotional experiences (Walker, 2010; Xie et al., 2013). Given the necessity of these functions, substantial sleep loss leads to heavy drowsiness, making it impossible to delay sleep further despite one's best efforts to stay awake. This is certainly adaptive because continuous sleep deprivation in animals has been found eventually to result in death (Greenspan, Tononi, Cirelli, & Shaw, 2001). The critical role of sleep for functioning of complex organisms speaks to the inherent daily undulation of human behavior and affect; perhaps the most powerful effect on the motivation to engage, ability to think, and the human's sense of agency is the diurnal variation of the sleep–wake cycle.

Sleep disruption can be defined as any significant deviation in sleep quantity, integration, or timing relative to the optimal sleep needed by a given individual (typically between 7 and 9 hours of uninterrupted sleep during the night). Note that experimental investigations into consequences of sleep disruption have typically focused on insufficient sleep in the form of total sleep *deprivation* (i.e., skipping sleep entirely) or sleep *restriction* (i.e., sleep limited to less than the needed nightly amount). Most correlational evidence, on the other hand, involves subjective sleep *quality*, that is, self-reported problems in initiating or maintaining sleep indicative of sleep fragmentation (i.e., awakenings/arousals while in bed). Critically, all these forms of sleep disruption have adverse effects on neurophysiological function, which we summarize next.

Neurocognitive Consequences of Sleep Loss

Arousal and Vigilance

A key consequence of sleep loss is the overall reduction in arousal and vigilance. Neuroimaging positron emission tomography (PET) studies of sleep deprivation reveal broad reductions in metabolic rates across frontal and temporal lobes, thalamus, basal ganglia, and the cerebellum (Thomas et al., 2000; Wu et al., 1991). Similarly, functional magnetic resonance imaging (fMRI) studies indicate that sleep deprivation is specifically linked to lower thalamus activation during performance, and that lapses following sleep deprivation are associated with reductions in frontoparietal regions, sensory cortex, and thalamus (Portas et al., 1998; Chee et al., 2008). However, performing complex tasks after sleep loss may lead to *increased* compensatory recruitment of frontal control areas relative to performing simpler tasks (Chee, Soon, Lee, & Pallier, 2004; Drummond et al., 2005; Drummond, Brown, Salamat, & Gillin, 2004; Harrison & Horne, 2000). This speaks to the dynamic relationship between sleep loss and arousal; although missing sleep lowers overall arousal, which harms performance, increasing motivation and task difficulty may lead to compensatory control that boosts arousal in order to maintain performance.

Critically, these compensatory responses become both increasingly necessary and increasingly insufficient as “time on-task” increases. In other words, it becomes increasingly difficult to sustain the necessary drive and attention throughout performance when sleepy (e.g., driving) because sleep-initiating mechanisms produce lapses of attention and micro sleeps for which compensating is ultimately impossible (Goel, Rao, Durmer, & Dinges, 2009). These findings support the *wake state instability hypothesis*, the notion that increasing sleep loss produces both overall decrements and increased variability in performance, resulting from interactive, mutually inhibiting mechanisms controlling sleep and wakefulness (Doran, Van Dongen, & Dinges, 2001; Lim & Dinges, 2008; Phillips & Robinson, 2008).

Executive Functioning

As mentioned earlier, executive functioning is typically used to describe the most sophisticated and demanding aspects of cognitive function, such as the ability to attend selectively, to maintain and update information in short-term memory, and to plan and shift strategies (Goel et al., 2009). Critically, all the executive functions draw on the capacity for effortful attention and are therefore necessary for successful self-regulation (McCabe et al., 2010; Posner & Boies, 1972). They also rely especially on the frontal, parietal, and anterior cingulate cortexes necessary for cognitive control, error detection, and inhibition.

There is extensive evidence that people’s ability to plan, maintain information in memory, and inhibit undesirable cognitive responses is impaired by sleep loss (Harrison & Horne, 2000; Lim & Dinges, 2010). Although simple recall of facts and logic-based problem solving are not affected much, divergent thinking, which involves generating creative solutions, adopting novel approaches, and shifting thinking strategies, seems strongly impaired (Harrison & Horne, 2000). Similarly, tasks that rely on cognitive control (e.g., working memory and inhibition) are adversely affected by sleep loss (Chuah, Venkatraman, Dinges, & Chee, 2006; Couyoumdjian et al., 2010; Lim & Dinges, 2010; for a review, see Killgore 2010). Although these declines may be due to specific impairments in frontal functioning (Harrison & Horne, 2000), they may also reflect overall reductions in arousal (see earlier discussion) or impaired connectivity between frontal and limbic areas (Altena et al., 2008; Cote et al., 2008; Killgore, 2010; Krueger et al., 2008; Tucker, Whitney, Belenky, Hinson, & van Dongen, 2010).

Summary

In short, sleep is critical for maintaining optimal cognitive functioning. Sleep disruption generally leads to impaired vigilance, lapses of attention, problems with working memory, and compromised cognitive control. These impairments generally mean reductions in arousal, as well as activity in frontal control areas, although effortful compensation that engages frontal areas is often possible. Nevertheless, this compensation becomes increasingly difficult as the pressure to sleep builds and produces instability in wakeful functioning and attention. Before we consider the implications of these neurocognitive effects of sleep for self-regulation, we first evaluate how strongly sleep predicts self-regulatory outcomes themselves.

DOES SLEEP IMPACT SELF-REGULATORY OUTCOMES?

Although there is extensive evidence about the impact of sleep on cognitive control, the role of sleep in self-regulation of emotion and impulsive behavior is only now emerging. In this vein, one of our goals in this chapter is to integrate this body of evidence and stress the important role that regulation of effortful attention plays across cognitive, affective, and behavioral phenomena.

Self-regulatory outcomes considered in this review are those that rely on control of one's own thoughts, emotions, behavioral impulses, or performance. All these outcomes reflect an attempt by the self to control unwanted reactions by the self. We first review evidence that has linked general self-regulatory tendencies (e.g., impulsivity) to aspects of sleep, as well as consider the evidence for the causal role of sleep in this association. Then, we turn to findings that have implicated sleep in specific aspects of self-control, namely, academic and occupational performance, emotional regulation, and impulse restraint. Although nascent, research across these domains consistently reveals sleep to be indispensable for understanding self-control and its role in human behavior.

Individual Differences in Self-Control

Mounting evidence suggests that individuals with suboptimal self-regulatory tendencies (e.g., high impulsivity or low conscientiousness) tend to experience sleep disruption. Research from the clinical domain suggests that sleep disorders often occur alongside impulsivity, whereas impulse disorders often occur alongside sleep problems (Kamphuis, Dijk, Sreen, & Lancel, 2014; Medeiros, Carvalho, Silva, Prado, & Prado, 2005). For example, children with attention-deficit/hyperactivity disorder have more severe sleep problems than typical children (Kamphuis et al., 2014; Owens, Maxim, Nobile, McGuinn, & Msall, 2000; Ring et al., 1998). Research on student samples has also implicated low sleep quality and sleepiness in persons with lower conscientiousness or impulsivity (Duggan, Friedman, McDevitt, & Mednick, 2014; Grano et al., 2007; Gray & Watson, 2002; Van de Laar, Verbeek, Pevernagie, Aldenkamp, & Overeem, 2010). Recent research from our laboratory implicates self-control as the key common element in these associations. Across series of studies examining both adults and children, we found that higher frequency of both nighttime and daytime sleep problems signals lower levels of trait self-control across a variety of measures, that sleep problems co-occur with everyday self-regulatory failures (e.g., missing bill payments), and that these associations hold across a variety of demographic groups (Krizan & Hisler, 2016). In short, individuals whose sleep is disrupted tend to exhibit less self-control.

Is sleep itself responsible for these associations? Although many factors are certain to play a role, two forms of evidence implicate sleep as the formative factor in differential levels of self-control. First, longitudinal evidence tracking both sleep and self-control over time reveals that ongoing aspects of sleep or their change can shape subsequent levels of person's self-control. Specifically, mounting sleep problems in early childhood predict later behavioral impairments in cognitive control (Friedman, Corley, Hewitt, & Wright, 2009), and the amount of children's sleep predicts teacher-rated self-regulatory difficulties a year later (Krizan & Hisler, 2016). Second, studies assessing the impact of sleep-based interventions often find that sleep changes have downstream consequences with regard to

self-control. Specifically, restricting sleep typically compromises sustained attention and increases restlessness and impulsivity, whereas extending sleep improves cognitive control and compliance with school demands (Fallone, Acebo, Seifer, & Carskadon, 2005; Gruber, Cassoff, Frenette, Wiebe, & Carrier, 2012; Sadeh, Gruber, & Raviv, 2003; for a review, see Turnbull, Reid, & Morton, 2013). Together, these findings implicate optimal sleep as an important factor in shaping individuals' chronic self-regulatory outcomes, starting in childhood. However, besides being associated with general tendencies toward self-control, does sleep predict specific self-regulatory outcomes?

Occupational and Academic Performance

Whether attending school or reporting for work, achievement in these occupational roles takes up most of people's day and is often a central life goal. Effective performance in these settings is directly reliant on self-control, as avoiding procrastination, showing persistence, and choosing appropriate challenges all reflect successful self-regulation (Baumeister et al., 2007).

Research on children's school performance consistently implicates both sleep quality and quantity as central to academic achievement. Young children with sleep disorders routinely underperform in school. One study found that children with significant sleep problems were three times more likely to fail mathematics (de Carvalho et al., 2013). Similarly, among adolescents, both lower sleep quality and quantity predict worse school performance (Titova et al., 2015; Wolfson & Carskadon, 2003).

Sleep also appears to play an important role in how adults perform at work. Note that succeeding at a typical job necessitates not only instrumental self-control (e.g., finishing that project), but also social restraint (e.g., cooperating with others whom one may not like). Regarding the former, sleep is critical for maintaining adequate ability and motivation to work. As a result, sleep loss reduces employee motivation (Baranski, Cian, Esquievie, Pigeau, & Raphael, 1998; Kessler et al., 2011), increases impatience (Swanson et al., 2011), and results in increased work disability, injuries, and absenteeism (Salminen et al., 2010; Salo et al., 2010).

Regarding social restraints, sleep disruption may also compromise willingness and ability to work with others, as well as to comply with organizational procedures. On this score, sleep deprivation increases workplace deviance, namely, tendencies to take inappropriate shortcuts, cheat, or loaf (for a review, see Barnes, Schaubroeck, Huth, & Ghumman, 2011). For example, individuals are more likely to engage in cyberloafing and theft at work when they slept poorly the night before (Christian & Ellis, 2011; Wagner, Barnes, Lim, & Ferris, 2012). In fact, Christian and Ellis (2011) directly implicate self-control as being responsible for these effects of sleep relative to how people do their jobs. Proper sleep therefore seems essential for regulating behavior in the service of crucial academic and occupational goals.

Emotion Regulation

Besides being employed to meet performance goals, self-regulation also guides individuals' emotional lives. Although emotions are useful signals of goal progress, successful goal pursuit often requires intentionally changing initial emotional reactions (Gross, 2008), either because these reactions are subjectively unpleasant and interfering (e.g.,

anxiety) or socially inappropriate (e.g., anger). Sleep is intimately tied to people's emotional lives. Two of the most robust consequences of sleep disruption are increased feelings of negative affect (i.e., tension, irritation, and depression) and decreased feelings of positive affect (i.e., energy, joviality, and enthusiasm) (Caldwell, Caldwell, Brown, & Smith, 2004; Christian & Ellis, 2011; Kahn-Green, Killgore, Kamimori, Balkin, & Killgore, 2007; Kahn-Green, Lipizzi, Conrad, Kamimori, & Killgore, 2006; for a review, see Pilcher & Huffcutt, 1996).

Importantly, the effects of these consequences of sleep loss on our emotional lives seem to reflect compromised emotion regulation strategies. For example, poorer sleep quality directly predicts less successful reappraisal of negative emotional experiences during a laboratory task (Mauss, Troy, & LeBourgeois, 2013). Furthermore, sleep is critical for integrating emotional experiences; those deprived of (especially REM) sleep may show greater sensitivity to negative stimuli and longer perseverance of negative associations (Tempesta et al., 2010; Rosales-Lagarde et al., 2012; Van der Helm et al., 2011).

Supporting these findings, neuroimaging studies show that sleep deprivation undermines functional connectivity between the amygdala and frontal cortex (Killgore, 2013; Yoo, Gujar, Hu, Jolesz, & Walker, 2007). Given that frontoparietal brain areas are crucial to cognitive control, these findings imply worse regulation of emotions following sleep loss (Ochsner & Gross, 2008). Similarly, research on physiological consequences of sleep loss shows less well-regulated responses to stressors (Williams, Cribbet, Rau, Gunn, & Czajkowski, 2013). Together, these findings converge on the conclusion that sleep is a key necessity for maintaining affective functioning and that disrupting it may be especially likely to undermine regulation of emotional impulses (Gruber & Cassoff, 2014).

Behavioral Restraint

Exerting self-control often requires restraining desires, resisting temptations, and ignoring urges in order to achieve what is really important. In fact, the need to restrain a variety of unwanted urges, emotional reactions, and ruminations is critical to self-regulatory outcomes such as school performance and emotional behavior (Baumeister et al., 2007). As a result, sleep is likely to play an influential role in impulsive behavior driven by momentary gratifications.

Note that sleep disruption itself creates such impulses and temptations. First, if one is awake long enough, the need for sleep can become such an overwhelming impulse that it ultimately overtakes any other behavior. The associated fatigue and malaise also represent a powerful impulse toward rest and avoidance of the effort described earlier. Second, sleep loss also increases desire for high-calorie foods. Controlled studies have revealed that partial or total sleep deprivation leads to favoring more unhealthy snacks (e.g., candy) and higher activation of reward- and food-sensitive brain centers in response to calorie-rich foods (Greer, Goldstein, & Walker, 2013; St-Onge, Wolfe, Sy, Schechter, & Hirsch, 2014). This may help explain why insufficient and poor sleep is associated with binge eating and obesity (Trace et al., 2012). In short, sleep loss in itself creates unique powerful impulses that may undermine pursuit of important goals, for example, by creating barriers to maintaining one's fitness or diet.

Sleep disruption compromises how people handle other impulses. Research on sleep and executive cognitive functioning (reviewed earlier) has established that sleep disruption

is associated with problems in response control that involve inhibition (Couyoumdjian et al., 2010; Drummond et al., 2005). This research suggests that sleep problems are likely to hurt our ability to overcome visceral sensations (e.g., ignore pain) or override habitual responses that require monitoring (e.g., leave the door unlocked for the pet sitter despite the daily habit to lock it). In this vein, sleep deprivation increases behavioral pain sensitivity (Finan, Goodin, & Smith, 2013), outbursts of inappropriate laughter and humor (Horne, 1993), tempting violations of personal moral standards (Killgore et al., 2007), and under-controlled expression of racial prejudice (Ghuman & Barnes, 2013). We suggest that sleep disruption is likely to impair our ability to reconsider any initial course of action, yielding downstream effects on a variety of emotional and behavioral responses.

HOW DOES SLEEP IMPACT SELF-REGULATION?

So far, we have demonstrated that sleep plays an indispensable role in people's cognitive and emotional functioning, and that disruption of both sleep quantity and quality undermines self-regulatory outcomes from virtually all domains of human behavior. Earlier on we argued that effortful attention is the common substrate of both executive cognitive functioning and behavioral self-control. We now describe how this attentional deployment is necessary for three essential forms of self-regulatory activities, namely, investing behavioral effort, choosing goals and monitoring their progress, and restraining undesirable urges. These three sets of regulatory processes play an important role in illuminating *how* sleep impacts self-regulatory outcomes described earlier. Moreover, they provide an important theoretical bridge between research on neurocognitive effects of sleep and social-personality psychology theories of self-regulation.

Effort and Persistence

Many of the self-regulatory outcomes reviewed earlier are heavily dependent on sustained effort (e.g., work performance). During task performance of any appreciable difficulty, effortful attention is recruited in service of cognitive or motor performance. Given that sleep undermines optimal use of effortful attention, one key reason why sleep loss impairs self-regulation should involve lowered effort and persistence. In this vein, sleep loss leads students to prefer easier, nonacademic tasks and to spend less time on activities such as dressing neatly and fashionably (Engle-Friedman et al., 2003). Similarly, it leads test-takers to prefer easier rather than more difficult math problems (Engle-Friedman & Riela, 2004) and to engage in wasting more time during work (Hoeksema-van Orden et al., 1998). These choices seem logical because they dovetail with subjective perceptions of increased effort following lost sleep, evident in higher perceptions of difficulty for athletic challenges, physical tasks, and intellectual problems (Engle-Friedman et al., 2010; Rodgers et al., 1995). This impact of sleep on compromised effort and persistence is likely a key contributor to lower work productivity, poorer school performance, and disinhibition that result from sleep loss.

How sleep impacts perceptions and investments of effort in goal pursuit therefore forms an important future line of inquiry regarding self-regulation. Core issues in demand of research attention involve how sleep impacts perceptions of effort relative to behavioral effort investment, to what extent emotional dysregulation following sleep loss

undermines interest or ability in maintaining effortful performance, and to what extent people are willing and able to compensate for these effects when working on important goals.

Setting and Monitoring Goals

Self-regulation necessitates setting goals, choosing means of goal accomplishment, and monitoring effectiveness of those means (i.e., evaluating goal progress). Given the multiplicity of personal goals and ever-shifting situational affordances to satisfy them, choosing appropriate goals and courses of action, and tracking their progress, is one hallmark of successful self-regulation (Carver & Scheier, 1981; Gollwitzer, 1990). Again, we assume these activities involve effortful attention that is directed toward deliberating about personal priorities (e.g., “Should I stay or should I go?”), assessing private experience (e.g., “Do I have enough strength to finish cleaning up?”), tracking features of the social context key to self-regulation (e.g., “Is my boss here?”), and evaluating distance to the goal (e.g., “Does she believe me?”).

An essential aspect of goal setting or choice is how people appraise the *value* and *risk* of different courses of action. People often fail at self-regulation because they underestimate the risk of particular actions, or because some urges seem more important in the moment than they do later. Research that has examined decision making suggests that sleep-deprived individuals are more likely to make risky choices (Hockey, Maule, Clough, & Bdzola, 2000; Killgore, Balkin, & Wesensten, 2006; Killgore, Kamimori, & Balkin, 2011) and to accept more risks when standing to gain additional rewards rather than lose goods already in their possession (McKenna, Dickinson, Orff, & Drummond, 2007). This may be driven by higher expectations of gain during risky decisions (Venkatraman, Chuah, Huettel, & Chee, 2007). Moreover, sleep-deprived individuals seem more likely to discount the value of future rewards, especially when earning them requires effort (Libedinsky et al., 2013; Reynolds & Schiffbauer, 2004). These findings imply that sleep disruption may lead people to take unreasonable risks or forgo important future opportunities.

Tracking goal progress also seems affected. Recent experimental evidence has revealed that sleep deprivation directly impairs decision making that is dependent on incorporation of feedback (Whitney, Hinson, & Jackson, 2015). Moreover, the research on driving when drowsy clearly shows that the vigilance required for adequate driving performance is impaired (Rau, 2005). Finally, research on romantic relationships suggests that poor sleep harms our ability to keep track of important relationship events that signal couple well-being. For example, Gordon and Chen (2014) found that poor sleep undermines both one’s own emotions and the accuracy in evaluating one’s partner’s emotions. Monitoring a partner’s emotional states is critical for sustaining any relationship, and these findings point to the important role of sleep in managing relationship-relevant goals. Collectively, these findings help explain why, when sleep deprived, people may fail to offer a helping hand to a coworker or miss an important meeting (see earlier discussion; Barnes, Schaubroeck, Huth, & Ghumman, 2011).

Overall, this evidence converges on the conclusion that many self-regulatory failures associated with sleep disruption may be partly attributable to failures in choosing or adequately tracking important goals. Theoretical perspectives on motivation and social goal-pursuit behavior raise a number of important questions regarding the role of sleep.

Does sleep affect some basic forms of motivation more than others (e.g., approach vs. avoidance: McNaughton & Gray, 2000; autonomy vs. competence: Deci & Ryan, 1995)? How does sleep disruption affect deliberate versus implementation phases of action (Gollwitzer, 1990)? Is being sleep deprived akin to an attentional myopia that steers us toward whatever goals are the most salient (Mann & Ward, 2007)?

Inhibition and Restraint

Many famous cases of self-control failures involve giving in to one's impulses, be they sexual, violent, or merely gustatory. This occurs amid social norms that require people to exercise personal restraint and alongside personal goals that often involve *not doing* something. Attempts at restraint additionally involve effortful attention aimed at ignoring distractions (e.g., background noise) or discounting conditioned cues (e.g., noise of the game buzzer when a person is not playing). These maneuvers generally require inhibition of visceral urges or habitual responses. Evidence we review here clearly reveals that sleep (1) creates powerful urges that themselves require self-regulation and (2) impairs the ability to inhibit various temptations, be they learned or innate.

First, chronic sleep loss produces a mounting sleep pressure that causes tiredness, fatigue, and ultimately loss of consciousness. Dealing with various levels of sleep pressure under conditions of insufficient rest is both extremely common and very consequential for people's daily lives. Much of evidence we reviewed can be taken as supporting the notion that sleep loss involves an urge to rest (Engle-Friedman, 2014). Moreover, it increases preferences for high-calorie foods, undermining a key target of restraint for the most of us. Unfortunately, restraint in combating these urges created by sleep loss may eventually become impossible given their homeostatic priority.

Second, a part of the critical role that sleep plays in optimal cognitive functioning involves efficient inhibitory processes. A key consequence of sleep disruption is impairment in inhibition of threatening, distracting, or previously conditioned stimuli. Neuroimaging evidence of a frontal-amygdala disconnect following sleep loss (reviewed earlier) is fully consistent with this proposal. This may play an important role in people's ability to inhibit unwanted emotional reactions or behavioral urges such as anger and aggression, or to resist everyday temptations (Hoffman et al., 2012; Krizan & Herlache, in press). Whether sleep differentially affects inhibition of learned versus innate, cognitive versus emotional, and important versus peripheral responses remains to be determined.

WHY DOES SLEEP IMPACT SELF-REGULATION?

Having connected sleep to self-regulation through effortful attention to one's goal-directed behavior, control of goals, and restraint, we conclude with a discussion of broader theoretical issues. We stress two distinct conceptual possibilities for these effects of sleep on self-regulation. First, we consider how the *capacity* for intentionally regulated behavior may be impacted by sleep. Second, we consider how the process of setting goal *priority* may be affected (Figure 11.1). These two possibilities reflect biological imperatives because organisms need not only resources to pursue any goal at all but also means of resolving goal conflicts when they arise. They also reflect contemporary theoretical debates regarding the apparent limits on self-controlled behavior and psychological resources necessary for self-regulation. Critically, we emphasize the dynamic interplay

between capacity and priority, concluding that sleep disruption triggers a variety of *compensatory* responses in order to achieve the most important goals for an organism under conditions of strained resources (Figure 11.1).

Sleep and the Capacity for Regulating Attention and Behavior

Parallel-Processing Capacity

How much activity a person can attend to or engage in at any given moment is limited by a maximal physiological processing capacity (Kahneman, 1973). Due to anatomical limitations, neuronal processing has to contend with a series of “bottlenecks” that require attention to be selective in terms of what people consciously see, hear, or feel. For example, the previously discussed executive cognitive functions seem to rely on a limited storage capacity; under the most challenging circumstances, people can hold only about three to five pieces of information in mind; under the best circumstances, they can hold about seven (Cowan, 2010; Miller, 1956). The extent to which this processing capacity limit reflects physical constraints or neuronal efficiencies is not yet clear, but it does reflect an important limit on the ability to reflect on one’s behavior and revise accordingly. Note that this capacity may become further limited by metabolic resources when people become less able to think as a result of prolonged sleep deprivation or starvation (Keyes, Brozek, Henschel, Mickelsen, & Taylor, 1950).

As we suggested earlier, sleep is essential to maintaining and honing these processing allowances. Evidence we have reviewed clearly establishes that sleep deprivation impairs a variety of self-regulatory outcomes that require attention or working memory, which rely on this processing limit. These effects do not seem to reflect a simple loss of motivation by research volunteers because even highly motivated medical residents have shown reduced working memory capacity during the sleep-deprived periods when they are on-call overnight (Gohar et al., 2009). Whether this results from a general reduction in drive and arousal or selective impairment in higher cortical areas is unclear, but sleep disruption seems to lower the capacity for information processing even when people are highly motivated. However, people can compensate somewhat for these deficits, especially in tasks that are familiar yet afford enough flexibility in how to use the limited mental resources (Hockey, Wastell, & Sauer, 1998). The role of sleep in maintaining processing capacity therefore plays a critical role in self-regulatory processes and is worthy of research focus.

Self-Regulatory Capacity

Besides the amount of information that can be handled at any given moment, there may be another limit on capacity for goal-directed action. The notion of *ego depletion* suggests there are also short-term *temporal* limits on effortful self-regulation (Baumeister et al., 2007; Maranges & Baumeister, Chapter 3, this volume). According to this view, there is a limited resource needed for successful self-regulation and behavioral restraint. When this resource is depleted through cognitive work or self-control, subsequent efforts at self-control are more likely to fail. For example, after exerting themselves to suppress any emotional displays while watching a disturbing film, student participants were less likely to persist on a subsequent problem-solving task that required effort (Baumeister, Bratslavsky, Muraven, & Tice, 1998). Similar effects were found for regulating emotion,

controlling thoughts, sustaining performance, and inhibiting impulsive behavior (for a review, see Hagger, Wood, Stiff, & Chatzisarantis, 2010). From our perspective, this phenomenon reflects apparent limits on deployment of effortful attention. This interpretation is strengthened by the existence of *directed attention fatigue*, a neurological phenomenon that occurs when the brain's inhibitory systems are overworked due to continuous suppression of incoming stimuli competing with a focal task (Navalpakkam & Itti, 2005).

It is not yet clear whether these regulatory decrements truly reflect exhaustive depletion of a regulatory resource or more strategic conservation. First, incentives can lower or even completely eliminate the impact of prior exertion on self-regulatory performance (Muraven & Slessareva, 2003; Vohs, Baumeister, & Schmeichel 2012). In some cases prior self-regulation can even enhance future performance, akin to a learning curve (Converse & DeShon, 2009). Second, so far there is no method to measure directly the purported capacity (a goal that may actually be unattainable). Despite the important role that glucose plays in self-regulation, the available evidence suggest blood glucose levels are not a direct gauge of self-control capacity because the brain constantly requires a large amount of glucose, and the bioavailability of glucose in the organism is sufficiently large and dynamic to preclude a simple correspondence (Beedie & Lane, 2012; Kurzban, 2009).

Finally, there may be competing motivational forces that play a role. There are compelling evolutionary reasons to anticipate that organisms balance task engagement that yields extrinsic rewards (exploitation) with explorations of alternative opportunities (exploration). In this vein, cognitive control (which always involves continued exclusive focusing on one thing over another) may be both inherently aversive and have decreasing utility with use (Botvinick, 2007; Inzlicht, Schmeichel, & Macrae, 2014; Kool, McGuire, Rosen, & Botvinick, 2010). The role sleep plays in these behavioral patterns that is suggestive of limited capacity is unknown given that sleep is typically not assessed in these studies, and sleep deprivation research typically focuses on more specific cognitive or affective variables. To our knowledge, only one experiment manipulated regulatory depletion and sleep deprivation simultaneously (Vohs, Glass, Maddox, & Markman, 2011). These researchers examined aggression (frequently a product of failed self-control) following normal sleep or total sleep deprivation after participants either did or did not suppress their emotional reactions to a film. Despite increased aggression following ego depletion, sleep deprivation in this study did *not* have an effect. Thus, how sleep interacts with potential self-regulatory capacity remains a key avenue for future work, especially regarding individuals' ability to exert continual effort, maintain performance over time, and endure adverse conditions.

Sleep and the Priority of Behavioral Goals

Whereas the capacity to process information, maintain engagement, and suppress unwanted urges has at least some limits that impinge on people's likelihood to self-regulate, their shifting goals, priorities, and motivations are arguably even more important. Whatever the limits, organisms must navigate them in order to maximize their goal achievement in accordance with personal standards and priorities. This process of setting goal *priority* includes both relatively automatic drive tendencies that shift in strength over time (e.g., hunger, fatigue) and conscious, identity-relevant goals that require deliberation, planning, and effortful implementation (e.g., completing the write-up of this chapter).

We argue that the priority of behavioral goals is in a reciprocal dynamic relationship with capacity to regulate behavior. In other words, organisms had to evolve mechanisms to optimize their resources and cope with their absence (Kurzban, Duckworth, Kable, & Myers, 2013). Just as sleep plays a critical role in regulating metabolic resources and processing capacity, it also has a strong effect on goals and behavioral choices. As mentioned earlier, when sleep is sufficiently disturbed, the goals of rest and eventually sleep take the utmost priority. The clearest effects of goal priority shifts following sleep are evident in research documenting withdrawal of effort and loafing (Hoeksema-van Orden, Gaillard, & Buunk, 1998).

What is critical when considering these shifts in choices following sleep deprivation is that they are strategic. Specifically, they suggest a process of *compensation*, in which sleep disruption creates performance impairments, and the organism prioritizes rest and sleep over other (at the time less important) activities by making conscious choices to avoid effort and unnecessary engagement (Freeman, 1932; Laird & Wheeler, 1926). In many cases, however, it is imperative to maintain performance despite sleep loss (e.g., piloting a plane overnight). In these situations, redistributing or investing additional effort seems key.

Important and typically complex tasks that rely on monitoring or planning (i.e., executive functioning) also offer more flexibility to maintain performance. To this end, Hockey (1997) has proposed a compensatory control model that assumes a complex performance system (i.e., the brain) is biased toward maintaining high-priority goals (at the expense of lower-priority goals). This compensation is evident in not only reduced attention to less important aspects of the task, less demanding strategies of processing, but also increased regulatory cost (in terms of strain and sympathetic activation). Accordingly, when sleep deprived and supervising a complex regulatory system (e.g., flying a plane), individuals can maintain overall performance on the primary metric (preventing system faults) but respond more slowly, neglect secondary tasks, and have more interceptive than preventive actions (Hockey et al., 1998). These results indicate extensive flexibility in how people manage performance within complex environments following sleep loss and point to many different compensatory strategies that deserve research attention.

Critically, some efforts to compensate for sleep loss involve very conscious self-regulation; one of the primary ways many of us protect performance following sleep loss is by ingesting psychostimulants (e.g., coffee; Ludden & Wolfson, 2019). Other tactics, such as increasing motor activity (e.g., going for a walk) or physical stimulation (e.g., playing loud music) are also available. All of them reflect deliberate attempts to self-regulate the state of sleepiness (i.e., lower it) and protect other goal pursuits. In short, one main effect of sleep loss is a shift of ongoing priorities and engaging in a variety of compensatory efforts. Together, these tactics include withdrawing from tasks deemed noncritical, prioritizing the most important aspects of performance during complex tasks, and indirectly stimulating oneself to maintain motivation and performance. Such compensation may itself utilize attentional resources. Therefore, sleep disturbance has far-reaching effects on people's goal priorities as they rest rather than work, redouble efforts, or take the shortcut to get it done.

Finally, it is important to note that there is a prevalent lay belief that sleep loss impairs self-control (Vohs et al., 2011). Such belief may itself contribute to negative effects of sleep loss on controlled behavior via *self-licensing*, namely, engaging in tempting yet undesirable behaviors due to a belief that one has earned one's reward. For example, after thinking they have invested more rather than less effort into an experimental task,

participants were more likely to indulge themselves with snacks (Witt Huberts, Evers, & de Ridder, 2012). Broadening this reasoning suggests that people who are aware of their sleep loss and its potential negative effects may view it as a license to avoid effort, indulge themselves, or engage in a variety of unwanted behaviors. This possibility should be carefully considered in future work on sleep and self-control.

Summary

People just cannot do it all; the human organism is unable or unwilling to sustain effortful executive functioning or self-regulation beyond a certain point. Being sleepy enough is one of these breaking points. Although there is seemingly plenty bioavailable energy to continue the required brainwork for most people under normal circumstances, a variety of neurochemical and physiological responses seem to ensure that cognitive and behavioral activities be (at some point) redirected to sleep, less effortful, or more intrinsically rewarding activities. In other words, there is a unique *conservation bias* regarding the use of the more advanced cognitive processing that is key to self-regulation. This bias may stem from a need to maintain general brain receptiveness to incoming stimuli, from lower energy efficiency of cortical areas that drive sophisticated cognitive work, or from some other hemostatic process (Raichle & Gusnard, 2002; Thomasi, Wang, & Volkow, 2013).

Disrupting sleep seems to impose a severe burden on the capacity to self-regulate successfully, likely due to opposing neural inputs driving sleepiness and interfering with waking consciousness, as well as an impaired central arousal mechanism that drives attention and effort. Simultaneously, sleep loss activates a variety of compensatory strategies involving both homeostatic mechanisms and conscious choices that impact priorities of goals that people pursue. All these consequences of sleep disruption also reveal a need to conserve energy resources and protect self-regulatory performance. These compensatory dynamics should form a central focus of future research.

CONCLUSION

People spend one-third of their lives sleeping. This universal activity is essential for human survival, but we have argued that it is also essential for self-regulation. By integrating evidence across multiple disciplines, we have demonstrated that neurocognitive effects of sleep have direct implications for self-regulatory processes, that sleep is a strong predictor of numerous self-regulatory outcomes, and that sleep can illuminate important contemporary debates about capacity for intentional self-regulatory behavior. Without proper sleep, people's ability to restrain themselves does indeed seem to resemble that of a 2-year-old.

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CHAPTER 12

Automatic Self-Regulation

From Habit to Goal Pursuit

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Traditionally, *self-regulation*, or the regulation of one's behavior in the pursuit of personal goals, has been assumed to occur in a consciously controlled fashion, including the willpower needed to overcome one's initial impulsive reactions to stimuli (Mischel, Cantor, & Feldman, 1996; Muraven & Baumeister, 2000). These goal-directed processes of regulation have been contrasted with automatic processes that follow an individual's impulses (e.g., Metcalfe & Mischel, 1999; Muraven & Baumeister, 2000; Strack & Deutsch, 2004). Over the course of about the last three decades, however, accumulated evidence has indicated that much of the goal-directed regulation of cognition and behavior can also occur in an automatic fashion. Here, we use the term *automatic* to refer to the fact that people may engage in regulating their behavior without conscious awareness of the triggers and of the processes guiding their behavior. While other features of automaticity may also apply to self-regulation, they are not the focus of this chapter (for a detailed discussion, see Moors & De Houwer, 2006).

In other words, in this chapter we discuss research suggesting that even complex behaviors in pursuit of a wide range of goals in people's dynamic daily lives can be activated and executed effectively without the need for conscious awareness (e.g., Dijksterhuis & Aarts, 2010; van Gaal & Lamme, 2012; Hassin, 2013). In light of a general crisis of confidence in scientific findings, some of the specific findings on nonconscious processes have recently been questioned in terms of their robustness and reliability (e.g., Doyen, Klein, Pichon, & Cleeremans, 2012; Newell & Shanks, 2014). However, evidence is still accumulating for a wide variety of adaptive and powerful nonconscious influences on human behavior, supporting the original notion of William James (1890) that the largest part of behavior is guided by automatic regulatory processes, saving the resources of humans' limited consciousness for the intervention in urgent and exceptional matters. Here, we use the latest advances in the field of automatic self-regulation to elucidate to some degree how it is possible that our motivated behavior can direct people toward their

goals so effectively, yet do so without their conscious awareness. We illustrate the fundamental processes discussed with research findings from, among other domains, health behavior and interpersonal relationships.

To be sure, there can be no doubt that conscious awareness is often associated with goal pursuit and can be extremely helpful for attaining one's goals. For example, conscious awareness of one's goals, and of the obstacles that keep one from attaining them, allows one to mobilize and integrate one's resources in a novel way; to set out a completely new course of action if needed (Dijksterhuis & Aarts, 2010); or to contemplate, set, pursue, and monitor abstract goals across long periods of time (Baumeister, Masicampo, & Vohs, 2011). Conscious planning has been shown to be useful for goal attainment, even when this requires a course of action that implies a diversion from one's habitual behavior (Gollwitzer & Sheeran, 2006; Holland, Aarts, & Langendam, 2006; Papies, Aarts, & de Vries, 2009). Furthermore, using conscious awareness in an effortful fashion, such as in mindfulness and meditation training, can facilitate self-regulation by strengthening the executive control processes required to support one's goal pursuit effectively, and can reduce the temptation of attractive alternatives for one's long-term goals (e.g., Hasenkamp & Barsalou, 2012; Papies, Barsalou, & Custers, 2012; Papies, Pronk, Keesman, & Barsalou, 2015; Teper & Inzlicht, 2013; van Dillen & Papies, 2015). Despite the important role for consciousness, however, recent developments in the literature suggest that across situations in daily life, people can effectively pursue many of their goals effectively without necessarily having to rely on conscious awareness and control of their behavior.

Approaching self-regulation from this perspective touches on intriguing questions regarding the origin of control over such processes and the role of the "self" as the consciously active agent of regulation (see, e.g., Bargh & Ferguson, 2000; Baumeister, 1998; Baumeister, Schmeichel, & Vohs, 2007). Specifically, whereas people often derive the sense of self-regulation ("It's me who is doing the control") from their conscious experiences of self-agency, recent research suggests that such self-agency experiences can originate in the unconscious and are the result of an inference that occurs fluently and perfunctorily after action performance. Thus, how do conscious experiences of agency relate to the fact that much of the regulation of behavior unfolds outside conscious awareness? We briefly address this issue in the last part of this chapter. In the meantime, however, we treat self-regulation as the regulation of cognition and behavior that occurs within a given individual in the service of goal pursuit.

In this chapter, we examine automatic self-regulation by analyzing the ways in which we can pursue our goals without conscious awareness of the triggers and of the processes involved in the pursuit of the goal at hand. Thus, we start out by examining how goals are represented in order to determine which features of goal representations actually motivate human behavior nonconsciously. Here, we show that both the accessibility of the specific content of the goal and an affective cue signaling its desirability are crucial for triggering nonconscious motivation to pursue the goal. Next, we discuss how goal pursuit can be triggered by environmental cues, then how goal-directed behavior can be performed nonconsciously by addressing the role of habits both for selecting and executing goal-directed actions. We then address how adaptive cognitive processes facilitate and protect goal pursuit in dynamic circumstances. These mechanisms include, among others, the active maintenance, shielding, and monitoring of one's goals, changes in the perception of and attention to goal-relevant stimuli, and evaluative processes, all contributing to

self-regulation without the need for conscious awareness. Finally, we examine how non-conscious self-regulation relates to the experiences of self-agency that accompany much of human behavior and discuss how the desire to feel in control over one's actions deals with instances of nonconscious goal pursuit.

HOW GOALS ARE REPRESENTED

The goals that people pursue in their daily lives can differ widely in their level of abstractness: Whereas socializing or having a slim figure are representations of complex goals whose achievement usually requires a series of behaviors, getting hold of a bottle of water or producing matching symbols on a slot machine are results that can be attained by a simple hand movement or a button press. Across such instances, goals can be conceptualized as mental representations of certain behaviors or outcomes that are desirable to engage in or to attain (Bargh, 1997; Custers & Aarts, 2005; Fishbach & Ferguson, 2007).

Research in several domains of psychology has confirmed the original ideomotor notion of William James and has shown that human actions are represented in the brain in terms of their observable effects, associated with the motor program needed to produce the effect (Hommel, Musseler, Aschersleben, & Prinz, 2001; Jeannerod, 2001; Prinz, 1997; Vallacher & Wegner, 1987). As a consequence, merely thinking about a certain outcome can activate the behavioral program needed to achieve that outcome. In addition, representing actions in terms of their potentially desirable results allows people to direct their behavior by anticipating its effect. This way, goals can serve as the standard and reference point for behavior, ensuring that the ongoing actions actually produce the desired results.

However, not every behavior or outcome that is represented in terms of a result of concrete actions actually operates as a true goal for an individual. An outcome is much more likely to motivate behavior to attain it if it is perceived to be rewarding by the individual. How is the rewarding value of an outcome actually determined, and how is this done in the absence of conscious deliberation? Following the conceptualization of a goal as a desired outcome or behavior, recent research into the underlying mechanisms of non-conscious goal pursuit has focused on the role of positive affective signals as indicators that a given state is worth pursuing (e.g., Custers & Aarts, 2005; Ferguson, 2007; see also Förster, Liberman, & Friedman, 2007).

Affective signals play a fundamental role in directing human behavior and are processed quickly, without the need for conscious awareness upon perception of a stimulus (Chen & Bargh, 1999; Damasio, 1994; Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Zajonc, 1980). Positive affect has been shown to play a central role in incentive learning and the neural mechanisms involved in reward processing and motivation (see Berridge, 2007), suggesting that positive affective signals may be crucial for conveying information about the desirability and therefore the motivational value of a potential goal state. We conceptualize a goal, therefore, as consisting of the cognitive representation of an outcome or behavior that can serve as a reference point for one's actions, coupled with a signal of positive affect that indicates that this reference point is desirable to attain. In other words, the positive affective signal turns a behavior representation into a goal representation and helps to recruit resources toward actually pursuing it when the goal is activated.

ACTIVATING GOAL REPRESENTATIONS AND GOAL-DIRECTED BEHAVIOR BY EXTERNAL CUES

An abundance of empirical evidence shows that activating a behavior representation that is associated with positive affect can indeed lead to goal-directed behavior. In one of the first series of studies on this topic, Bargh, Gollwitzer, Lee-Chai, Barndollar, and Troetschel (2001) subtly activated the goal of achievement, which is assumed to be positive for university students, by asking student participants to solve word puzzles in which words related to achievement (e.g., *strive*, *succeed*) were included or not, without drawing participants' attention to it. They observed that these participants later displayed more motivated behavior to perform well on an intellectual task than control participants. Fitzsimons and Bargh (2003) and Shah (2003) later showed that the motivation to achieve could also be triggered when participants were primed with the name of a significant other who was strongly associated with the goal of doing well in college, such as one's mother or father (see also Kraus & Chen, 2009). Other studies have confirmed that a variety of social cues, such as the names of attachment figures, the goal-directed behavior of other people, the experience of social exclusion, names and exemplars of social categories, religious cues, or cues related to power or to mastery, can function as primes to trigger motivated behavior in participants (e.g., Aarts, Chartrand, et al., 2005; Aarts, Gollwitzer, & Hassin, 2004; Custers, Maas, Wildenbeest, & Aarts, 2008; Galinsky, Gruenfeld, & Magee, 2003; Gillath et al., 2006; Lakin, Chartrand, & Arkin, 2008; Moskowitz, Gollwitzer, Wasel, & Schaal, 1999; Moskowitz & Ignarri, 2009; Randolph-Seng & Nielsen, 2007; Stajkovic, Locke, & Blair, 2006; Thompson & Musket, 2005), even in children (e.g., Over & Carpenter, 2009a, 2009b).

Other studies have examined whether goal-directed behavior is more likely to result from an external cue when the activated goal state is relatively more positive. In one set of studies, Ferguson (2007) measured participants' implicit affective responses toward potential goals, for example, the goal of being thin, and found that participants who valued this goal relatively more strongly than other participants displayed more goal-directed behavior toward it, such as resisting high-fat food in daily life and consuming less fattening food in a taste test in the laboratory.

Extending these findings, a series of recent field experiments has shown that mere activation of the goal of being thin leads diet-motivated participants to consume less high-fat food and to buy fewer unhealthy snacks in a grocery store, whereas it does not affect control participants who are less motivated to watch their weight and presumably associate less positive affect with the concept of dieting (Papies & Hamstra, 2010; Papies, Potjes, Keesman, Schwinghammer, & van Koningsbruggen, 2014; Papies & Veling, 2013). In one study, for example, participants who entered a grocery store were handed either a flyer that contained words related to the goal of dieting or a control flyer. After they finished grocery shopping, their purchases of unhealthy snack foods were assessed, together with a number of control variables. Results showed that overweight participants, for whom dieting is more likely to be a desirable behavior, bought fewer unhealthy snacks when the dieting goal had been activated by the flyer they received, while normal-weight participants were not affected. Importantly, although some participants were more likely to think about the flyer than others, this did not moderate the effects of the exposure to the goal-related cues, suggesting that no conscious awareness was necessary for the goal cues to trigger goal-directed action (Papies et al., 2014).

In studies that manipulated rather than measured whether a behavior is represented as desirable for a person, Custers and Aarts (2005) showed that the exposure to a behavioral state that is initially neutral can trigger motivated behavior, but only when it is unobtrusively coupled with positive affect, for example, through an evaluative conditioning procedure. Finally, a study building on these findings (Aarts, Custers, & Marien, 2008) directly demonstrated that actual goal-directed behavior requires the motivating power of positive affective signals rather than merely relying on the ideomotor principle of triggering a behavior by means of the common code for the results of one's action and their motor programs (Hommel et al., 2001; Jeannerod, 2001). Here, words related to the concept of exertion (e.g., *exert*, *vigor*) were paired with positive words or with neutral words. Subsequently, participants were given a handgrip and instructed to squeeze it in response to a cue they saw on the computer screen. Participants who had been exposed to the concept of exertion started squeezing the handgrip earlier than participants who had not been exposed to this concept, suggesting that exposure to the concept of exertion prepared the associated motor program to implement motor behavior upon request. However, participants for whom the concept of exertion had been paired with positive affect also displayed motivated behavior in terms of increased effort: They exerted more force than the other participants when squeezing the handgrip. This additional effect of positive affective signals shows that outside participants' awareness, positive affect served to motivate participants, so that they put additional effort into their behavior, going beyond the mere activation of a neutral end state (see also Takarada & Nozaki, 2014, for a replication).

In summary, the broad array of studies on external cues affecting motivated behavior shows that to the degree to which a goal is desirable, and thus associated with positive affect, external goal-related cues not only activate the mental representations of outcomes but also trigger actual motivation. Thus, when a behavioral state is represented as actually being desired, activating it by means of external cues triggers the motivation to pursue it as a goal.

THE ROLE OF HABITS IN SELECTING GOAL-DIRECTED BEHAVIOR

In addition to being represented as outcomes or behaviors that are associated with positive affect, goals are embedded in knowledge structures containing goal-relevant information, which are crucial for automatic self-regulation. Indeed, when activating a goal in social psychological studies, researchers most likely do not prime a single concept, but rather a rich conceptual structure containing, among others, behavioral, motor, affective, and interactional information (Bargh, 2006). In other words, goal representations—like other representations in human memory—are situated, based on an individual's earlier experiences (Papies & Barsalou, 2015; see also Barsalou, 2003). Thus, these knowledge structures also include situational and contextual cues indicating opportunities and means for goal pursuit (Aarts & Dijksterhuis, 2000; Austin & Vancouver, 1996; Bargh, 1990, 1997; Bargh & Gollwitzer, 1994; Cooper & Shallice, 2006; Kruglanski et al., 2002). For example, the goal of socializing can be mentally associated with contextual cues (e.g., bars) and with behaviors (e.g., buying a round of drinks; Sheeran et al., 2005), and a delicious chocolate cake can be associated with social events (e.g., birthday parties; Papies, 2013) and the goal of hedonic enjoyment, or, conversely, the goal of following a

diet and consequently, with the behaviors of approaching it or of rejecting it in favor of healthier alternatives (e.g., Bargh et al., 2001; Fishbach, Friedman, & Kruglanski, 2003; Papies & Barsalou, 2015; Papies, Stroebe, & Aarts, 2007, 2008b).

These knowledge structures containing environmental cues, goal representations, and means and procedures for goal pursuit are crucial for automatic self-regulation because they enable people to pursue goals nonconsciously and without the need for deliberation. Repeatedly pursuing a goal in a given context via a certain course of behavior forges a strong cognitive link between the goal representation and the representation of this behavior. When the goal later becomes activated again in the same context, this can automatically lead to the activation of the habitual means for goal pursuit. Thus, automatic self-regulation heavily relies on habits, which have been defined as goal-directed behaviors and can be triggered by contextual cues (Aarts & Dijksterhuis, 2000). This way, for example, rather than having to think deliberately every day about how to get to work in the morning, people automatically grab the car keys or get on their bikes, based on what they have done before, in a similar situation.

The important role of habits in automatic self-regulation has received empirical support in a number of studies, for example, in the domain of personal transport during one's daily activities (e.g., Aarts & Dijksterhuis, 2000). Here, priming participants with certain destinations in the context of going there (e.g., going to a lecture, going shopping) triggered the activation of certain means for personal transport (e.g., biking). However, this effect occurred only among those participants who habitually used that means of transport (i.e., bicycle) to reach their personal transport goals during their daily activities. Similarly, words denoting potential locations for running have been shown to prime the activity of running, but only among participants who habitually run as a form of exercise (Neal, Wood, Labrecque, & Lally, 2012). In the domain of the habitual drinking of alcohol among students in the United Kingdom (Sheeran et al., 2005), activating the goal of socializing increased accessibility of the concept of drinking, but only among those student participants who were regular drinkers of alcohol in social situations. In addition, after a socializing prime, these students were more likely to choose a voucher for alcohol than for coffee or tea as a reward for their participation in the experiment. Finally, a large number of studies examining behaviors that are performed frequently in one's daily life and in stable contexts, such as purchasing food, physical exercise, or seat belt use, have shown that the performance of these behaviors is to a large degree predicted by the strength of one's habits toward them (e.g., Ouellette & Wood, 1998; van't Riet, Sijtsma, Dagevos, & de Bruijn, 2011; Wood, Tam, & Wit, 2005).

At the same time, conscious intentions have also been found to be predictive of such behaviors. In other words, some part of human behavior is under conscious control, but habits can take over if they are sufficiently strong (e.g., Danner, Aarts, & de Vries, 2008; Norman, Armitage, & Quigley, 2007; Ouellette & Wood, 1998). Indeed, research on the interplay between habits and intentions has shown that intentions are predictive of behavior when habits are weak—for example, because the behavior is not performed frequently or is performed in a variable context—but they do not predict behavior when habits are strong (i.e., when behavior is performed frequently in a stable context; Danner et al., 2008; Norman & Conner, 2006; Ouellette & Wood, 1998; Verplanken, Aarts, van Knippenberg, & Moonen, 1998; Wood et al., 2005). Thus, as a goal-directed behavior is executed more frequently in a stable context and increases in habit strength, conscious intentions tend to become less influential in guiding it.

One can easily imagine that habits can have beneficial effects in daily life, as was predicted early on by William James, who emphasized the important role of habits for freeing up mental capacities for processes that require conscious awareness (James, 1890). Recent work indeed points to such benefits, such that habits mediate the effects of self-control on a number of positive outcome measures such as eating healthy, exercising, and studying, and are associated with high experienced automaticity of these behaviors (e.g., Galla & Duckworth, 2015). In other words, individuals with high self-control are good at achieving their behavioral goals because they can rely on good habits that make choosing goal-directed behaviors less effortful. Similarly, recent work has shown that habits can lead to beneficial outcomes (e.g., eating a healthy breakfast) even when a person's self-control resources are temporarily low (e.g., due to a stressful week of examinations) because the habitual behavior is triggered automatically (Neal, Wood, & Drolet, 2013). At the same time, strong habits can make it difficult to change one's behavior because contextual cues keep triggering one's habitual courses of action despite conscious intentions to do otherwise. Indeed, in a meta-analysis of behavior change studies, behaviors that are susceptible to habit formation are much less likely to be changed by means of conscious intentions than behaviors that are less susceptible to habit formation (Webb & Sheeran, 2006). Thus, habits play an important role in nonconscious self-regulation, by allowing for the instigation of goal-directed behavior without the need for conscious deliberation, but also by limiting the effectiveness of intentions for behavior change.

THE ROLE OF HABITS IN EXECUTING GOAL-DIRECTED BEHAVIOR

Goal-directed habits are crucial also for the efficient execution of behavior, which relies on the routinization of skills. At the lowest level of analysis, habits can be regarded as stimulus–response links that are established and reinforced by rewards that follow certain responses to a stimulus. If, for example, one feels refreshed after drinking a glass of water on a hot day, the sight of a glass of water may later evoke the action of grabbing it in order to drink. Eventually, when a behavior has repeatedly and successfully been executed in response to a certain stimulus and the stimulus–response association has become well-ingrained in procedural memory, the perception of the stimulus may automatically trigger the execution of the associated behavior. In other words, once the habit is sufficiently strong, it can operate independently of the reward that initially served to reinforce the link between the stimulus and the response (Dickinson, Balleine, Watt, Gonzales, & Boakes, 1995). This enables the efficient performance of instrumental actions in a similar context later on, without the need for conscious awareness and intentions (see also Wood & Neal, 2007).

However, not all behaviors can be executed successfully by such single responses to certain stimuli. A more complex behavior may require skills that consist of several sequential responses, with one response triggering the next in an effortless fashion, and often in highly dynamic circumstances (Aarts & Custers, 2009; Cooper & Shallice, 2006). Researchers have suggested that habitual behavior then operates via a feedback control system, in which one's actions can be adjusted in an ongoing manner. More specifically, the sensory and perceptual result of one action forms the input for the next one, thereby allowing for constant adjustments and efficient regulation of skillful actions in changing circumstances (e.g., Fournieret & Jeannerod, 1998; Frith, Blakemore, & Wolpert, 2000;

Powers, 1973). When driving one's car, for example, the required behavior is largely the same every time one takes the usual route to work. Still, slightly different actions are needed on different occasions, such as when the traffic light is red instead of green, when there is a slow car in front, or a steady side wind requires adjusting one's steering wheel. Such adjustments of one's habitual behavior can be made in a nonconscious manner by monitoring the results of one's actions and using perceptual feedback to fine-tune the execution of the necessary skills and responses (Aarts & Custers, 2009; Bargh & Ferguson, 2000). Thus, once a course of action is triggered to reach a certain goal, the execution of habitual goal-directed behavior is monitored and adjusted by nonconscious processes of self-regulation, so that the same goals can be attained under different circumstances.

In summary, habits are crucial mechanisms for navigating complex and challenging environments in which most people live because they allow for the efficient selection of goal-directed behaviors once a goal has been activated and then ensure the smooth execution of behavior to attain the goal.

ADAPTIVE COGNITIVE PROCESSES SUPPORTING AUTOMATIC SELF-REGULATION

Thus far, we have discussed how goals are represented, how they can be activated by external cues, and how pursuit of them often relies on habits that have been established by previous instances of successfully pursuing the goal in a similar context. Sometimes, however, successful self-regulation cannot rely on past behavior, or the pursuit of a goal has to be postponed, shielded from distractions or from tempting alternatives, or monitored over an extended period of time. Recent research has identified how adaptive perceptual and cognitive processes support self-regulation in those circumstances without the need for conscious awareness, specifically by following the principles of executive control (Aarts & Hassin, 2005; Bargh, 2005; Dijksterhuis & Aarts, 2010; Hassin, Aarts, Eitam, Custers, & Kleiman, 2009; Miller & Cohen, 2001). We briefly discuss these processes next.

Research on working memory processes has revealed that adaptive cognition and behavior benefit from three essential functions of the so-called "workspace of the mind": (1) the active maintenance of relevant information, (2) the allocation of attention to task-relevant information and inhibition of task-irrelevant information, and (3) the processes of monitoring and feedback processing (Hassin et al., 2009; Miller & Cohen, 2001; Miyake & Shah, 1999). Such processes also seem to play a role in automatic self-regulation. However, automatic self-regulation also benefits from other adaptive processes in perception and evaluation, which further support the efficient pursuit of goals in dynamic circumstances. In the next section, then, we discuss research that has shown, for example, that the activation of a goal leads to the active maintenance of this goal in mind, to perceiving one's environment in goal-congruent ways, and to the nonconscious monitoring of relevant processes in the service of goal pursuit.

Once a goal is activated, its representation in working memory is likely to be kept cognitively accessible, in order to facilitate goal pursuit once a suitable opportunity arises. In several studies it has been shown that exposure to cues that activate goals in an individual's mind causes sustained activation of that goal, even in relatively long windows (several minutes) between the moment of goal activation and measuring its operation (Aarts et al., 2004; Bargh et al., 2001; Fishbach et al., 2003; Papies et al., 2014). Crucially, such

sustained activation distinguishes the processing of goals from mere semantic knowledge, which remains active for only a short period, then quickly dissipates (Atkinson & Birch, 1970; Higgins, Bargh, & Lombardi, 1985; Srull & Wyer, 1979). One can easily see why it would be beneficial to keep mentally active over an extended period of time the representation of a goal that has motivational, rewarding significance: Even when goal pursuit is not immediately possible, this allows one to monitor one's environment for new opportunities and grab them once they arise, thus increasing the chances for goal attainment.

Automatic self-regulation further benefits from processes of perception and attention in line with one's goal pursuit. Fundamental research on visual perception, for example, has shown that how we perceive our physical environment depends on our current goals and the state of our body. Thus, a hill seems steeper to us when we have less resources available for climbing it, presumably in order to make smart decisions on how to spend these resources (Proffitt, 2006; Schnall, Zadra, & Proffitt, 2010). Goal-instrumental objects are perceived as larger in size when the relevant goal has been activated, presumably in order to increase the likelihood of acting on them (e.g., van Koningsbruggen, Stroebe, & Aarts, 2011; Velkamp, Aarts, & Custers, 2008). Similarly, active goals can make ambiguous stimuli seem more goal-congruent, such that, for example, a half-smile is perceived as friendlier and other people are perceived as physically closer when one is motivated to experience social connectedness (Bélanger, Kruglanski, Chen, & Orehek, 2014; Pitts, Wilson, & Hugenberg, 2014; see also Balcetis & Dunning, 2006). In addition, goal-relevant stimuli attract increased visual attention (e.g., dieters look longer at highly desirable food words than at other stimuli; Papies, Stroebe, & Aarts, 2008a; see also Moskowitz, 2002; Raymond & O'Brien, 2009). Without the involvement of conscious awareness, such effects on perceptual and attentional processes support automatic self-regulation by making it more likely that an individual will effectively detect and use goal-relevant means and opportunities in the environment.

Similar effects on the automatic evaluation of goal-relevant stimuli further support automatic self-regulation. When pursuing a goal (e.g., quenching one's thirst), even when this happens nonconsciously, objects that might facilitate this pursuit (e.g., water) are evaluated more positively compared to when one is not pursuing that goal and compared to less relevant objects (e.g., coffee; Ferguson, 2008; Ferguson & Bargh, 2004). Conversely, stimuli that might interfere with one's goals are processed less positively. In the domain of interpersonal relations, for example, individuals who are committed to an ongoing romantic relationship derogate the attractiveness of potential alternative partners, pay less attention to them, and also implicitly represent these potential mates as less attractive, thereby protecting their current commitment (Karremans, Dotsch, & Corneille, 2011; Maner, Gailliot, & Miller, 2009; Meyer, Berkman, Karremans, & Lieberman, 2011; Miller, 1997; Ritter, Karremans, & van Schie, 2010). However, while these processes may occur nonconsciously, they nonetheless require cognitive resources, as they only occur when enough resources are available or when individuals are high in executive control (Meyer et al., 2011; Pronk, Karremans, & Wigboldus, 2011; Ritter et al., 2010; see also Bélanger et al., 2014).

Effective goal pursuit also benefits from inhibition mechanisms that shield one's focal goal from distractions, such as attractive opportunities for pursuing alternative goals. Shah, Friedman, and Kruglanski (2002), for example, showed that exposing participants to cues that activate a personal goal (e.g., studying) led to the inhibition of an alternative goal that could not be pursued at the same time (e.g., socializing; for similar

findings, see Fishbach et al., 2003; Papies et al., 2008b). Similarly, once a goal has been attained, goal-related information is no longer relevant and is inhibited in order to prevent interference with other processes (see Förster et al., 2007). Finally, in support of nonconscious monitoring processes during goal pursuit, it has been shown that participants who are chronically working on a certain goal (e.g., the goal of looking neat) spontaneously activate actions to reach this goal (e.g., ironing) when it appears necessary (i.e., when they are confronted with a situation that is discrepant with that goal, for example, wearing a wrinkled shirt; Custers & Aarts, 2007a; see also Fournier et al., 1998; Hassin, Bargh, Engell, & McCulloch, 2009).

In summary, a variety of cognitive processes, ranging from perception, attention, and inhibition to evaluation and feedback processing, support automatic self-regulation in dynamic circumstances even when people are not consciously aware of the goals they are currently pursuing. This suggests that the mere activation of a goal instigates executive control processes, presumably because they are recruited for the maintenance and possible pursuit of the goal (Hassin, Aarts, et al., 2009; Marien, Custers, Hassin, & Aarts, 2012; Masicampo & Baumeister, 2011; Megías et al., 2015; Shah & Kruglanski, 2002; Soto, Mäntylä, & Silvanto, 2011). Importantly, however, these processes are not “free” and effortless, as they do require mental resources. Accordingly, while contemporary social cognition research often assumes that nonconscious processes are efficient and do not claim mental resources, the findings of studies cited here suggest that engaging in automatic self-regulation does have costs. Specifically, the execution of the processes described earlier renders them less available for other tasks (e.g., Marien et al., 2012) and is compromised by potential lack of resources (e.g., Meyer et al., 2011; Ritter et al., 2010). These mechanisms supporting automatic self-regulation therefore represent a class of mental processes in which awareness and mobilization of effort do not necessarily go hand in hand (Aarts, 2007; Badgaiyan, 2000; Hassin, Aarts, et al., 2009; Lau, Rogers, Haggard, & Passingham, 2004). This concurs with recent views suggesting that consciousness and attention are distinct faculties (Dijksterhuis & Aarts, 2010; Koch & Tsuchiya, 2007; Lamme, 2003). Importantly, although it seems likely that nonconscious and conscious processes involved in self-regulation both operate on a platform that uses mental resources, it is currently unknown how much this platform shows overlap between unconscious and conscious self-regulatory processes, and whether the amount of resources needed to work on this platform differs between the two types of regulation. These are key questions for future research to advance the understanding and examination of the human capacity to regulate and pursue goals in daily life.

THE SENSE OF AGENCY IN AUTOMATIC SELF-REGULATION

Up to now we have discussed how people can regulate their goal pursuit outside of conscious awareness. However, the idea that goal pursuits materialize unconsciously is not without problems and may even sound counterintuitive. After all, the actions people conduct and the outcomes that these actions produce are often accompanied by conscious experiences of self-agency. This experience of self-agency (i.e., the feeling that one causes one's own actions and their outcomes) has an intimate relationship with self-awareness and constitutes an important building block for our concept of free choice and the belief that behavior is governed by “consciousness” or some other type of inner agent, such as

“the will” or “the self.” How, then, can we reconcile the finding that much of human behavior unfolds and is regulated outside of conscious awareness with the fact that people have those pervasive agency experiences?

One way to address this issue is by arguing that nonconscious goals do not reach self-agency experiences; hence, self-agency only emerges from intentional action: People consciously intend to produce a specific action or outcome, and when the perception of the action or outcome corresponds with this intention, they feel self-agency (e.g., Bandura, 1986; Carver & Scheier, 1981; Deci & Ryan, 1985). In this view, experiences of self-agency would be the obvious result of consciously forming and pursuing one's goals. Although the establishment of self-agency resulting from intentional action requires specific mechanisms that have been elucidated only recently, research adopting this perspective has shown that the processing of self-agency draws on a variety of authorship indicators (Wegner & Sparrow, 2004), such as direct bodily feedback (e.g., Gandevia & Burke, 1992; Georgieff & Jeannerod, 1998), direct bodily feedforward signals known as *effference copies* (e.g., Blakemore & Frith, 2003; Blakemore, Wolpert, & Frith, 2002), and other indirect feedback derived from the external world (e.g., Daprati et al., 1997). In essence, these signals all provide a person with information about the intended outcome of his or her actions.

However, while dismissing the possibility that self-agency does not involve and ensue from nonconscious goal-directed processes may be one strategy to solve the fundamental issue of how we establish a sense of personal authorship, recent research offers a somewhat different perspective. This research argues that our conscious experience of self-agency is an inference that occurs fluently and perfunctorily after action performance (Prinz, 2003; Wegner, 2002). This inferential character of experiences of self-agency has become apparent in a large number of recent studies (Aarts, Custers, & Wegner, 2005; Aarts, Oikawa, & Oikawa, 2010; Belayachi & Van der Linden, 2010; Custers, Aarts, Oikawa, & Elliot, 2009; Dannenberg, Förster, & Jostmann, 2012; Desantis, Roussel, & Waszak, 2011; Dijksterhuis, Preston, Wegner, & Aarts, 2008; Jones, de-Wit, Fernyhough, & Meins, 2008; Moore, Wegner, & Haggard, 2009; Ruys & Aarts, 2012; Sato & Yasuda, 2005; van der Weiden, Aarts, & Ruys, 2013; Wegner & Wheatley, 1999), demonstrating that agency experiences are the result of a match between the outcome of an action and knowledge about the outcome that was active just prior to its occurrence.

In one study showing this effect (Aarts, Custers, et al., 2005), participants and the computer each moved a single gray square in opposite directions on a rectangular path consisting of eight white tiles. Participants could press a key to stop the rapid movement of the squares, which would turn one of the eight tiles black. From a participant's perspective, this black tile could represent the location of either his or her square or the computer's square at the time he or she pressed the stop key. Thus, the participant or the computer could have caused the square to stop on the final position (outcome), rendering the exclusivity of causes of outcomes ambiguous (Wegner & Wheatley, 1999). In fact, however, the computer always determined the stops, so actual control was absent. In this task, participants either consciously set the intention to stop on a specific position, or they were subliminally primed with that position just before they saw the presented stop on the corresponding location. To measure experiences of self-agency, participants then rated the extent to which they felt they caused the square to stop. Results showed that both intention and priming led to an increased sense of self-agency, suggesting that online self-agency experiences were primarily based on a match between preactivated and actual

outcomes, irrespective of whether the source of this activation was a conscious intention or an unconscious prime. This, together with other findings, indicates that agency experiences not only arise from conscious goals, but they also accompany the unconscious activation of goal representations. This, in turn, can lead people to believe that the outcomes of their behaviors were consciously intended, whereas, in fact, they were influenced by cues in the environment without being aware of it.

It is important to emphasize that considering oneself to be the cause of one's own actions and the resulting outcomes is not necessarily illusory, as desired outcome representations (i.e., goals) that are activated outside awareness are also more likely to guide the actions that produce that outcome than when these representations are not activated (Aarts et al., 2004; Bargh et al., 2001; Custers & Aarts, 2007b). If, for instance, you want another person to like you, this changes your behavior toward that person in the service of the given goal, even though you may not be aware of the goal and the effects of pursuing it. Hence, self-agency and nonconscious goal pursuit may go hand in hand given that nonconscious activation of goals promotes both goal attainment and agency experiences. As a result, agency experiences in such situations may not be deceptive but are instead an accurate assessment of the source that produced the outcome. Thus, whereas the experience of self-agency can be a guess, sometimes this guess is right. In that case, experiences of self-agency may serve humans well because they can help to identify the results of one's actions in social situations when one lacks conscious knowledge of producing them. More importantly, the experience of agency, deriving from either conscious intentions or nonconscious goals, is a crucial source for people's general belief that they can and do influence their own behavior, which has been shown to be associated with increased health and well-being (e.g., Taylor & Brown, 1988).

In addition, the belief that they have control over their behavior and its outcomes can also motivate people to look ahead and to consciously plan their actions. As discussed earlier, this can be beneficial for self-regulation in many circumstances, for example, when a situation demands a completely new course of action, when previous goal-directed actions were obstructed, or when long-term efforts are required. Action planning can then facilitate goal achievement by creating new action representations that include sensorimotor information regarding one's future behavior, as well as information about situational cues that can serve to initiate and guide behavior without much conscious thought (e.g., Gollwitzer & Sheeran, 2006; Papies et al., 2009). Indeed, without repeatedly experiencing a sense of control over important outcomes, people may be much less likely to see the point of reverting to such an effortful means of directing their behavior, which can clearly help successful goal pursuit. Future research may increase our understanding of how conscious planning can interact with automatic self-regulation, and provide demonstrations of how such knowledge can be applied to enhancing self-regulation in important domains such as health behavior (see also Papies et al., 2015).

SUMMARY AND CONCLUSIONS

In this chapter we have examined automatic self-regulation by analyzing the cognitive processes that allow people to pursue their goals in daily life without relying on conscious awareness. We have seen that goals can be conceptualized as mental representations of outcomes or behaviors that are associated with positive affect and can be activated by

external cues. Goals are embedded in rich knowledge structures that include contexts for pursuing the goals, as well as effective means and procedures for goal pursuit, all based on an individual's earlier experiences. To the degree that they have been automatized as habits by frequent past performance, goal-directed actions can be triggered once a goal is activated, and they support effective goal pursuit, independent of conscious intentions. We have further seen how automatic processes of attention, perception, evaluation, and executive control support automatic self-regulation by ensuring privileged processing of goal-relevant information and making sure that people recognize opportunities to pursue their current goals. Finally, we have examined the occurrence of experiences of self-agency with regard to behaviors that are produced by automatic processes of self-regulation. Specifically, although people often experience agency concerning their own behavior, these experiences might emerge from performing and observing actions and the results they produce, rather than reflecting the actual cause of the mechanisms driving goal-directed actions.

Together, the processes of automatic self-regulation that we have discussed in this chapter elucidate how people can function so effectively in their dynamic living environments: the pursuit of many daily-life goals, such as socializing, traveling to work, or eating healthy, or can be "outsourced" to processes that do not require conscious awareness. This way, humans can focus on less ordinary endeavors, such as finding a romantic partner, writing an article, or cooking a Thanksgiving dinner. While the processes that support this automatic self-regulation often let people perceive the world in a somewhat inaccurate and biased way, they are functional, for example, in that they increase the likelihood of people detecting and acting on good opportunities. A potential downside of automatic self-regulation may be that habits make people conservative: Once a habit has developed, changing it by means of conscious intentions becomes increasingly difficult, even if the habitual behavior has become undesirable. When sufficient resources are available, however, conscious processes can intervene to change behavior, so that ultimately self-regulation can be automatized again in new, desirable ways.

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CHAPTER 13

Planning Promotes Goal Striving

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Determining the factors that promote successful goal striving is one of the fundamental questions studied by self-regulation and motivation researchers (for a review, see Gollwitzer & Oettingen, 2012). A number of theories and supporting empirical data suggest that the type of goal chosen and the strength of the commitment to that goal are important determinants of whether an individual carries out the behaviors necessary for goal attainment (e.g., Ajzen, 1991; Bandura, 1977; Carver & Scheier, 1998; Locke & Latham, 1990, 2013). In these models, choosing or accepting a goal or standard is the central act of will in the pursuit of goals. We agree with this contention but argue that a further act of will can greatly facilitate goal attainment, in particular, when goal striving is confronted with problems of implementation. Such an act of will takes the form of making a plan that specifies when, where, and how a goal-directed response is to be enacted. More specifically, the person self-regulates by making an if-then plan, forming an implementation intention that specifies an anticipated opportunity or obstacle and links it to a goal-directed response.

Accordingly, Gollwitzer (1993, 1999) has proposed a distinction between goal intentions and implementation intentions. Goal intentions have the structure of “I intend to reach Z!”, whereby Z may relate to a certain outcome or behavior to which the individual feels committed. In contrast, implementation intentions have the structure of “If situation X is encountered, then I will perform the goal-directed response Y!” Whereas goal intentions merely specify desired end states (“I want to achieve goal X!”), the if-component of an implementation intention specifies when and where one wants to act on the given goal, and the then-component of the plan specifies how this will be done. Implementation intentions therefore delegate control over the initiation of the intended goal-directed response to a critical situational cue by creating a strong associative link between this cue and the respective goal-directed response.

Empirical data collected in experimental laboratory and field studies support the assumption that implementation intentions help close the gap between wanting to attain a goal and actually attaining it. This positive effect on goal attainment has been observed

for goals related to various domains of life: the consumer world, academic achievement, environmental protection, health concerns, and goals related to being more egalitarian in judging others or showing prosocial behaviors. It also does not seem to matter whether these goals have been assigned by others or whether people came up with them by themselves. A meta-analysis published in 2006 based on close to 100 implementation intention studies showed a medium-to-large effect on increased rate of goal attainment ($d = 0.61$; Gollwitzer & Sheeran, 2006). There are also more recent meta-analyses focusing exclusively on the health goals of eating a healthy diet (Adriaanse, Vinkers, de Ridder, Hox, & de Wit, 2011) and engaging in physical activity (Belanger-Gravel, Godin, & Amireault, 2013), as well as the improvement of people's prospective memory performance (Chen et al., 2015).

EFFECTIVELY COPING WITH THE CHALLENGES OF GOAL PURSUIT

People can use implementation intentions to deal effectively with the major challenges of goal striving (Gollwitzer, 2014). Forming implementation intentions has been demonstrated to facilitate getting started, to protect an ongoing goal pursuit from disruptions, to disengage readily from ineffective means and unattainable goals, and to pursue the focal goal without getting exhausted. Implementation intentions were found to help individuals to *get started* with goal striving in terms of remembering to act. Extensive research using experimental task paradigms common in the analysis of prospective memory found that if-then plans do enhance memory to enact one's intentions at a certain point in time or event in the future. An enhancement of prospective memory performance is also observed with all kinds of real-life tasks, such as taking medication on time, taking flu shots, or casting one's vote. Implementation intentions also help action initiation, for example, in terms of overcoming an initial reluctance to act with respect to obtaining a mammography, undertaking a testicular self-examination, performing cervical or colorectal cancer screening, and resuming activity after joint replacement surgery. Moreover, people starting to eat a low-fat diet, recycle, engage in more physical exercise, use public transportation rather than one's own car, and purchase organically produced food were all found to benefit from having formed respective implementation intentions.

Goals such as eating a low-fat diet and engaging in regular physical exercise cannot be accomplished by a simple, discrete, one-shot action because they require that people keep striving over an extended period of time. The needed *staying on track* may become very difficult when certain internal stimuli (e.g., being anxious, tired, and overburdened) or external stimuli (e.g., temptations and distractions) interfere with the ongoing goal pursuit. With respect to shielding an ongoing goal pursuit from disruptive internal stimuli, implementation intentions were found to be effective with respect to performance anxiety in sports (e.g., Stern, Cole, Gollwitzer, Oettingen, & Balci, 2013), test anxiety, social and general anxiety, worry about attending psychotherapy, and also more specific emotions (e.g., disgust; Schweiger Gallo, McCulloch, & Gollwitzer, 2012). With respect to protecting an ongoing goal pursuit from outside interference, implementation intentions were found to be effective regarding distractive video clips in studies with college students, as well as with 6- to 8-year-old children.

Goals and means that are no longer feasible and/or desirable require individuals to adjust goal striving or even to *disengage* from the chosen goals and means altogether. Such

disengagement can free up resources and minimize frustration that results from experiencing repeated negative feedback. However, because having chosen a goal or means is linked to potential self-defensiveness originating from a strengthened sense of accountability, individuals often stick to the chosen goals and means even though this is disadvantageous, a phenomenon referred to as *escalation of commitment* (Brockner, 1992). Implementation intentions can be used to promote the disengagement needed in such situations by specifying negative feedback as a critical cue, and linking this cue to switching to a more appropriate alternative goal pursuit or using alternative means. Indeed, when research participants were asked to form implementation intentions that linked negative feedback on the ongoing goal striving to immediately switching to a different means or goal, disengagement from goals and means was found to occur more frequently than for participants who had merely been asked to form respective goal intentions (e.g., “I will only work with the best means available!”; Henderson, Gollwitzer, & Oettingen, 2007). Recently, Wieber, Thürmer, and Gollwitzer (2015) observed that down-regulating self-defensiveness by using if-then plans (Thürmer, McCrea, & Gollwitzer, 2013) provides a further route to promoting disengagement from a failing course of action.

Finally, forming implementation intentions can help to prevent *resource depletion* because it enables individuals to engage in automated goal striving (spelled out below). As a consequence, the self should not become depleted (Baumiester, Vohs, & Tice, 2007) when goal striving is regulated by implementation intentions. Indeed, in studies using different ego depletion paradigms, research participants who used implementation intentions to self-regulate in one task did not show reduced self-regulatory capacity in a subsequent task (e.g., Webb & Sheeran, 2003). Moreover, Bayer, Gollwitzer, and Achtziger (2010) demonstrated that people can protect themselves from the negative effects of existing ego depletion in striving for a new goal (i.e., performance on a subsequent task) by spelling out performance on the respective task in advance in terms of if-then plans; a reduced task performance was no longer observed with ego-depleted participants. These findings imply that even individuals who believe that willpower is a limited resource do have a chance to escape the negative performance effects of ego depletion. Believers of the limited resource model do not have to be turned into nonbelievers or even believers of an unlimited resource model (Job, Walton, Bernecker, & Dweck, 2013) by a respective persuasion intervention. Rather, people only need to form if-then plans before starting to work on a first task, thus preventing ego depletion, or to form if-then plans prior to working on subsequent tasks, in which case they perform effectively when ego depletion has occurred.

PROCESS EXPLANATION: STRATEGIC AUTOMATICITY

Research on the underlying mechanisms of implementation intention effects indicates that implementation intentions facilitate goal attainment on the basis of psychological mechanisms that relate to the anticipated situation specified in the if-part of the plan, and the mental link created between the if-part and the then-part. Because forming an implementation intention implies the selection of a prospective critical situation, the mental representation of this situation is expected to become highly activated and hence more accessible. This heightened accessibility of the if-part of the plan has been observed in several studies using different cognitive task paradigms. For instance, Webb and Sheeran

(2004), using a cue detection task, observed that implementation intentions improved performance. Using a dichotic listening task paradigm, Achtziger, Bayer, and Gollwitzer (2012, Study 1) found that words describing the critical cue specified in the if-part of an implementation intention were drawing attention toward them. When these critical words were presented to the nonattended ear, the shadowing performance in terms of enunciating the words presented in parallel to the attended ear did decrease in implementation intention participants. Moreover, using a cued recall task in Study 2, participants more effectively recalled the available situational opportunities to attain a set goal given that these opportunities had been specified in if-then links, and this was true whether the cued recall was requested 15 minutes or 24 hours later. Furthermore, using a lexical decision task paradigm, Parks-Stamm, Gollwitzer, and Oettingen (2007) observed that implementation intentions not only increased the activation level of the specified critical cue but also diminished the activation level of nonspecified competing situational cues. Finally, a recent line of research examined perceptual consequences of making if-then plans. In these studies, a well-established chronometric method was employed: the psychological refractory period (PRP) paradigm (Pashler, 1994) combined with the locus-of-slack logic (Schweickert, 1978). The collected data (Janczyk, Dambacher, Bieleke, & Gollwitzer, 2015) support the idea that if-then plans do facilitate early perceptual processing and not just attentional responding of the specified critical cues. In summary, the studies reported in this paragraph do suggest that if-then plans enhance the activation of the mental representation of specified critical situational cues, making them more accessible.

There are also studies demonstrating a strong associative link between the mental representation of the specified critical cue and the mental representation of the specified response. These associative links (Webb & Sheeran, 2007, 2008) are quite stable over time (Papies, Aarts, & de Vries, 2009). Gollwitzer (1999) argued that the associative links created by forming implementation intentions should lead to a consequence that is best referred to as *strategic automaticity*: Once the critical cue is encountered, the execution of the goal-directed response specified in the then-component of the implementation intention exhibits features of automaticity, including immediacy, efficiency, no need of a conscious intent, and autonomous responding. Having formed an implementation intention, which can best be understood as a strategic act of will because it is intended to promote goal attainment, individuals can then act *in situ* without having to deliberate on whether to act.

Indeed, if-then planners were found to act more quickly (e.g., Gollwitzer & Brandstätter, 1997, Experiment 3); this speeded-up responding still evinced under high cognitive load and therefore qualifies as efficient (e.g., Brandstätter, Lengfelder, & Gollwitzer, 2001). Moreover, no repeated conscious intent is needed in the critical situation. Consistent with this claim, implementation intention effects are observed even when the critical cue is presented subliminally (e.g., Bayer, Achtziger, Gollwitzer, & Moskowitz, 2009). Also supportive of the assumption that no conscious intent is needed is recent research by Schweiger Gallo, Pfau, and Gollwitzer (2012) on increased hypnotic responsiveness. When standard hypnotic instructions were enriched with respective implementation intentions, an increase in hypnotic responsiveness was observed, as assessed by heightened performance on a word search task. Importantly, this increase in performance was accompanied by a felt involuntariness of responding. Finally, action control by implementation intentions is also associated with an enhanced autonomy of the specified critical

response (i.e., a fourth feature of automaticity). Using a flanker task, Wieber and Sasenberg (2006) observed that the situational cues specified in the if-part of an implementation intention still received attention when they were presented in a task context that required the participant to ignore them.

The most convincing support for the hypothesis that action control by implementation intentions qualifies as automatic was obtained in a functional magnetic resonance imaging (fMRI) study reported by Gilbert, Gollwitzer, Cohen, Oettingen, and Burgess (2009), in which participants had to perform a prospective memory task; the frequency of acting on a prospective stimulus was assessed in participants who had formed either a goal intention or an implementation intention. Acting on goal intentions was associated with brain activity in the lateral rostral prefrontal cortex, whereas acting on implementation intentions was associated with brain activity in the medial rostral prefrontal cortex. Brain activity in the latter area is known to be associated with bottom-up (stimulus) control of action, whereas brain activity in the former area is known to be related to top-down (goal) control of action (Burgess, Dumontheil, & Gilbert, 2007). As automatic action control qualifies as highly stimulus driven rather than outcome driven, these brain data are in line with the data collected using cognitive task paradigms suggesting that action control by if-then plans is automatic.

But do the processes triggered by implementation intentions actually mediate their effects on goal attainment? In the Gilbert and colleagues study (2009), the increased brain activity in the medial rostral prefrontal cortex matched the increase in prospective memory performance caused by forming implementation intentions. Moreover, Aarts, Dijksterhuis, and Midden (1999), using a lexical decision task, found that implementation intentions led to faster lexical decision times for those words that described the specified critical situation; importantly, this heightened accessibility of the critical situation in turn mediated the beneficial effects of implementation intentions on rate of goal attainment. Finally, Webb and Sheeran (2007, 2008) found that the effects of if-then plans on goal attainment were mediated simultaneously by accessibility of the specified situational cues and strength of the created associative links between these cues and the respective goal-directed responses.

WHEN WILLPOWER IS NEEDED

Any self-regulation strategy that claims to facilitate goal attainment reliably has to prove itself under conditions when “the going gets tough.” Such conditions are manifold, but the following three stick out: (1) when a person’s capabilities, such as intelligence, limit goal striving; (2) when opponents, such as negotiation partners, limit one’s goal striving; and (3) when the wanted behavior runs into conflict with unwanted reflexive (impulsive) behavior. For all three of these situations, implementation intentions, however, stood the test.

As to situations in which *knowledge, skills, and personal attributes* constrain performance, Bayer and Gollwitzer (2007) found that simple if-then plans managed to enhance participants’ performance with respect to a standardized intelligence test (i.e., the Raven test). Participants only had to form a self-efficacy-enhancing implementation intention: “Whenever I start a new problem on this test, then I will tell myself: I can solve this problem!” Given that intelligence is commonly conceived of as a stable personality attribute,

these findings are striking. They have led to recent research on the question of whether people can also change unwanted personality traits if they furnished respective goals with implementation intentions. In line with Bayer and Gollwitzer's studies on enhancing intelligence, Hudson and Fraley (2015) found that when people add implementation intentions such as "If I feel stressed, then I'll call my mom and talk about it!" to the goal to change an unwanted personality trait of being an introvert to becoming an extravert, this actually leads to respective personality change.

As to situations in which an *opponent limits one's performance*, studies in which pairs of negotiators had to distribute a common resource were conducted (Trötschel & Gollwitzer, 2007). In these studies, negotiators played the roles of representatives of two neighboring countries and negotiated the distribution of the regions, villages, and towns of a disputed island. When the negotiation outcomes were framed in terms of losses as compared to gains, the common finding (e.g., Bazerman, Magliozzi, & Neale, 1985) that loss frames lead to less cooperation than goal frames was replicated. However, when participants formed implementation intentions to make cooperative counterproposals whenever a proposal from the counterpart was received, the negative effect of loss framing was wiped out; now participants negotiated as constructively under a loss frame as they did under a gain frame. Research using the ultimatum game (Kirk, Gollwitzer, & Carnevale, 2011) also indicated that implementation intentions can help performance in the face of opponents. Impulsive rejections of unfair offers at a cost to oneself were successfully curbed by making if-then plans geared toward down-regulating anger.

The self-regulation of an ongoing goal pursuit needs willpower when *reflexive (impulsive) responses* hinder initiating and executing goal-directed responses that are instrumental to attaining one's goals. Can making if-then plans help people to allow their goals to win out over their antagonistic reflexive responses? By assuming that the control of action by implementation intentions is immediate and efficient, and adopting a simple horserace model (see Adriaanse, Gollwitzer, de Ridder, de Wit, & Kroese, 2011), people should be in a position to break reflexive responses by forming implementation intentions that spell out a response contrary to the reflexive response to the critical situation. This hypothesis has been tested with respect to cognitive, affective, and behavioral reflexive responses.

Automatic biases, such as stereotyping, represent a reflexive *cognitive* response that may be in opposition to one's goals to be fair. Extending earlier work by Gollwitzer and Schaal (1998), Stewart and Payne (2008) found that implementation intentions designed to counter automatic stereotypes (e.g., "When I see a black face, I will then think 'safe!'") indeed managed to reduce automatic stereotyping. Further research by Mendoza, Gollwitzer, and Amodio (2010) using the so-called "shooter task" paradigm, has added to these findings by showing that the behavioral expression of stereotypes can also be down-regulated by forming implementation intentions.

With respect to reflexive *affective* responses, a series of studies was conducted by Schweiger Gallo, Keil, McCulloch, Rockstroh, and Gollwitzer (2009) with individuals suffering from arachnophobia (fear of spiders). Implementation intentions geared toward either ignoring presented spider pictures or staying calm in the face of such pictures helped to reduce the arousal in these participants, even though arachnophobic individuals are known to reflexively experience arousal when confronted with spider pictures. Actually, both types of implementation intentions reduced the arousal to the degree that was observed with control participants not suffering from arachnophobia. One study, using

dense-array electroencephalography (EEG), even indicated that implementation intentions specifying an ignore response significantly reduced the early activity in the visual cortex in response to spider pictures typically observed with arachnophobic individuals, as reflected in a smaller P1 assessed at 120 milliseconds after a spider picture had been presented. Apparently, the strategically automated ignore response managed to outrun the reflexive fear response.

Moreover, with respect to *behavioral* reflexive responses, Cohen, Bayer, Jaudas, and Gollwitzer (2008, Study 2; see also Miles & Proctor, 2008) found that if-then plans help decrease the advantage of habitual behavioral responses over nonhabitual ones, as observed in a Simon classification task. In this type of task, classifying a stimulus (e.g., low vs. high tones) with the hand that corresponds to the location of the presented stimulus (i.e., to the left vs. right side of the person) is faster than classifying it with the noncorresponding hand. Specifying a noncorresponding response in an implementation intention geared toward fast responding, however, managed to alleviate this reduced speed of classifications made by the noncorresponding hand.

Implementation intentions were also found to help people control behavioral priming effects that occur outside a person's awareness (Gollwitzer, Sheeran, Trötschel, & Webb, 2011). Various experiments tested whether people can protect their ongoing goal pursuits from antagonistic priming effects by using if-then plans. In one of the studies, participants had to perform a driving simulation task. Participants primed with the goal of being fast increased driving speed and mistakes when they had merely formed a goal intention to drive only as fast as safety allowed or had formed no driving-related goal intention at all. However, participants who had furnished the safety-related goal intention of driving only as fast as safety allowed with an implementation intention ("Whenever I enter a curve, then I'll reduce my speed!") no longer evinced any priming effects. Priming the goal to drive fast no longer increased speed and driving mistakes.

In addition, if-then plans specifying the replacement of a habitual response with an alternative response when the critical habitual situation is encountered helped people break bad snacking habits (Adriaanse, Gollwitzer, et al., 2011). When the researchers investigated the cognitive processes underlying this effect using a primed lexical decision task, it turned out that the habitual unhealthy snack was more accessible than an alternative healthy snack (e.g., an apple) when primed with the critical situation (e.g., feeling irritated). Importantly, this was reversed when participants formed if-then plans that linked the initiation of the healthy response to the critical habitual cue.

Still, forming implementation intentions may not always block reflexive responses. Whether the reflexive response or the if-then guided response will "win the race" depends on the relative strength of the two behavioral orientations. For instance, if the reflexive response is based on strong habits (Webb, Sheeran, & Luszczynska, 2009), and the if-then guided response is based on weak implementation intentions, the reflexive response will win over the if-then planned response; but the reverse should be true when weak habits are in conflict with strong implementation intentions. This implies that inhibiting strong reflexive responses requires the formation of strong implementation intentions.

One route to forming strong implementation intentions pertains to creating strong links between situational cues (if-component) and goal-directed responses (then-component). This may be achieved by enriching the formation of implementation intentions with mental imagery (e.g., Knäuper, Roseman, Johnson, & Krantz, 2009; Knäuper et al., 2011). But note that verbal encoding has often been found to suffice in making

implementation intentions effective (McFarland & Glisky, 2012). An alternative route to strengthening implementation intentions was suggested by Adriaanse, de Ridder, and de Wit (2009), who argued that people should specify those critical cues for the if-part of an implementation intention that speak to their unique personal problems with the habitual behavior they want to overcome. Oettingen (2012, 2014; Oettingen & Cachia, Chapter 30, this volume) points out that mentally contrasting a desired future outcome with present reality helps people to detect the personal obstacles that actually stand in the way of goal attainment, and it creates a readiness to link these obstacles to instrumental responses to overcome them. In summary, if-then plans have the potential to reduce the disruptive influence of reflexive antagonistic responses, and this seems to hold true for cognitive, affective, and behavioral responses alike.

NEW DIRECTIONS IN IMPLEMENTATION INTENTION RESEARCH

One new line of research on implementation intentions pertains to using them in *behavior change interventions*. Here the critical question is: How are people helped best to make effective if-then plans? One approach that has been used successfully (for athletic goals: Achtziger, Gollwitzer, & Sheeran, 2008; for weight loss goals: Armitage, Norman, Noor, Alganem, & Arden, 2014) is creating extensive lists of both critical situational cues and instrumental goal-directed responses, providing these lists to people, and asking them to create if-then plans. These plans are then formed by picking those critical situations that are personally most relevant and linking them to the listed responses that participants feel capable of executing in these situations.

A quite different approach to developing behavior change interventions using implementation intentions is teaching the formation of implementation intentions in terms of a metacognitive strategy. Content-free principles of plan formation that are explained in detail can then be used by the individual for any of the goals he or she wants to attain. An intervention that does this very effectively is mental contrasting with implementation intentions (see Oettingen & Cachia, Chapter 30, this volume). Mental contrasting (Oettingen, 2000; Oettingen, Pak, & Schnetter, 2001) implies juxtaposing fantasies about desired future outcomes with obstacles in present reality. This strategy not only creates strong goal commitments and vigorous goal striving in individuals with high expectations of success, but it also guarantees the identification of personally relevant obstacles that can then be specified as the critical cues in the if-component of implementation intentions; it also helps to identify instrumental means to overcome these obstacles that can be specified in the then-component. Moreover, mental contrasting has been found to create a readiness for making plans that link obstacles to instrumental goal-directed responses (Kappes, Singmann, & Oettingen, 2012). Because implementation intentions are known to unfold their beneficial effects in particular when both the commitment to the goal and the respective implementation intention is high (Achtziger et al., 2012; Sheeran, Webb, & Gollwitzer, 2005), mental contrasting guarantees that these prerequisites are in place.

Mental contrasting interventions have recently been enriched with explicit instructions to form if-then plans. In such mental contrasting with implementation intentions (MCII) interventions, researchers observed lasting behavior change (for a review, see Oettingen, Wittchen, & Gollwitzer, 2013; Oettingen, 2014). With regard to physical exercise and healthy eating (i.e., eating more fruits and vegetables) in middle-aged adults,

drastic improvements were observed that lasted over the time periods of 4 months and 2 years, respectively (Stadler, Oettingen, & Gollwitzer, 2009, 2010). Moreover, Adriaanse, Oettingen, Gollwitzer, Hennes, de Ridder, & de Wit (2010) showed that MCII helped to reduce unhealthy snacking in college students. MCII worked for both students with weak and strong such habits, and it was more effective than either mental contrasting or forming implementation intentions alone. Finally, MCII also had beneficial effects outside of the health domain. For example, it enhanced study efforts in students preparing for standardized tests, and it improved academic performance at home and at school (Duckworth, Grant, Loew, Oettingen, & Gollwitzer, 2011; Duckworth, Kirby, Gollwitzer, A., & Oettingen, 2013). It was also found to promote integrative bargaining in buyer and seller dyads negotiating over the sale of a car; again, MCII worked better than either mental contrasting or if-then plans alone (Kirk, Oettingen, & Gollwitzer, 2013).

However, sticking two self-regulatory behavior change tools together (as is done in MCII) may not always be beneficial. For instance, various studies have explored whether combining self-affirmation with the formation of implementations would intensify behavior change effects. Whereas self-affirmation plus if-then plan formation worked well in some intervention studies (e.g., reducing alcohol consumption: Ferrer, Shmueli, Bergman, Harris, & Klein, 2012; eating more fruits and vegetables: Harris et al., 2014), it did not help in others (e.g., promoting exercise behavior; Jessop, Sparks, Buckland, Harris, & Churchill, 2014). Possibly, whenever the information provided with regard to the behavior change at issue turns out to threaten the person's self-integrity, a self-affirmation exercise prior to forming implementation intentions may be helpful because it reduces self-defensiveness and therefore encourages participants to make binding if-then plans. If the information is nonthreatening, however, a self-affirmation exercise may not be helpful because it may curb the perceived necessity to make goal-promoting if-then plans; if one feels already pretty good about oneself, one's goal striving does not seem to need a boost. Finally, a recent study on the reduction of alcohol consumption in adolescents shows that self-affirmation exercises themselves can be strengthened by making if-then plans ("If I am anxious, then I will think about the things I value about myself"), and that self-affirmation guided by if-then plans created particularly strong behavior change effects (Armitage, Rowe, Arden, & Harris, 2014).

A further new line of implementation intention research pertains to the use of *if-then plans in groups*. Two questions are addressed in this research: The first is whether individual group members can use implementation intentions to promote collaboration and therefore improve group performance. The second is whether groups can also use we-implementation intentions (If we encounter . . . , then we will . . . !) to promote group performance, and which type of implementation intention (I- vs. We-implementation intentions) is more conducive to promoting group performance (Thürmer, Wieber, & Gollwitzer, 2015a, 2015b; Wieber, Thürmer, & Gollwitzer, 2012, 2013). For instance, Thürmer and colleagues (2015b) analyzed how collective if-then plans improved organizational decision making through increased information exchange and cooperation. Three-person panels had to choose the best of three job applicants. The first candidate was modestly qualified, with six out of nine attributes in his favor—but every panel member knew about all six of these positive attributes. The second candidate also had six attributes in his favor, but the individual panel members only shared knowledge about three of them. The third candidate, the superior candidate, had nine attributes in his favor, but each panel member received information about only three of these positive

attributes. To realize that the third candidate had nine positive attributes, the members of the panels had to share information with one another. All the panels were instructed to do so before arriving at a final decision. Half the panels made an if–then plan: “If we are ready to make a decision, then we will review the positive qualities of all candidates before deciding!” Panels that made no if–then plans chose the superior candidate only 18% of the time, whereas panels with if–then plans selected the superior candidate 48% of the time.

A final new line of research explores whether if–then plans can be used to benefit one’s *social interactions*. For instance, Stern and West (2014) reported that implementation intentions specifying how to act when feeling anxious boosts interest in sustained contact and close interpersonal distance in interracial interactions. And Przybylinski and Andersen (2012) observed that implementation intentions can be used to block *transference*, in which prior relationships play out in present ones often without awareness and even when problematic to the individuals involved. Finally, Wieber, Gollwitzer, and Sheeran (2014) demonstrated that mimicry effects on social interactions can also be controlled by forming if–then plans, even though, as with transference, people are not usually aware of its influence on their judgments and behaviors. Although mimicry generally facilitates social interactions, sometimes its effects can hamper the pursuit of focal goals (e.g., when we fall for the persuasive efforts of a salesperson mimicking our bodily and facial expressions). In one of their studies, Wieber and colleagues had participants form the goal “I want to be thrifty with my money! I will save my money for important investments!” or an implementation intention regarding this goal “I want to be thrifty with my money! And if I am tempted to buy something, then I will tell myself: I will save my money for important investments!” They were then mimicked by the experimenter, who tried to seduce them into spending the money they had earned for participating in the experiment on some leftover coffee vouchers and chocolate bars. Control group participants showed the common mimicry effect of a higher readiness to spend their money when being mimicked by the salesperson. Implementation intentions to be thrifty, however, strongly reduced participants’ giving in to the persuasive attempts of the experimenter to spend their money, whereas mere goal intentions to be thrifty failed to do so.

OPEN QUESTIONS

Even though research on the effects of if–then plans on the rate of goal attainment and the underlying processes of these effects has been quite extensive since the time when the concept of implementation intentions was first introduced (Gollwitzer, 1993), there is still a host of unanswered questions.

Potential Moderators

Moderators of if–then plan effects on goal attainment have been targeted with respect to features of the implementation intentions formed, the superordinate goal, the person, and the context in which implementation intentions are formed and executed.

Regarding the *features of if–then plans*, it is important to recognize that people can commit to their plans to a different degree, and that only people who form their if–then

plans in a binding manner can be expected to be guided by them (Achtziger et al., 2012). The person with an if-then plan should no longer be able to feel that there is a choice to be made when the critical situation is encountered. The action to be taken in the critical situation has been determined ahead of time, and the person is now on automatic pilot—the planned action will be triggered directly by the specified cue.

But implementation intentions may also differ in their format. For instance, when it comes to shielding an ongoing goal pursuit from internal and external disruptions, quite different if-then plans can be used. Take the example of a person whose goal is to stay friendly to a neighbor who keeps making outrageous requests. She may form suppression-oriented implementation intentions, such as “And if my neighbor approaches me with an outrageous request, then I will not get upset!” The then-component of such suppression-oriented implementation intentions does not have to be worded in terms of not showing (i.e., negating) the critical behavior (in this example getting upset); it may alternatively specify a replacement behavior (“then I will respond in a friendly manner!”), or focus on ignoring the critical cue altogether (“then I’ll ignore her request!”). Recent research (Adriaanse, van Oosten, de Ridder, de Wit, & Evers, 2011) suggests that negation implementation intentions are less effective than the latter two types (i.e., replacement and ignore if-then plans).

One can also form implementation intentions geared toward stabilizing the ongoing focal goal pursuit at hand: “If the first part of my paper is finished, then I’ll immediately turn to the second part!” Bayer and colleagues (2010) demonstrated their effectiveness in a series of studies showing that if-then plans geared toward stabilizing an ongoing goal pursuit effectively blocked the disruptive effects of self-doubts, inappropriate mood, and ego depletion. Research indicates that the ongoing goal pursuit can also be stabilized in a more general way (Kroese, Adriaanse, Evers, & de Ridder, 2011; van Koningsbruggen, Stroebe, Papies, & Aarts, 2011). Such if-then plans specify the disruptive stimulus in the if-part and a reminder of one’s goal at hand in the then-part: “then I will remind myself that my paper has a deadline that I want to meet!”

It is important to recognize, however, that focusing one’s if-then plans on the ongoing activity may at times be counterproductive. For instance, for individuals with high test anxiety, using implementation intentions that increase the focus on the ongoing task of performing well on a challenging arithmetic test was demonstrated to be harmful to task performance (Parks-Stamm, Gollwitzer, & Oettingen, 2010). And Gollwitzer and Schaal (1998) observed that individuals who were highly motivated to do well on a focal arithmetic test performed more poorly than a no-plan control group when using assigned if-then plans that specified “to increase one’s efforts” on the test when disruptive stimuli are encountered (in this case, attractive video clips). Possibly, in both of these studies, focusing strictly on the ongoing math test may have triggered worries about succeeding on the test and therefore undermined performance.

Also, when forming implementation intentions, the associative link created between the critical situation and the instrumental response should be as strong as possible. This is achieved most easily when implementation intentions use an if-then format. Simply having research participants specify the when, where, and how of acting and trusting that they will in turn form if-then plans is a suboptimal way of creating strong implementation intentions in research participants. For instance, Chapman, Armitage, and Norman (2009) observed that for the goal to increase one’s fruit and vegetable intake,

an implementation intention using an if–then format had a greater impact than an implementation intention that settled with simply listing the when, where, and how of acting toward the goal.

For if–then plans to be effective, it is also important that people specify the critical situational cue in such a way that it is readily detected when it is actually encountered. Even though concrete specifications may in general be superior in this respect than abstract specifications, this may not always be true. Think, for example, of the specification of internal cues. Specifying as the critical cue the state of getting irritated may seem rather abstract, but the individual (e.g., a tennis player who wants to stay calm when he is falling behind in the game; Achtziger et al., 2008) knows exactly what is implied and will therefore easily recognize this state when it occurs. When it comes to appropriate specifications of the then-component of an if–then plan, it seems crucial to pick a response that is highly instrumental to goal attainment. Also, it needs to be a response that the person feels capable to execute in the critical situation (i.e., self-efficacy is high; Wieber, Odenthal, & Gollwitzer, 2010).

Finally, there is the question of how many if–then plans should one form for a given goal? Verhoeven, Adriaanse, de Ridder, de Vet, and Fennis (2013) investigated the behavioral and cognitive implications of making multiple implementation intentions targeting unhealthy snacking habits and its underlying processes, linking multiple habitual snacking cues to healthy alternatives. They found that formulating multiple implementation intentions was not effective in decreasing unhealthy snacking, whereas formulating a single plan successfully induced behavior change. By using a lexical decision task, they also observed that when making a single plan, but not multiple plans, the healthy alternative became cognitively more accessible in response to a critical cue prime than the habitual response.

Moderators of the effects of if–then plans may also be found in certain *features of the planning person*. For instance, the personality attribute of socially prescribed perfectionism seems to undermine implementation intention effects on goal progress, whereas for participants who score high on self-oriented perfectionism, no such effects are observed (Powers, Koestner, & Topciu, 2005). Possibly, social perfectionists fail to commit and stick to implementation intentions because they are very sensitive to the fact that the preferences of others often change unexpectedly, and that their high readiness to respond to such changes in a flexible manner may be undermined by strong commitments to a fixed if–then plan. Moreover, the willingness to make if–then plans and reliably enact them seems to also be reduced in highly impulsive individuals (i.e., for individuals high in urgency, it was found that implementation intentions fail to promote goal attainment when the situational context is emotionally charged; Burkhard, Rochat, & Van der Linden, 2013; see also Churchill & Jessop, 2010, 2011), whereas it seems to be heightened in individuals high in conscientiousness (Webb, Christian, & Armitage, 2007) and those with a strong propensity to manage their time and money effectively (Lynch, Netemeyer, Spiller, & Zammit, 2009).

But what about moderators in terms of the cognitive capacities that are needed to form and enact if–then plans? Research on this question has turned to critical clinical samples: children with attention-deficit/hyperactivity disorder (ADHD) (see summary by Gollwitzer, Gawrilow, & Oettingen, 2010; see also Barkley, Chapter 27, this volume), patients with frontal lobe damage (e.g., Lengfelder & Gollwitzer, 2001; McFarland & Glisky, 2011), and patients with schizophrenia (Brandstätter, Lengfelder, & Gollwitzer,

2001; Chen et al., 2014), all of whom are known to suffer from cognitive deficits related to executive functions. All of these samples benefited from forming implementation intentions. For instance, children with ADHD who were taught the MCII technique were rated by their parents to have shown a heightened level of self-regulation in their everyday life during the 2 weeks after the intervention (Gawrilow, Morgenroth, Schultz, Oettingen, & Gollwitzer, 2013). This indicates that even though children with ADHD are known to suffer from reduced executive functions, they can benefit from making if-then plans in their daily self-regulation challenges (e.g., doing their homework on time).

Further research involving children with ADHD showed that the typical deficits in executive functions can also be targeted directly by forming respective implementation intentions. For instance, it was demonstrated (Gawrilow & Gollwitzer, 2008) that children with ADHD who furnished a suppression goal with implementation intentions improved inhibition of an unwanted response in a go/no-task to the same level observed in children without ADHD, and the combination of implementation intentions and psychostimulant medication resulted in the highest level of suppression performance in children with ADHD. Moreover, children with ADHD made fewer perseverative errors on a shifting task when instructed to make respective if-then plans, and they also benefited from if-then plans in solving math problems that required both working memory and the inhibition of distractions (Gawrilow, Gollwitzer, & Oettingen, 2011b). And finally, children with ADHD could successfully use if-then plans to enhance their delay of gratification performance (Gawrilow, Gollwitzer, & Oettingen, 2011a). It appears, then, that individuals with handicapped executive functions can still use if-then plans as a self-regulation tool for their daily goal pursuits, and they can even make if-then plans to support exactly those executive functions in which they are weak.

Features of the targeted goal have also been studied as potential moderators. In line with the notion that if-then plans unfold their effects when “the going gets tough,” many studies indicate that participants who form implementation intentions perform better than participants who only form goal intentions when the goals at hand are difficult rather than easy (Gollwitzer & Sheeran, 2006). However, having a strong goal commitment in place is a prerequisite for the positive effects of implementation intentions on attaining difficult goals. Sheeran and colleagues (2005, Study 1) report that weak goal commitments undermine the effectiveness of if-then plans. This observation is in line with findings by Koestner, Lekes, Powers, and Chicoine (2002), who found that implementation intentions evince stronger effects when they are formed in the service of self-concordant goals. People also refrain from acting on their if-then plans when the respective goal is not activated in the situation at hand (Sheeran et al., 2005, Study 2).

But should people form implementation intentions for all of their goals, from studying to having fun? It seems that the benefits of if-then planning for attaining a single goal do not typically extend to multiple goals (Dalton & Spiller, 2012). Planning may draw attention to the difficulty of executing multiple goals, which undermines commitment to those goals relative to other desirable activities and thereby undermines if-then planning effects. Framing the execution of multiple goals as a manageable endeavor, however, seems to reduce the perceived difficulty of multiple goal pursuit and can therefore help people accomplish the various goals they have furnished with if-then plans.

Finally, various *contextual features* matter. One is the emotional state in which the person finds him- or herself when forming if-then plans and enacting them. An emotional state that has positive effects on plan formation and enactment seems to be the

emotion of anger (Maglio, Gollwitzer, & Oettingen, 2014). Apparently, anger creates a strong sense of being in control that facilitates both the making of firm plans and decisively acting on them. Another contextual feature seems to be the person's mindset. When a person is deliberating on the pros and cons of pursuing a goal, he or she experiences a deliberative mindset (Gollwitzer, 2012) that is characterized by open-mindedness. Because implementation intentions affect behavior by automatic, bottom-up action control processes triggered by exactly those situational cues specified in the if-part, being in a deliberative mindset should disrupt this type of action control. As a consequence, deliberative mindsets have been found to eliminate the common beneficial effects that implementation intentions have on goal attainment (Wieber, Sezer, & Gollwitzer, 2014).

In summary, many factors enhance or weaken action control by implementation intentions; they pertain to the implementation intentions formed, the superordinate goal, the person, and the context in which implementation intentions are formed and enacted. Most of the studies so far have focused on one of these factors at a time. But future research might want to address the question of how these factors interact. Such a more comprehensive approach is exemplified by a recent set of studies reported by Hall, Zehr, Ng, and Zanna (2012). They examined the joint influence of goal strength, executive control resources (ECRs), and differentially supportive environmental conditions on the effectiveness of implementation intentions geared toward enhancing physical exercise. The beneficial effects of implementation intentions turned out to be more potent under challenging environmental conditions, and implementation intentions were of special benefit for those with initially low ECRs. However, more recent research by Hall, Zehr, Paultzki, and Rhodes (2014), also examining the interaction of potentially undermining factors of implementation intention effects, found that in old to very old people, low ECRs do manage to undermine the positive effects of implementation intentions on physical activity.

Costs of If-Then Planning

Given the many benefits of forming if-then plans, one wonders about potential costs. Such costs may be expected when recognizing and quickly seizing an alternative opportunity is essential for achieving the goal at hand. Indeed, Masicampo and Baumeister (2012) reported that when participants were assigned a task goal in the laboratory, making an if-then plan hindered participants' capitalization on a presented alternative opportunity for achieving the goal. Research in our laboratory also showed the advantage in seizing specified situational cues; their mental representations become highly activated, and the mental representations of competing situational cues become deactivated (Parks-Stamm et al., 2007). But recent research indicates that this lack of flexibility is dependent on the person's counterfactual mindset (McCulloch & Smallman, 2014). More specifically, subtractive counterfactual mindsets in which counterfactual thoughts focus on removing a performed action were found to enhance flexibility. In contrast, additive counterfactual mindsets in which counterfactual thoughts focus on imagining new actions were found to enhance rigidity.

But is the failure to use alternative opportunities actually a cost in terms of reaching the goal for which the implementation intention has been formed? Note that the goal is still attained even though an alternative opportunity to realize the goal has not been seized. From a goal attainment perspective, therefore, speaking of costs only makes

sense when a better opportunity is not seized. So the question that arises is whether opportunities that promise easier or more beneficial goal attainment than the one specified in one's implementation intention will indeed stay unused. Interestingly, research on this question shows that implementation intention participants seem to have no problems with making effective use of better opportunities that arise unexpectedly (Gollwitzer, Parks-Stamm, Jaudas, & Sheeran, 2008). Analogous research analyzing the use of alternative goal-directed responses shows that implementation intentions also seem to allow people to stay open to the use of responses that are of higher or at least the same instrumentality.

Moreover, as we noted earlier, implementation intentions respect the strength of the superordinate goal and its state of activation. This means that people can be expected to adjust their goal striving sensitively to the strength and activation of the goal at hand. They should stop striving for goals they have attained and halt striving in inappropriate contexts. So there is no need to fear that if-then guided goal striving is rigidly repeated again and again only because the critical situation is encountered repeatedly, or that people rigidly act on their if-then plans in inappropriate situations. For instance, one does not have to fear that an if-then plan to complain to one's boss as soon as one sees him will be enacted at his birthday party. Recent research also shows that if-then guided goal striving is quite sensitive to failure feedback (Gollwitzer et al., 2008). The feedback only needs to be explicit enough to be noticed by the person acting on an if-then plan. Still, in the future researchers might want to investigate how if-then plans can be worded in a way to keep rigidity at a minimum. One route that we imagine might be effective is using if- and then-specifications that are rather inclusive ("If I get anxious, then I will tell myself: Be confident!") and therefore cover many different critical situations and many instrumental responses.

Alternative Process Explanations

Rather than operating via strategic automaticity, might forming if-then plans increase a person's commitment to the goal (produce heightened goal strength) or increase his or her self-efficacy with regard to attaining the goal at hand? But a critical meta-analytic analysis of these potential alternative explanations (Webb & Sheeran, 2008) does not render them viable. A further alternative explanation is the presumption that implementation intention participants as compared to mere goal intention participants are always given more information on the details of how to attain the goal at hand. Admittedly, in the first studies on implementation intentions, this problem has not received the necessary attention. But recent research makes sure that either the mere goal intention group receives strategy information as well or that the if-then plan group receives no additional strategy information at all; the instructions given in the goal intention condition are simply worded in an if-then format. Even under these very controlled circumstances, participants with if-then plans show enhanced goal attainment compared to participants with mere goal intentions (e.g., Wieber, Gollwitzer, & Sheeran, 2014).

There is also the possibility that if-then plans may have unfolded their often striking effects by having enhanced experimenter demand. However, in various studies, experimenter demand was checked after the experiment was completed, and no differences between mere goal and implementation intention participants were evident. Also, experimenter demand was often checked in pilot participants who received either mere goal or

implementation intention instructions. Again, no differences emerged between goal and if-then plan participants.

Finally, the effects of implementation intentions maybe understood as nothing but specific goal effects, in line with Locke and Latham's (1990) *goal-setting theory*, which postulates that specific goals lead to better performance than "do your best" goals. But note that the specificity to which Locke and Latham refer in their extensive research relates to the standards that people ultimately want to meet in their goals, and it is challenging, precisely defined standards that are found to promote goal attainment (Locke & Latham, 2013). In the case of implementation intentions, in contrast, the when, where, and how of goal striving is specified and linked together in the form of an if-then statement: "If a certain situation occurs, then I will show a certain goal-directed response!" It is therefore not the level of goal standards (e.g., for a tree cutter, exactly how many trees he wants to cut on a given day) but rather when, where, and how a person wants to act in order to meet the set goal standards.

CONCLUSION

We suggested that goal striving can be enhanced by a simple planning strategy: making if-then plans. Certainly, there are other routes people may take to enhance their goal striving. These pertain to strengthening goal commitment by enhancing self-efficacy beliefs (Bandura, 1977) or changing the framing of one's goals, so that one becomes more willing to strive. The latter can be achieved by focusing on autonomous rather than controlled rewards (Ryan & Deci, 2000), by adopting a promotion rather than a prevention focus (Higgins, 1997), or by setting learning goals rather than performance goals (Dweck & Leggett, 1988). In contrast, the presented research suggests that goal striving can be strategically enhanced by making if-then plans, thus handing it over to specified if (situation)-then (goal-directed response) contingencies that establish bottom-up regulation of one's goal striving.

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PART III

SOCIAL, ORGANIZATIONAL, AND CULTURAL DIMENSIONS OF SELF-REGULATION

CHAPTER 14

Trust and the Perception of Self-Control

Knowing When to Trust Others

CATRIN FINKENAUER

FRANCESCA RIGHETTI

You must trust and believe in people, or life becomes impossible.

—ANTON CHEKOV, *Uncle Vanya* (1896)

If one asks people for the essential ingredient of relationships, most agree with Chekhov and answer that without trust, social life is impossible. Trust is crucial to getting through the myriad interdependent interactions people face every day, from banking to parenting, from business negotiations to lovemaking. Scientific evidence confirms that trust forms the basis for all interdependent interactions (e.g., Fukuyama, 1995; Simpson, 2007b). People are in interdependent interactions when the cognitive, affective, or behavioral outcomes of one person are dependent on the other person (Kelley, 1997; Rusbult & Van Lange, 2003). Interdependence varies dramatically across relationship contexts and is most pronounced in close relationships in which people have repeated interactions over time. The quality of interdependent relationships has an important effect on people's psychological, physical, and relational well-being (e.g., Holt-Lunstad, Smith, & Layton, 2010). Yet relationships are riddled with unpredictability and risk: Will she cooperate or behave selfishly? Will he forgive me or will he retaliate; will he protect me or betray me? Given the risks involved in interdependent relationships, researchers have emphasized that trust is one of the most desired qualities in any relationship (e.g., Rempel, Holmes, & Zanna, 1985) and "one of the most important components—and perhaps the most essential ingredient—for the development and maintenance of happy, well-functioning relationships" (Simpson, 2007a, p. 587). How do people know whom to trust?

In this chapter, we propose that self-control, people's capacity to control impulses and regulate thoughts, behaviors, and emotions, is key to unraveling how people discern others' trustworthiness. To motivate this idea, we begin by conceptualizing trust

and its importance in relationships. Next, we present theories and empirical evidence establishing that trustworthy relationship partners signal relative comfort and safety, and enable people to thrive psychologically, behaviorally, and physically in their relationships. Importantly, we show that most research has focused on the *truster*, the person who accepts “vulnerability based upon the positive expectations of the intentions or behavior of another” (Rousseau, Sitkin, Burt, & Carpenter, 1998, p. 395). This literature identified dispositional qualities of trusters that dispose them to accept more or less vulnerability, to be more or less trusting toward relationship partners. Nevertheless, trust is an inherently interpersonal phenomenon, happening between people rather than within one person. Consequently, the relationship partner is key to explaining when and why people trust others. Therefore, we then explore the qualities that a *trustee*, the person who notices the truster’s vulnerability and rewards trust by behaving in a benevolent manner, needs to possess for trust to emerge. We review supporting evidence for our suggestion that self-control is essential for trust to emerge in interdependent interactions in different types of relationships, ranging from relationships among strangers to close relationships, and from relationships among adults to relationships between parents and children. Finally, we explore the implications of our suggestions for interpersonal trust repair. We conclude with suggestions for future studies to assess the extent to which trustees’ exertion of self-controlled behavior may facilitate interpersonal trust, and crucially, trust repair.

CONCEPTUALIZING TRUST AND ITS ROLE IN RELATIONSHIPS

Trust has been studied across various scientific disciplines, including sociology, economics, neurobiology, political science, and psychology. Despite the great interest in trust, there is no universal definition of trust. Most definitions, however, agree that trust comprises people’s belief or expectation that another person’s behavior toward the self will be beneficial and positive (Robinson, 1996). Many definitions additionally propose that trust also comprises people’s intention to accept vulnerability based on the positive expectation about the other person’s behavior and intentions (e.g., Rousseau et al., 1998).

Even in close relationships in which partners know each other well, one cannot take the other’s trustworthiness for granted. Selfishness and betrayal may be improbable, but not impossible. So, when and how do people decide that others can be trusted? To understand trust in interdependent relationships, three classes of factors are important to consider: (1) the truster’s dispositional characteristics, (2) situational factors, and (3) the trustee’s characteristics.

The Truster’s Dispositional Qualities

Most prior research has focused on explaining when, how, and why trust develops in trusters. One line of research suggests that experiencing warm, supportive, and sensitive interactions with a primary caregiver is crucial to the development of trust (Bowlby, 1973). Specifically, Bowlby proposed that when caregivers serve as a safe haven and a secure base in the face of threat, children develop positive representations of others. These social representations formed in the context of child–caregiver relationships carry forward to people’s adult relationships. They influence people’s thoughts, feelings, and

behaviors, and help them to predict and understand their social environment (Pietromonaco & Barrett, 2000). Ample research supports this suggestion, and shows that individuals with secure attachment styles place greater trust in others in their adult relationships (e.g., Collins & Feeney, 2000; Mikulincer, 1998).

Another line of research highlights that individual differences in trust result from the way people appraise their partner when they face interdependence dilemmas (Holmes & Rempel, 1989). Based on prior experiences in their relationships, dispositionally high trusters develop more consistent and positive representations of their relationship partners than dispositionally low trusters. These representations allow them to maintain more favorable attributions about their partner's behavior, even in times when the relationship is threatened. Dispositionally high trusters are motivated to "make their relationships work": They downplay their partner's negative actions in the relationship, display more positive and less negative affect during conflict, and recover from negative relational experiences more quickly (Holmes & Rempel, 1986). Thus, dispositionally high trusters' mental representations of their partner allow them to maintain a constructive relationship and consider their partner in a broader, long-term perspective.

A recent observation study by Shallcross and Simpson (2012) provides behavioral evidence for these suggestions. In this study, people identified an important personal goal that would require a sacrifice from their partner. They discussed this topic with their partner. Trained coders rated the videotaped discussions for partner accommodation (i.e., reacting in a constructive and supportive way to their partner's goal and desire, despite the sacrifices it implies). As compared to dispositionally low trusters, dispositionally high trusters experienced an increase in their current feelings of trust during the discussion in which they asked their partner to engage in a considerable sacrifice for them. Dispositionally high trusters also overestimated their partner's level of accommodation during the discussion. Partners who had high dispositional trust, in turn, were more likely to show an increase in accommodation when confronted with their partner's goal and the sacrifice it entailed for themselves than did partners who had low dispositional trust. These findings not only show that dispositionally high trusters engage in more pro-relational behavior even when confronted with a potential relationship threat, their trust also elicits behavior that increases trust over time.

Finally, research indicates that people with low self-esteem find it hard to trust their relationship partners (Murray, Holmes, Griffin, Bellavia, & Rose, 2001). Specifically, this research shows that people who view themselves negatively also view their partner as more negative and tend to doubt that their partner's benevolent behaviors are genuine. Thus, research confirms that trust is related to dispositional qualities of trusters. Simply focusing on the truster's characteristics, however, fails to consider the relational situation in which trust emerges.

Situational Factors

Most of the definitions of trust emphasize that trust emerges in situations in which people are vulnerable to others, who can decide to hurt or benefit them (e.g., Rousseau et al., 1998; Yamagishi, 2011). Thus, trust emerges in situations that involve interpersonal risk. When two people are interdependent and their interests align (i.e., what is good for one individual is also good for the other), the risk is relatively small: Because the desired outcome is good for both partners, the other will likely act favorably. On the contrary, trust

becomes particularly relevant in situations of conflict of interests (Holmes & Rempel, 1989; Wieselquist, Rusbult, Forster, & Agnew, 1999).

In situations of conflict of interests, the behavior that most benefits one relationship partner may actually harm, or not be very beneficial for, the other partner. In other words, in these situations, one person's interests require the partner to set aside his or her personal interests and desires for the better of the person and, ultimately, the relationship. For example, Anna and Paul have been together for 2 years. Their anniversary is coming up, and Anna's dearest wish is to spend a romantic evening with Paul in their favorite restaurant. That day, however, Paul's favorite soccer team plays in the finals, and he and his friends have been planning to watch that game together. When Anna presents her request to Paul, she faces an interdependence dilemma: Will Paul reject her and pursue his interests by watching the game with his friends? Or will he set his desires aside and pursue Anna's interest and promote his relationship with her? In this situation, Anna's outcomes are at risk because it is uncertain whether Paul will be responsive to her needs, or whether he will reject her request and act selfishly. By presenting her request to Paul, Anna accepts vulnerability to rejection and hurt. She needs to trust Paul to behave in a trustworthy manner and show his investment in the relationship. Such situations of conflict of interests thereby are especially diagnostic for trust in relationships (Rusbult & Van Lange, 2003). Consistent with this idea, a recent meta-analysis has shown that people cooperate relatively easily when their interests do not conflict much. However, trust becomes a strong determinant of cooperation in situations of large conflict of interests (Balliet & Van Lange, 2013) because in those contexts there is much uncertainty, and consequently more risk, about the other person's behavior.

Although trust is especially relevant in situations of conflict of interests, trust can also be involved in situations in which people are working toward a common goal and the truster needs to believe that the trustee can carry out the task and reach a common goal. For example, if Lisa and Jeff are working together on an important order that needs to be delivered in time, Lisa may accept vulnerability and decide to divide the tasks with Jeff if she trusts that he will carry out his duties and ultimately his part on time.

Trustees' Characteristics: Who Are Trustworthy Partners?

One of the most prominent models that describe the characteristics of a trustworthy partner is proposed by Mayer, Davis, and Schoorman (1995). According to their model, the perception of the trustee's ability, benevolence, and integrity are crucial determinants of trust. *Ability* is a group of skills, competencies, and characteristics that enable the trustee to exert influence in a specific domain. For example, people may trust their plumbers because they assume that their plumbers have the knowledge and know-how to repair their sink better than they could on their own. *Benevolence* is the belief that the trustee is motivated to bring benefit to the truster due to some specific attachment or history with the truster (e.g., prior experiences, romantic partners). Finally, *integrity* is the belief that the trustee adheres to principles and values acceptable to the truster. For example, a truster may believe that the trustee will follow norms of kindness and generosity toward old women and children. Although they have different roots, benevolence and integrity both represent a motivation to behave in a benevolent manner. Thus, trust can be considered as being influenced by the perception of two trustee characteristics: His or her

ability to perform a particular behavior and the motivation to act favorably toward the truster.

Trusters typically infer ability and motivation from previous behaviors of and experience with the trustee (see Heider, 1958; Weiner, 1986). For example, in two large longitudinal studies among couples, Wieselquist and colleagues (1999) found that people's greater commitment to their partner (Rusbult, 1983) motivated them to engage in more prorelationship behaviors (e.g., forgiveness, sacrifice, accommodation). When the partner perceived these behaviors, he or she consequently experienced greater trust. Wieselquist and colleagues suggest that engaging in prorelationship behavior is essential for the development of trust because it shows that the partner is motivated to transform self-oriented impulses into behaviors that are beneficial to the partner and the relationship. However, many prorelationship behaviors that occur in relationships are not only the result of the motivation to deviate from selfish impulses but also reflect the ability to do so. In situations that call for trust, for example, in situations of conflict of interests, self-control provides people the ability to engage in prorelationship behaviors and to behave in a trustworthy manner (Pronk & Righetti, 2015; Righetti & Finkenauer, 2011).

PERCEIVED SELF-CONTROL AS THE ABILITY TO BE TRUSTWORTHY

Self-control is the ability to change one's thoughts, emotions and behaviors to bring them in alignment with a standard (e.g., Baumeister, Vohs, & Tice, 2007). Self-control can vary across individuals (trait) and across situations (state) (Tangney, Baumeister, & Boone, 2004). Although some people generally have more self-control than others, there are situations in which most people experience a reduction in self-control and a state of ego depletion (Baumeister & Heatherton, 1996). Self-control depends on a limited resource that operates like a strength or energy. People consume this resource when they exert self-control, and it weakens with each following exertion of behavior that requires self-control (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998; Muraven, Tice, & Baumeister, 1998), ultimately leading to self-control failure. Typically, in the experimental paradigm testing the effects of self-control depletion, half of the participants are asked to engage in an initial task that requires self-control while the other half performs a comparable but neutral task. Afterward, all participants perform a second, unrelated task that requires self-control (e.g., attempting to solve unsolvable anagrams). Compared to participants who performed the neutral task, participants who had earlier engaged in a task requiring self-control are depleted of self-regulatory resources. Their performance is generally poorer on the second task, and they are more likely to encounter self-control failure (e.g., Baumeister et al., 1998; Muraven et al., 1998).

Although self-control is a general ability to bring an individual closer to some standards in the personal and interpersonal sphere, people use much of their self-control to promote better interpersonal functioning (for a review, see Pronk & Righetti, 2015). This means that people often use self-control to refrain from selfish impulses that could damage others and to behave in a more prosocial manner (for an exception, see Righetti, Finkenauer, & Finkel, 2013).

Consistent with this idea, previous research has shown that self-control promotes many prorelationship behaviors, such as engaging in perspective taking (Tangney et al., 2004), being able to accommodate after having being provoked by one's partner (Finkel

& Campbell, 2001), and forgiving after one has been hurt (Balliet, Li, & Joireman, 2011; Burnette et al., 2014; Pronk, Karremans, Overbeek, Vermulst, & Wigboldus, 2010). Self-control also provides the ability to refrain from intimate partner violence (Finkel, DeWall, Slotter, Oaten, & Foshee, 2009), to derogate attractive alternatives and remain faithful (Pronk, Karremans, & Wigboldus, 2011; Ritter, Karremans, & van Schie, 2010), to engage in some forms of sacrifice (Pronk & Karremans, 2014), and to maintain balance between personal and relational needs that ultimately promotes relationship satisfaction (Visserman, Righetti, Kumashiro, & Van Lange, 2014).

Self-control is associated with various beneficial behaviors in the personal sphere. Importantly, highly self-controlled individuals are also more successful in their personal lives than individuals with low self-control. For example, they obtain higher academic achievements, have better physical and mental health, and have greater financial success (Boals, vanDellen, & Banks, 2011; Crescioni et al., 2011; Duckworth & Seligman, 2005; Moffit et al., 2011; Tangney et al., 2004).

Given the many advantages that self-control brings to people's interpersonal and personal lives, we proposed that people who are high in self-control are usually perceived to be trustworthy partners in situations in which there are either conflict of interests or common interests. In situations of conflicting interests, in which the first impulse is to be self-interested, self-control enables people to inhibit this impulse and instead act according to broader considerations (e.g., their partner's interests, relationship interests, social norms, values, ideals, or long-term goals). Thus, people with high self-control are better able to enact prorelational responses (e.g., forgiveness) than those with low self-control, and for this reason, they can be trusted more. In situations of common interests (i.e., situations in which people are working toward a common goal), people with high self-control are less likely to act according to destructive impulses (e.g., procrastinating, giving up too early) and are better able to accomplish their goals. Thus, people have learned that others with high self-control are effective goal pursuers. Consequently, they will expect greater reliability and trustworthiness when pursuing a common goal with high self-control others than with low self-control others.

Adult Relationships

To test this idea, we conducted a set of studies that assessed whether individuals can perceive both trait self-control and depletion of state self-control in others, and how these perceptions influence interpersonal trust (Righetti & Finkenauer, 2011). In one study, participants were asked to form an impression of a stranger who, they were led to believe, had performed a behavior in the past that required high versus low self-regulatory strength. For example, in the high-self-control-other condition, participants were led to believe that an ostensible other participant had financial problems and, although tempted to purchase certificates of deposit (CDs), resisted the temptation and eventually did not buy anything. In the low-self-control-other condition, participants were led to believe that the ostensible other participant had financial problems and, when tempted to purchase CDs, bought several of them. Participants rated the stranger as more trustworthy when he or she displayed high rather than low self-control. Furthermore, participants' perception of the stranger's self-control mediated the effect of the stranger's high versus low self-regulatory behavior condition on participants' trust.

In a second study, we tested the same hypothesis among married couples. People learn about others' traits from observing their behavior. In this study, we examined whether people use the perception of three behaviors that require self-control (forgiveness, successful goal achievement, and reliability) to infer the level of their partner's self-control and, in turn, whether high-self-control partners are trusted more than low-self-control partners. Each partner completed questionnaires assessing his or her perceptions of the partner's forgiveness, successful goal accomplishment, reliability, and self-control. Then participants were asked how much they trusted their partner. Results revealed that the more partners were perceived to perform the three behaviors, the more they were perceived to be high in self-control and, eventually, were trusted more.

Two follow-up studies demonstrated that individuals can also detect the temporary state of self-control depletion in others, and that this perception influences their judgment of others' trustworthiness. Upon coming to the laboratory, participants engaged in a 2-minute attention-control task that required the exertion of self-control. The task was designed not to deplete them, but rather to allow them to experience the task. Subsequently, participants were told that a fellow participant in another cubicle had performed the task for either 2 minutes (nondepleted-other condition) or 15 minutes (depleted-other condition). Participants attributed lower self-control strength to the other participant who performed the video task for 15 minutes than to the one who did so for 2 minutes, and, crucially, they trusted the nondepleted participant more than they did the depleted participant. In addition, compared to participants who perceived the other to be non-depleted, participants who perceived the other participant to be depleted of self-control strength invested less money in the depleted participant during an economic game, indicating diminished trust.

Subsequent research indicated that *compulsive Internet use*, defined as a loss of control over one's Internet behavior (LaRose, Lin, & Eastin, 2003) and characterized by unsuccessful efforts to control, cut back, or stop Internet use when intended (Young, 2004), is also a behavior that signals a partner is low in self-control and therefore can be trusted less (Muusses, Finkenauer, Kerkhof, & Righetti, 2015). Given the addictive characteristics of compulsive Internet use (e.g., withdrawal reactions when the Internet is not available, preoccupation with the Internet, and repeated unsuccessful efforts to decrease or stop Internet use; Greenfield, 1999; Meerkerk, van den Eijnden, Vermulst, & Garretsen, 2009), this behavior should be pretty visible to a romantic partner and be used as a gauge to infer self-control. Consistent with this idea, adopting a relational perspective and testing for cross-partner effects, Muusses and colleagues (2015) found that individuals with low self-control indeed were more likely to engage in compulsive Internet use. Importantly, consistent with the hypothesized cross-partner effect, partners accurately perceived this behavior. Perceiving compulsive Internet use, in turn, led individuals to infer that their partner had low self-control, and, consequently, they trusted him or her less. Thus, although Internet use is a pervasive behavior in modern society, not being able to turn one's attention away from it can damage people's relationships (Kerkhof, Finkenauer, & Muusses, 2011), and one possible mechanism is that this behavior signals low self-control and, consequently, low trustworthiness.

To sum up, the empirical evidence that we have described indicates that, among adults, self-control is an important characteristic to which people attend in order to determine whether they can trust others. Do these findings extend to other relationships?

Parent–Child Relationships

We started this chapter by claiming that trust is important in all interdependent relationships. Empirical evidence confirms this suggestion for not only adult relationships but also for relationships among children, and between parents and children. Among children and adolescents, trustworthy peers are preferred as friends (Rotenberg et al., 2004). Furthermore, parents who trust their children share more information with them, and spend more time with them (Kerr, Stattin, & Trost, 1999). When children feel that their parents trust them, in turn, they report fewer arguments and more acceptance in the family. Thus, trust is essential in relationships between parents and children.

The question that arises, then, is whether perceived self-control may serve as an indicator of trust in family relationships. Family relationships provide a unique challenge for our prediction, in that they comprise horizontal relationships between family members, with equal status of both adults and children (i.e., parent–parent and sibling–sibling relationships) and vertical relationships in which partners have unequal status (i.e., parent–child relationships). Do family members use self-control to appraise whether they can trust each other?

As we have described, in horizontal relationships, adults do indeed use their perception of each other's self-control as a gauge for trustworthiness. Does this also apply to children's relationships with their peers and adults? The existing literature suggests that the answer is "yes." To illustrate, children with low self-control at age 8.5 years showed poorer school and social functioning at age 9.5, as indicated by teacher ratings. Also, peer nominations indicated that those children were less accepted by their peers (Diamantopoulou, Rydell, Thorell, & Bohlin, 2007). Furthermore, research suggests that even 4-year-olds are selective in trusting adult strangers, preferring an informant who was more accurate and more emotionally reliable over an informant who had committed an error in a previous encounter (Harris, 2007). Thus, research suggests that children, too, may use perceived levels of their peers and adult strangers' self-control to appraise their trustworthiness.

Although children may be likely to assess others' levels of self-control, it is unclear whether they do so with their parents. Similarly, it is unclear whether parents appraise their children's levels of self-control to gauge their trustworthiness. On the one hand, for these vertical relationships, there are reasons to predict that parents and children trust each other unconditionally (Steinberg, 1990). Nevertheless, both parents and children need to trust each other to be reliable: Parents desire to instill self-control in their children because they need to rely on their children to control their impulses, delay gratification, pursue long-term goals, express their emotions adequately, and meet their obligations and responsibilities, even when there is no parental supervision (Finkenauer, Engels, & Baumeister, 2005). Children monitor the reliability of familiar and unfamiliar adults (Harris, 2007), probably because they are fully dependent on adults' capacities to provide emotional security and be responsive to their needs (Davies, Sturge-Apple, & Winter, 2006).

To examine whether family members in all types of family relationships trust family members whom they perceive to possess high self-control more than they trust family members, whom they perceive to be low in self-control, Buyukcan-Tetik, Finkenauer, Siersema, Vander Heyden, and Krabbendam (2015) conducted a study among 84 families

that comprised two parents and two children. All four family members completed measures assessing the extent to which they trust all other family members and their perception of all other family members' levels of self-control. To test their hypotheses, Buyukcan-Tetik and colleagues applied the social relations model (Kenny, Kashy, & Cook, 2006).

Social relations modeling in a full-family design with four family members allowed the researchers to examine the associations between perceived self-control and trust in both horizontal and vertical relationships, irrespective of whether the family members are adults or children (Kenny et al., 2006; Kenny & Livi, 2009). Not surprisingly, generational differences between parents and children emerged. Specifically, on average, parents perceived less self-control in their children; they were perceived as having more self-control than their children; and they were trusted more. The reverse was true for children. Given that self-control and trust increase with age (e.g., Green, Fry, & Myerson, 1994; Sutter & Kocher, 2007), these findings support the idea that children and adults are accurate perceivers of other family members' levels of self-control.

Consistent with predictions, the bivariate associations between perceived self-control and trust yielded the predicted links at all levels of the analysis: On average, families with higher levels of perceived self-control also had higher levels of trust. Also, on average, family members who were perceived as having higher levels of self-control were also trusted more by all other family members. Crucially, consistent with the key prediction, perceived self-control was significantly related to trust in almost all specific relationships (10 out of 12 possible correlations across a family with four members); that is, the more a family member perceived a specific partner to have higher self-control, the more that family member trusted that specific partner. To illustrate, fathers who perceived their older child to have higher self-control also trusted their older child more. Similarly, an older child who perceived his or her mother to have higher self-control also trusted the mother more.

These findings further highlight the key role that perception of self-control plays in trust. Importantly and to our knowledge, for the first time, they suggest that even in family relations, trust needs to be earned. Family members, both parents and children, appraise other family members' ability to control their impulses, resist temptations, and regulate their behavior and emotions to evaluate their trustworthiness.

DOWNSIDES OF HIGH SELF-CONTROL IN INTERPERSONAL CONTEXTS

As we have demonstrated, being perceived to be high in self-control has several advantages. People tend to trust high-self-control others more, and they are more likely to form a meaningful and close relationship with them. Nevertheless, there might be costs associated with being perceived as high in self-control and reliable in most circumstances. Recent research from Koval, vanDellen, Fitzsimons, and Ranby (2015) has shown, in six studies, that people expect, and ask more, from high-self-control others than from low-self-control others. People may know that high-self-control others are persistent, do not give in to temptations, and are able to exert effort in tasks; therefore, they are likely to expect high outcomes from them. Because of this, people may also tend to ask high-self-control others to contribute more to joints tasks, expecting that this contribution

would require less effort from them than from low-self-control others. Being considered capable, being relied upon, and being asked to do more tasks than others can be costly to individuals with high self-control. Because time, energy, and self-control resources are limited, even high-self-control individuals may suffer from self-control depletion if they are overloaded with tasks. In fact, Koval and colleagues found that, high-self-control individuals feel burdened by others, in both their professional and personal lives. This is not surprising because being considered the one “who can always be relied on” and the one who “can do the task if nobody else had finished it” may be experienced as unfair and tiresome. Furthermore, being expected to always perform the best, doing more work than others, and helping close others’ goal pursuit consumes resources that could have gone toward the pursuit of other, important personal goals. When high-self-control individuals realize that their own goal pursuits are negatively affected by others’ requests, they may feel that others are burdening them.

Although, in general, high-self-control individuals tend to have better relationships than low-self-control individuals (Visserman et al., 2014; Vohs, Finkenauer, & Baumeister, 2011), Koval and colleagues (2015) also found that when high-self-control individuals feel burdened by others’ requests, they also experience a decrease in relationship satisfaction. Thus, although high-self-control individuals, by being trustworthy, are able to promote many beneficial relationship dynamics that foster relationship satisfaction, there is one dynamic that backfires: If people ask too much, high-self-control individuals may feel that there is an imbalance in their relationship, and they may feel exploited by these interpersonal requests.

Another dynamic in which high self-control may not be conducive to furthering trust is interpersonal competition. Self-control is an ability that, very often, serves interdependent functioning. It is ultimately a tool that enables people to attain a chosen goal; however, at times, self-control can be used to promote a self-serving goal (e.g., Righetti et al., 2013). For example, in competitive settings, the goal that best suits the situation is to harm the competitor to gain personal advantage. However, highly empathic individuals might impulsively feel bad about hurting others and may not be able to do so. Self-control may enable the individual to minimize the impact of such empathic concerns and instead act on the main competitive goal. In a war, for example, an enemy with high self-control is able to inhibit feelings of empathy, and he or she can behave in a goal-oriented manner. He or she will be able to destroy and kill, ignoring personal and human scruples. In such a context, an individual with high self-control may be perceived as extremely dangerous and obviously not trustworthy. Certainly, situations in which self-control is used to promote selfishness or to harm others represent only a minority of interpersonal situations and settings. As previous research has shown, most of the time, self-control is used in favor of interpersonal harmony (Balliet et al., 2011; DeWall, Baumeister, Gailiot, & Maner, 2008; Finkel & Campbell, 2001; Finkel et al., 2009; Peetz & Kammrath, 2011; Pronk et al., 2010, 2011; Ritter et al., 2010; Tangney et al., 2004). People who have learned the association between self-control strength and positive interpersonal behaviors may be more likely to expect prosocial responses from others who are high, rather than low, in self-control. A very interesting question for future research is whether people are able to correct for this expectation, whether they are able to consider that self-control may in certain contexts (e.g., competitive setting) be a characteristic that may be used to harm them, and that high-self-control others cannot be trusted.

THEORETICAL AND CLINICAL IMPLICATIONS

Overall, the literature we have reviewed provides converging evidence that people, adults and children, rely on partners' trait and state self-control to gauge their trustworthiness (Buyukcan-Tetik et al., 2015; Gomillion, Lamarche, Murray, & Harris, 2014; Righetti & Finkenauer, 2011). Given that we adopted an interpersonal perspective on self-control, the findings we describe in this chapter have important implications for our theories on relationships and highlight the dyadic impact of self-control. A daily diary study by Gomillion and colleagues (2014) illuminates this impact by identifying possible interaction cycles between relationship partners with high and low self-control. The study showed that although trust seems to be enhanced when partners are perceived to have high self-control, betrayal and rejection are still hurtful. Yet when rejecting partners are perceived to have high self-control, as compared to low self-control, people seem to give them more credit and are more optimistic that they will behave better in the future. Consequently, they retaliate less against high-self-control partners who have previously behaved in a rejecting manner. Importantly, high-self-control partners seem to deserve their credits; they make amends and engage in more positive behavior after having rejected their partner, thereby not only fostering positive interaction cycles but also preventing potentially hurtful interactions from becoming destructive.

The important implication for research on trust in relationships is that behavioral cues indicating self-control by one partner are perceived by the other partner. This partner, in turn, makes inferences about the other partner's dependability, predictability, and concern for his or her well-being and safety (Holmes & Rempel, 1989). Enacting self-controlled behavior therefore seems to provide people with a necessary cue that the other has the ability to maintain the relationship and engage in behavior that is best for both partners, even in situations in which partners' interests diverge. It is also a sign that the other is capable of reducing risk and enhancing safety and security (e.g., Collins & Feeney, 2000; Mikulincer, 1998). These suggestions have important implications for research and clinical practice in that they point to three interpersonal variables that affect the interplay between self-control and trust, and that are susceptible to change.

Behavioral Signals of Self-Control

The first variable is self-controlled behavior. It is possible that some behaviors indicating self-control are easier to judge and are better predictors of trustworthiness than others. Researchers have begun to examine which types of behavioral cues are diagnostic cues for self-control. Typically, these behaviors signal that people are able and motivated to engage in costly and effortful behavior, which contributes to their own goal achievement, including successful dieting, school or work success, and resisting temptations (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012; Muusses et al., 2015; Righetti & Finkenauer, 2011), or promotes the betterment of the relationship, including keeping promises and being accommodating during conflicts (Finkel & Campbell, 2001; Peetz & Kammrath, 2011). More research examining the extent to which different types of self-controlled behavior reliably predict others' future behavior would be important. Which behavioral cues can people look for to make the best predictions about others' trustworthiness and dependability? Do these cues vary across contexts (e.g., professional

vs. intimate relationships), relationships (e.g., friendship vs. romantic relationship), and perceivers (adults vs. children)?

The Truster

The second variable is the truster and perceiver of self-control in others. Research including both relationship partners indicates that people's perceptions of each other's self-control are anchored in reality. Relationship partners show significant, although moderate cross-partner agreement, between one partner's perception and the other's self-report of self-control (Righetti & Finkenauer, 2011). Research investigating how accurate people are in detecting and perceiving different types of self-controlled behavior would be particularly promising. To illustrate, for relationship partners, it may be more relevant to detect forgiveness than to detect restraint in eating behavior (Gill & Swann, 2004). Yet it is unclear which of these behaviors is more predictive of trustworthiness. Similarly, it is possible that people with high self-esteem (Murray et al., 2001) or with a secure attachment style (Mikulincer, 1998) are better at detecting and utilizing cues of self-control in others, which allows them to experience trustworthy interactions with others that may foster their sense of trust in others.

The Trustee

The third variable is the trustee and enactor of self-control. Empirical evidence suggests that self-control can be strengthened (e.g., Baumeister, Gailliot, DeWall, & Oaten, 2006; Diamond & Lee, 2011). To illustrate, self-control can be strengthened by effortful exercises that require people to override automatic behaviors, such as using one's nondominant hand for various minor tasks, such as opening doors and brushing teeth, or following special speech rules (e.g., saying "yes" instead of "yeah"; not swearing; Baumeister et al., 2006). Finkel and colleagues (2009) found that students who had engaged in such exercises for 2 weeks reacted less aggressively to provocations by their romantic partner than did students who had not done these exercises. Hung and Labroo (2011) demonstrated that exercises firming physical muscles increased self-control strength, enabling people to resist food temptations and to tolerate pain longer. Oaten and Cheng (2006) showed that a 2-month physical exercise training program improved performance on laboratory tests of self-control and also yielded behavioral improvements in healthy eating, finances, and household maintenance. Extending these findings to trustworthiness, it is possible that strengthening self-control among trustees also increases their trustworthiness and, ultimately, may improve their relationships.

Practical Implications

These suggestions have implications for prevention and intervention. In couple therapy, relationship partners often struggle with trusting the other: Can I let my guards down and be dependent and vulnerable? Can I count on the other in times of stress, need, or trauma? Will the other be able to protect me when I am vulnerable (e.g., Johnson & Bradley, 2009)? The answers to these questions become all the more important when one considers the positive effects of proximity of close, trustworthy others. They signal safety of the (social) environment (e.g., Bowlby, 1973) and reduce physiological stress

and pain reactions (Coan, Brown, & Beckes, 2014; Eisenberger, Taylor, Gable, Hilmert, & Lieberman, 2007). Trustworthy partners are perceived as having the propensity and resources to act to protect the person by maintaining safety and/or decreasing perceived environmental threat. Their presence can literally make the world seem less challenging. To illustrate, Schnall, Harber, Stefanucci, and Proffitt (2008) found that participants perceived hill slants as less steep when they stood next to a friend rather than a stranger. This effect was moderated by the duration of the friendship. The longer participants had been friends, the less steep the hill seemed. These findings suggest that to help couples grow and establish feelings of safety, improving both levels of self-control and relationship quality may be important to rebuild trust in couple intervention and treatment.

Similarly, in treatments with victims of family violence, child abuse, and maltreatment, a lack of trust in others in general, and in intimate partners in particular, is recognized as one factor that contributes—albeit partly—to some of the devastating consequences, including revictimization, mental health problems, delinquency, isolation, shame, guilt, low self-esteem, and insecure attachment (Egeland, Yates, Appleyard, & van Dulmen, 2002; Herrenkohl, Sousa, Tajima, Herrenkohl, & Moylan, 2008). Therefore, rebuilding and repairing trust among victims should have absolute priority in treatment. Our review suggests that victims may profit from an intervention that helps them to improve their accuracy in detecting and utilizing cues of self-control in others, to ensure their interpersonal safety and prevent revictimization. Importantly, given the dyadic nature of trust and the crucial role of parents in children's coping with abuse (Kendall-Trackett, Williams, & Finkelhor, 1993; Tremblay, Hebert, & Piche, 1999), not only victims but also relationship partners and parents should be the target of interventions. The evidence reviewed in this chapter provides novel suggestions that may help relationship partners to aid in rebuilding victims' trust: Enacting prorelationship behavior that signals high self-control, such as suggesting constructive strategies to solve dilemmas, inhibiting destructive impulses and aggression, keeping promises, and engaging in relationship-enhancing behaviors (e.g., forgiveness, accommodation) should facilitate trust repair. Similarly, goal-directed behavior that signals high self-control (e.g., eating healthy food, going to the gym, working hard for a promotion) should foster trust among victims.

CONCLUDING REMARKS

We have proposed that self-control is key to unraveling how people discern others' trustworthiness. Self-controlled behavior provides unambiguous evidence that a person is able and willing to engage in behavior toward the self that is beneficial and positive, even when the self is vulnerable and dependent. Perceiving self-control in others thereby serves as a cue that reduces interpersonal risks and uncertainty. We believe that our suggestions, and the evidence that supports them, complement existing models that, so far, have emphasized trustor's characteristics (see Simpson, 2007b, for a review) and situational factors (Balliet & Van Lange, 2013; Wieselquist et al., 1999). Although we concur that trustees' dispositions and situational factors are important to explain trust among people, our framework highlights the importance of considering trusters' characteristics that promote trust. Beyond providing an overview of the current state of the art of research on the interpersonal effects of self-control in different types of relationships, our framework

may serve as a theoretical basis for future research on the role of self-control in the development of trust and, importantly, trust repair.

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CHAPTER 15

Self-Regulation as a Transactive Process

*Reconceptualizing the Unit of Analysis
for Goal Setting, Pursuit, and Outcomes*

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Pity poor Linus, the solitary ostrich foraging in Kenya's Tsavo West National Park. He is hungry, but he knows that eating, with his head buried in the grass and other low vegetation, makes him especially vulnerable to predation. He must take regular breaks to raise his head so he can scan his surroundings for lions and other predators. Contrast his situation with that of Schroeder, an ostrich in the Park who is foraging in the company of Charlie, a conspecific. Schroeder, too, is hungry and wishes to avoid predation, but the presence of Charlie, with whom he can share the task of scanning for predators, means that he can spend more of his feeding time actually eating. Indeed, if Linus and Schroeder are typical of ostriches foraging alone rather than in pairs, Linus will spend 35% of his feeding time with his head in the air rather than eating, whereas for Schroeder, it will be only 23%. More importantly, Schroeder's diminished vigilance does not make him more vulnerable because the total amount of time that at least one ostrich's head, either Schroeder's or Charlie's, is raised is slightly higher when feeding in pairs than when feeding alone—37% versus Linus's 35% (Bertram, 1980; for a broad review, see Coan & Maresh, 2014).

Parallel findings pervade vast swaths of the animal kingdom. Consider the regulation of body temperature among rodents. Such thermoregulation, which is a prerequisite for survival, is bioenergetically costly, but how much bioenergetic resource investment it requires is lower when the rodents are in small social groups rather than by themselves. In a recent experiment, for example, members of *Octodon degus* (a Chilean rodent) were housed either by themselves or in groups of three or five (Nuñez-Villegas, Bozinovic,

& Sabat, 2014). The *basal metabolic rate*—the minimum rate of energy expenditure necessary to maintain homeostasis—of degus housed alone was 25% higher than that of degus housed in groups (2.16 vs. 2.69 kilojoules/hour⁻¹), which left them with fewer bioenergetic resources available for other tasks (for a broad review, see IJzerman et al., 2015).

We suggest that the feeding behavior of Kenyan ostriches and the thermoregulation tendencies of Chilean rodents speak to a crucial but widely neglected truth about self-regulation: that goal dynamics—goal setting, pursuit, and outcomes—are fundamentally social processes. Indeed, the central thesis of this chapter is that the most accurate unit of analysis for understanding human goal dynamics is not the individual person but rather the interdependent social group.

On first blush, this thesis might seem preposterous. As this handbook illustrates, research on self-regulation has been hugely innovative and influential in recent decades, and the rate of progress remains robust. Why must we consider a challenge to the pervasive (if implicit) assumption that goal-related processes predominantly reside within a single individual?

If the goal of self-regulation research is to develop models of goal-relevant processes that emerge within prototypical laboratory experiments—those in which individuals are, for example, seated alone at a table with a marshmallow on it or at a computer screen with tempting images on it—then the individual unit of analysis may well be optimal. If, in contrast, self-regulation researchers want to understand how people set, pursue, and achieve goals in their everyday lives, then a predominant focus on individual-level processes is likely to yield an incomplete, perhaps even inaccurate, understanding of goal dynamics. Consequently, we argue, any conceptual model seeking to capture such dynamics must address topics such as how pervasively people set and pursue goals for others and have those others set and pursue goals for them, and the circumstances under which social processes promote rather than undermine goal achievement.

To be clear, this thesis is not simply an argument about external validity. Of course, the pursuit of empirical paradigms that more closely approximate typical goal-relevant experiences from people's everyday lives is a worthwhile goal in itself, but that issue is secondary in this chapter. The primary issue is that the field's conceptualization of goal dynamics predominantly as within-individual processes, as implied by the term *self-regulation*, has yielded theoretical models that, we argue, do not approximate the true nature of goal setting and pursuit as these processes function in people's everyday lives.

TRANSACTIONAL GOAL DYNAMICS THEORY

The self-regulation literature is replete with theoretical models and empirical paradigms that treat the individual as the unit of analysis, and many of these models have produced groundbreaking insights. However, a broad range of 21st-century findings has begun to suggest that this individual level of analysis is oversimplified. For example, scholars interested in public health have demonstrated that important variables related to self-regulation—such as health behaviors and outcomes—can spread through social networks (Christakis & Fowler, 2008). One 32-year study of over 12,000 participants revealed that the odds of becoming obese increased by 37% if one's spouse had become

obese, and that the odds of quitting smoking increased by 25–67% if a friend, family member, coworker, or spouse had quit smoking (Christakis & Fowler, 2007, 2008). Likewise, a large-scale study of a team-based weight loss competition demonstrated that team members, all of whom were clinically overweight or obese, lost more weight to the extent that their teammates reported greater social influence in the weight loss domain (Leahey, Kumar, Weinberg, & Wing, 2012).

Such studies illustrate the influence of social factors on consequential outcomes. What they lack is clarity about the psychological mechanisms driving the effects. Although psychologists have increasingly recognized the importance of integrating social processes into the study of self-regulation (e.g., Aarts, Gollwitzer, & Hassin, 2004; Baumeister, DeWall, Ciarocco, & Twenge, 2005; Feeney, 2004, 2007; Finkel et al., 2006; Fitzsimons & Bargh, 2003; Gollwitzer, Sheeran, Michalski, & Seifert, 2009; Karremans, Verwijmerin, Pronk, & Reitsma, 2009; Richeson & Shelton, 2003; Shah, 2003; vanDellen & Baker, 2011; Vohs, Baumeister, & Ciarocco, 2005; Walton & Cohen, 2007; for reviews, see Finkel & Fitzsimons, 2011; Fitzsimons, & Finkel, 2010), little effort has been made to provide theoretical integration, which means that the emerging literature is a collection of largely disconnected effects.

In a recent review article, we offered a first attempt to provide an integrative theory, which we call *transactive goal dynamics* (TGD) theory (Fitzsimons, Finkel, & vanDellen, 2015). Rather than characterizing a given pair of people as two independent, self-regulating agents with largely independent goals and pursuits, TGD theory builds on the central insight behind research on transactive memory (Wegner, Erber, & Raymond, 1991) to characterize the social group as one self-regulating unit, with each member as a subunit in a single system of goal dynamics. It asks three questions about each goal that exists within a transactive system. For example, in the system created by a young married couple, John and Alice, who both work full time and who are raising their 2-year-old son: (1) who *sets* the goal (John, Alice, or both), (2) who is the *target* of the goal (John, Alice, or both), and (3) who *pursues* the goal (John, Alice, both, or neither)?

The emphasis emerging from this transactive approach diverges sharply from the emphasis that emerges from prevailing approaches in the self-regulation literature, in which John and Alice are independent agents who set and pursue their own goals independently. John wants to lose weight (goal setting), cuts back his carbohydrate consumption (goal pursuit), and drops 10 pounds (goal outcome); Alice wants to get a promotion (goal setting), spends more hours at the office (goal pursuit), and gets promoted (goal outcome). These cases are undeniably important but, we suggest, they represent a small subset of the goal-relevant dynamics that characterize people's everyday lives. In this sense, the field of self-regulation research is much deeper than it is broad.

Figure 15.1 illustrates the tenets of TGD theory. The first tenet is simply that relationship partners combine to form a single self-regulating unit, which consists of a complex web of goals, pursuits, and outcomes. The second tenet suggests that the *transactive density* of a given relationship—the complexity of the web of goal-related interdependence—is especially high when the partners have both the opportunity (e.g., circumstances that afford or require frequent interaction) and the motivation (e.g., mutual liking) for high levels of goal-relevant interdependence. The third tenet suggests that high transactive density interacts with *goal coordination*—the efficient use of pooled goal-relevant resources—to predict goal outcomes. Specifically, transactive density improves outcomes when coordination is strong (when goal facilitation is robust, role specialization

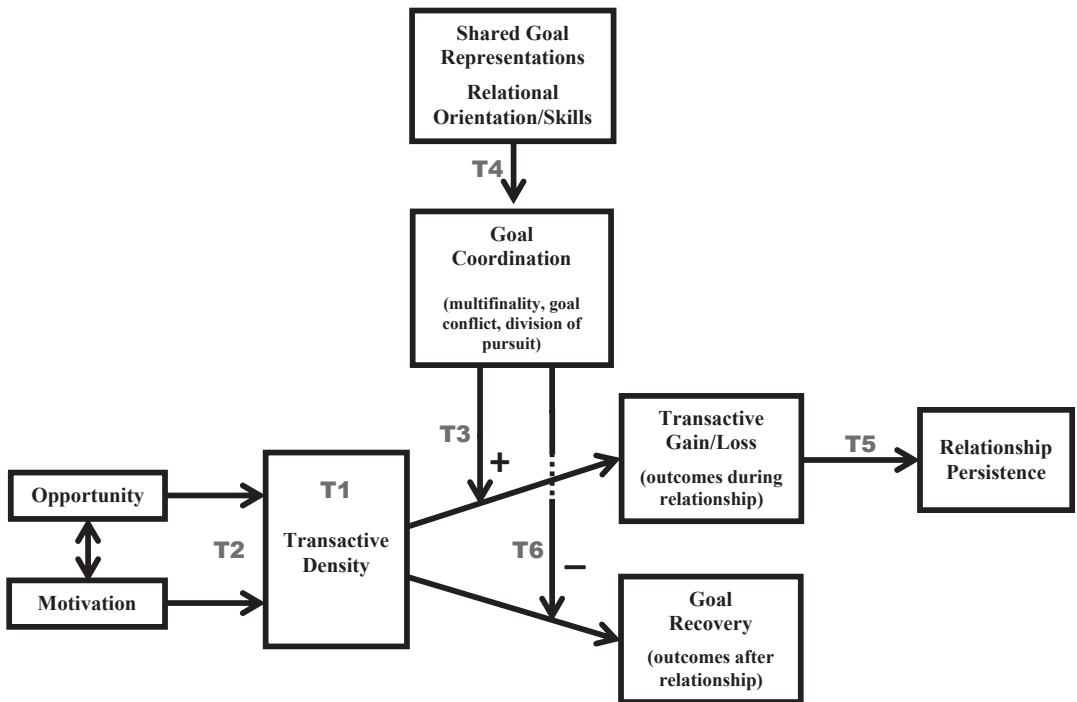


FIGURE 15.1. An overview of TGD theory. The Tenet 1 (T1) box represents the structure of transactive density. Tenet 2 (T2) indicates that opportunity and motivation are the key antecedents of transactive density. Tenet 3 (T3) indicates that goal coordination moderates the effect of transactive density on transactive gain/loss (goal outcomes during the relationship). Tenet 4 (T4) indicates that shared goal representations and relationship orientation/skills are the key antecedents of goal coordination. Tenet 5 (T5) indicates that transactive gain/loss predicts relationship persistence. Tenet 6 (T6) indicates that goal coordination moderates the effect of transactive density on goal recovery (goal outcomes after the relationship ends). From Fitzsimons, Finkel, and vanDellen (2015). Copyright 2015 by the American Psychological Association. Reprinted by permission.

is strategic, and goal conflict is minimal), but it undermines outcomes when coordination is weak. The fourth tenet is that strong goal coordination emerges from shared goal representations (e.g., both John and Alice want John to lose weight) and the partners' relationship orientation and skills (e.g., Alice is highly committed to John's well-being). The fifth tenet is that partners who experience *transactive gain*, or strong goal outcomes as a result of involvement in the relationship (e.g., stronger outcomes than they would have experienced on their own), are especially likely to persist in the relationship over time. The sixth tenet is that transactive density and goal coordination *during the relationship* interact to predict poor goal outcomes for the partners after the relationship ends. In a sense, this tenet is a postbreakup mirror image of the third tenet (in Figure 15.1, contrast the negative sign associated with the T6 arrow with the positive sign associated with the T3 arrow): To the extent that John and Alice facilitated each other's goal outcomes, specialized effectively, and had minimal goal conflict during the relationship, the harder it will be for each of them to develop effective goal dynamics following the termination of the relationship.¹

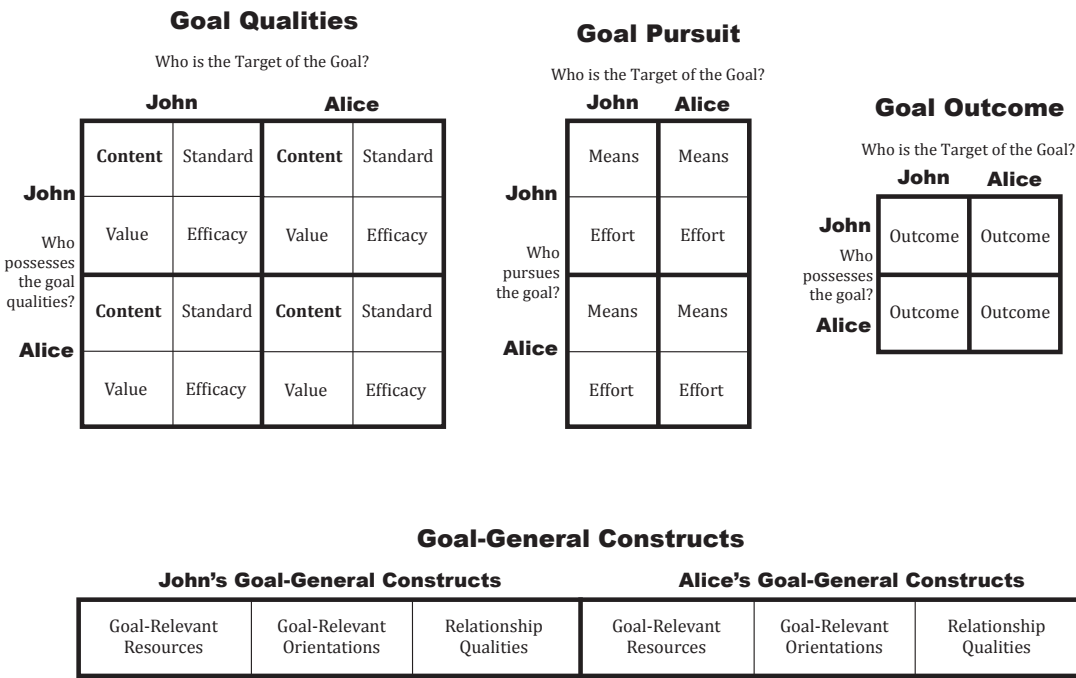
THE TGD PROCESS FRAMEWORK

In this chapter, we use the transactive perspective afforded by TGD theory to construct a descriptive, process-oriented framework of how two people’s goals, pursuit, and outcomes shape one another. This framework, which we call the *TGD process framework*, articulates basic pathways through which two people’s goals can affect each other, exploring how both partners’ possession and pursuit of goals targeted toward the self, partner, and system influence both partners’ goals, pursuits, and outcomes. The framework explores how established constructs from the self-regulation and goal pursuit literatures interact across members of a dyad to produce new patterns of behavior and outcomes.

Figure 15.2 provides a graphical depiction of the TGD process framework. Goal qualities appear at the left in a 2 (possessor: John’s or Alice’s goal) × 2 (target: John’s or Alice’s outcomes) structure. Goal pursuit appears in the middle in a 2 (pursuit: John’s or Alice’s pursuit) × 2 (goal target: John’s or Alice’s outcomes) structure. Goal outcomes appear at the right in a 2 (possessor: John’s or Alice’s goal) × 2 (target: John’s or Alice’s outcomes) structure. Goal-general constructs—goal-relevant resources, goal-relevant orientations, and relationship qualities—appear at the bottom.

Goal Qualities

Goal qualities describe characteristics of the goals within a transactive system (content, standard, value, and efficacy; see left portion of Figure 15.2). These qualities can be



oriented toward the self, the partner, or both, and they are independent of the process of pursuing the goal. *Self-oriented* goal qualities are those oriented toward one's own goal-relevant outcome, *partner-oriented* goal qualities are those oriented toward the partner's goal-relevant outcome, and *system-oriented* goal qualities are those oriented toward both partners' goal-relevant outcomes. Knowing that a goal is self-oriented, partner-oriented, or system-oriented does not tell us who, if anybody, is pursuing the goal. For example, Alice might set a partner-oriented goal for John to lose weight, and that goal can be pursued by Alice, John, both, or neither. Goal content is the requisite goal quality, which we underscore by bolding **Content** in Figure 15.2: If either partner (or both) wants either the self or the partner (or both) to lose weight, that goal content is relevant, and it becomes sensible to discuss the goal qualities of both partners associated with that content.

Content

Goal content refers to the mental representation of a desired end state. Content reflects a discrepancy either between the current goal-relevant state and a desired goal-relevant state, such as to weigh less than one currently does, or between the expected future goal-relevant state and a desired future goal-relevant state, such as to maintain one's current body weight rather than gaining weight (Carver & Scheier, 1998). *Personal goal content* refers to a goal relevant to a person's individual-level outcomes (e.g., to run a marathon), whereas *relational goal content* refers to a goal relevant to a person's relationship outcomes within the transactive unit (e.g., to be more sexually responsive). This distinction between personal and relational goal content crosscuts the (previously defined) distinction among self-oriented, partner-oriented, and system-oriented goal content. For example, for personal goal content, Alice might want to run a marathon, or she might want John to run a marathon. For relational goal content, Alice might want to be more sexually responsive to John or want John to be more sexually responsive to her.

Parallel self-oriented goals are cases in which both partners have set the same self-oriented goal (e.g., John wants to lose weight, and Alice wants to lose weight), and *parallel partner-oriented goals* are cases in which both partners have set the same partner-oriented goal (e.g., John wants Alice to lose weight, and Alice wants John to lose weight). *Shared target-oriented goals* are cases in which both partners have a goal oriented toward the same partner's outcomes (e.g., John and Alice both want John to lose weight), and *shared system-oriented goals* are cases in which both partners have a goal oriented toward both partners' outcomes (e.g., John and Alice both want John and Alice to lose weight).

Standard

The *goal standard* refers to the desired level of performance, a reference point or threshold at which an individual considers a goal to have been attained or a rate of progress to have been met (Carver & Scheier, 1998). Even when members of a transactive system share a goal for a target, they may not share a standard for that goal. Consider what happens when John and Alice share the goal that he lose weight, but he thinks 5 pounds is sufficient, whereas she believes 25 pounds is required. They are likely to pursue the weight loss goal similarly at first, but their pursuits might be at odds once he loses 5 pounds and wants to start indulging now and again. For example, he might want to start

indulging a bit more at dinnertime, but she might continue exerting herself to ensure that he eats plenty of vegetables and few carbohydrates.

Value

Goal value refers to the extent to which the individual evaluates the goal-directed end state positively. It encompasses constructs such as goal commitment, goal importance, and goal strength, as well as temporary fluctuations in motivational priority. Even if John and Alice agree that John should lose weight, and that his target weight loss standard should be 5 pounds, their goal coordination and interpersonal functioning might suffer (e.g., when shopping together at the grocery store) if Alice views the goal as more important than John does.

Efficacy

Goal efficacy refers to the individual's belief that a particular goal is attainable. It encompasses constructs related both to expectancies regarding the likelihood of achieving a specific goal and to subjective assessments of self-efficacy regarding the achievement of that goal. Even if John and Alice agree that John should lose weight, that his target weight loss standard should be 5 pounds, and value that goal equally, they might differ in their sense of efficacy regarding his potential success, which can cause conflict and coordination problems.

Considering the role of efficacy in this example highlights the sorts of questions that emerge when adopting a transactive perspective on self-regulation. We know from decades of research on self-regulation that high self-efficacy promotes goal pursuit (Bandura, 1977), but does that mean that high *partner efficacy* promotes pursuit? The translation into action of Alice's strong sense of efficacy in John's ability to lose the weight is far more complex than the translation of self-oriented efficacy to self-oriented action. On the one hand, Alice's sense of efficacy about John's abilities could make her feel confident that effort would not be wasted and therefore increase her exertions on his behalf. On the other hand, her sense of efficacy could make her pursuit seem superfluous, which could decrease her exertions on his behalf. Given the early state of research on interpersonal influences in goal pursuit, deriving specific hypotheses about when Alice's sense of efficacy will cause her to exert herself more versus less in pursuit of John's weight loss is premature. But developing novel hypotheses about such issues allows scholars to enter largely uncharted, but fertile, territory regarding how people set, pursue, and achieve their goals.

Goal Pursuit

Goal pursuit describes action (means and effort) implemented by a member of a transactive system that can reduce the discrepancy between current and desired goal-relevant states or enlarge the discrepancy between current and undesired goal-relevant states, or that is intended to have such an effect (see middle section of Figure 15.2). Like goal qualities, goal pursuit can be oriented toward the self's outcomes, the partner's outcomes, or both. Goal pursuit is also transactive, which means that it dynamically responds to the goals of others in the system. John may need to expend less effort on healthy eating once

Alice has chipped in to help, and he may reallocate this conserved effort to pursue a different goal.

Goal pursuit can apply to goals that were set by the self, the partner, or both. Regardless of which of them wants John to lose weight, Alice can pursue this goal by purchasing more carrots and fewer Doritos on her trips to the supermarket. However, there are important psychological and interpersonal consequences of the pursuit as a function of who set the goal. If John set the weight loss goal for himself, then Alice's decision to buy lower-calorie snack foods functions as a proxy for his pursuit of his own goal. In contrast, if she set the weight loss goal for him, then her decision to buy lower-calorie snack foods serves her own goal, not his. He will likely react to her pursuit behavior differently depending on which of them set the goal.

Just as an individual may possess a goal and do nothing to realize it, so too can members of TGD systems fail to act in any way that has an influence on the individual's standing relevant to the goal. When the unit of analysis is the dyad rather than the individual, however, there are some additional implications of these nonpursued goals. When an individual possesses a partner-oriented goal that the partner fails to pursue, the individual can feel annoyed or resentful, and the partner can feel pressured or disrespected (Simpson, Overall, Farrell, & Girme, Chapter 16, this volume). When both partners possess a goal that neither pursues, a pattern of blame and negative attributions can ensue. These effects may in turn reduce the likelihood of future goal pursuit or increase the likelihood of relationship dissolution.

Transactive goal conflicts emerge when the two partners' pursuits are incompatible. For example, John's pursuit of his weight loss goal might conflict with Alice's goal to become a master baker. Alice's pursuit of her goal to get a promotion at work might conflict with John's goal for the two of them to take a romantic getaway. Conflict in a transactive system can occur because of either the means used or the amount of effort invested by the partners.

Means

Means refers to a specific action performed by one or both partners that has the potential (or is intended) to move the target individual—or, in the case of system-oriented goals, both partners—closer to a desired goal-relevant state or further from an undesired goal-relevant state. Means refers to the manner in which one pursues a goal. Alice may highly value John's weight loss goal, but the means she pursues to support the goal (e.g., giving him nutrition advice) may be ineffective. If she switched to an alternative means (e.g., eliminating tempting snacks from the house), she could be more effective. By distinguishing goal content from means used to pursue the goal, the TGD process framework highlights the different ways in which partners may seek to pursue the same goal and how coordination between both partners' means can predict goal outcomes, even when partners agree about what goals to pursue.

Effort

Effort refers to energy expended by one or both partners that has the potential (or is intended) to move the target individual—or, in the case of system-oriented goals, both

partners—closer to a desired goal-relevant state or further from an undesired goal-relevant state. If Alice recognizes that John seeks to gain social confidence, or if she sets that goal for him, she might exert herself to organize fun social events for them and their friends. If John recognizes that Alice seeks a promotion, or if he sets that goal for her, he might do a lot of solo parenting so she has more time for work.

Goal Outcomes

Goal pursuit yields some kind of objective goal outcome, which can apply to goals that were (1) set by the self, the partner, or both, and (2) pursued by the self, the partner, both, or neither. Whereas goal content refers to mental representations of an end state, *goal outcome* refers to the actual state that exists following goal pursuit, regardless of who set or pursued those goals (see right portion of Figure 15.2). John has a certain weight, and Alice did or did not get promoted. As with goal qualities, the process framework conceptualizes the goal outcome within a 2 (possessor) $\times$ 2 (target) structure that captures the outcomes of both self-oriented and partner-oriented goals.

TGD theory suggests a novel approach to conceptualizing goal outcomes, called *transactive gain/loss*. This approach conceptualizes goal outcomes as a comparison of an individual's outcome to the individual's alternative outcome as it might exist if the individual were pursuing that goal on his or her own. John may eat seven servings of vegetables a day and no Doritos while married to Alice, but would subsist almost exclusively on Doritos if he were still single. Such discrepancies represent transactive gains or losses, and they reflect the extent to which an individual has a better or worse goal outcome in this relationship versus in no relationship.

Goal-General Constructs

Goal qualities, pursuit, and outcomes refer to a specific goal. However, when individuals pursue goals, they are also affected by *goal-general constructs*—variables that influence the dynamics surrounding the setting, pursuit, and outcomes of a given goal without being inherently linked to that particular goal (see bottom portion of Figure 15.2). The TGD process framework identifies three categories of such variables: goal-relevant resources, goal-relevant orientations, and relationship qualities. Such goal-general constructs influence goal setting, pursuit, and outcomes within the transactive system. If Alice is strongly committed to her relationship with John (a quality of the relationship), she may be especially likely to pursue his self-oriented goals and to exert effort in response to his partner-oriented goals (e.g., if he wants her to earn more money).

Goal-general constructs encompass both stable variables (e.g., an individual's trait conscientiousness) and situational variables (e.g., a noisy environment). They affect the pursuit of self- and partner-oriented goals by directly affecting qualities and pursuit, as well as by mediating and moderating links among qualities, pursuit, and outcomes. When the weather is hot and humid, even the most highly committed runner is likely to run at a relatively slow pace. Goal-general constructs can differ across members of the system. John and Alice may vary in the degree to which they are currently committed to their relationship, and, consequently, how much they are willing to make sacrifices to support goals set by the partner (Van Lange et al., 1997).

Goal-Relevant Resources

Goal-relevant resources in the process framework are variables that influence individuals' ability to engage in effective goal pursuit. They include psychological variables such as trait self-control, state self-regulatory depletion, and attention (Baumeister, Vohs, & Tice, 2007; Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008; Tangney, Baumeister, & Boone, 2004), as well as cognitive, physical, and structural resources such as intelligence, stamina, time, and money.

These resources affect goal qualities, pursuit, and outcomes through main effects and interactions. For example, as resources decline, competition among goals for the remaining resources increases, which may reverberate throughout the TGD goal network. When resources are abundant, individuals can work toward both their own and their partner's outcomes. In contrast, when resources are more limited, goal conflicts are inevitable, not only within each partner, but also across partners. Thus, interactions of resources with goal qualities such as goal value and standards, as well as with relationship qualities such as closeness and power, predict how much effort individuals put toward self- and partner-oriented pursuits, for example, when self-regulatory depletion increases the tendency to outsource effort to a partner (Fitzsimons & Finkel, 2011).

Skills are another example of a goal-relevant resource. One hypothesis that emerges from a TGD perspective is that increasing interdependence in goal pursuit should promote goal outcomes when partners have complementary skills and are effective in allocating tasks between partners. If partners have redundant skills (e.g., if both of them are good at goal-relevant planning but bad at monitoring goal-relevant progress), their pool of shared skill-related resources is no larger than the addition of their efforts divided by the demands on their efforts. If, in contrast, partners have unique skills, their pool of shared skill-related resources can potentially be much larger.

Goal-Relevant Orientations

Goal-relevant orientations are psychological tendencies toward goals in general. This category includes a wide variety of constructs, including strategic orientations such as regulatory focus (Higgins, 1997), as well as other goal-related mindsets, beliefs, or orientations (e.g., Dweck & Leggett, 1998; Fujita, Trope, Liberman, & Levin-Sagi, 2006; Gollwitzer, 1996). It also includes general psychological orientations that affect goal pursuit, such as cultural differences, gender differences, personality variables, or differences in self-esteem.

Many of these orientations have important effects—direct, mediating, or moderating—on TGD processes. For example, regulatory mode affects the likelihood of both offering and accepting partner sculpting in research on the Michelangelo phenomenon (Kumashiro, Rusbult, Finkenauer, & Stocker, 2007), with a strong orientation toward locomotion (movement from one goal state to another) promoting the tendency for one's ideal-self goal pursuits to be shaped by one's partner, as well as the tendency for one to shape one's partner's ideal-self goal pursuits. The goal-relevant orientations of the partners in a transactive system can themselves interact, such as when students learn better when their regulatory mode matches that of their educators (Pierro, Presaghi, Higgins, & Kruglanski, 2012).

Relationship Qualities

Because TGD systems consists of two (or more) individuals who come together to form a single self-regulating unit, it is also important to understand the features and qualities of the relationship between (or among) these individuals. According to the TGD process framework, different types of relationships, or different experiences of partners within those relationships, will produce different TGD processes and therefore different goal outcomes for the individuals. Our categorization of such relationship qualities includes variables that describe the nature or quality of the relationship between (or among) the transactive system members (e.g., Mikulincer & Shaver, 2007; Reis & Shaver, 1988; Rusbult, 1983).

As with goal-relevant resources and orientations, relationship qualities have important effects—direct, mediating, or moderating—on TGD processes. For example, fear that a partner may reject the self moderates the balance people strike between self-protective goals and relationship-enhancing goals (Murray, Holmes, & Collins, 2006). Individuals who understand and value their partners lead their partners to react less defensively to failure (Caprariello & Reis, 2011), and individuals who encourage dependence lead their partners to pursue more exploratory goals (Feeney, 2007).

Connecting Goal Qualities, Goal Pursuit, and Goal Outcomes

Thus far, we have focused on specific goal qualities (content, standard, value, and sense of efficacy), specific goal pursuit (means and effort), and goal outcomes as independent from one another. In truth, they influence one another in complex and interesting ways. There are many such pathways, so rather than elaborate on all of them, we briefly illustrate some of them. Subsequently, we provide three detailed examples.

Goal Qualities → Goal Pursuit

We begin by discussing how qualities shape pursuit. This influence can be direct, such as when a higher sense of efficacy leads to increased effort, or it can be mediated through other goal qualities, such as when higher standards lead to a decrease in sense of efficacy and a resulting decrease in effort. Goal qualities can also moderate the influence of other goal qualities on pursuit, such as when high value can overcome the negative effects of low sense of efficacy on effort. All of these processes occur transactively—Alice's goal qualities influence not only her own pursuit but also John's pursuit. The higher standard she has for his weight loss (25 pounds rather than 5 pounds), the more he might pursue high-risk means such as weight loss drugs rather than low-risk means such as exercise. The higher her sense of efficacy for his weight loss, the more effort he might exert to achieve this goal. In addition, goal qualities within the transactive system can interact to predict pursuit, such as if John were to only exert effort if *both partners* strongly value his weight loss or if Alice's high sense of efficacy in John's weight loss interacted with his own low sense of efficacy to predict her high levels of exertion and his own low levels of exertion.

Goal Pursuit → Goal Qualities

The link between pursuit and qualities is bidirectional. Both self- and partner-directed pursuits affect the goal qualities of both partners. Most straightforwardly, merely engaging in goal pursuit shapes goal qualities. Driven by basic perception and rationalization processes (Bem, 1965; Fishbach, Zhang, & Koo, 2009), individuals who pursue a given goal tend to value that goal more. We suggest that such effects can emerge transactively as well. Alice's decision to give up baking to help John lose weight might, through similar processes, cause her to value his weight loss more highly. John, in turn, might become more committed to his weight loss as a result of having witnessed Alice's sacrifice. Alternatively, John might interpret her dedication to his weight loss as evidence that she doubts his ability to achieve it on his own, which could undermine his sense of efficacy.

Goal Pursuit → Goal Outcomes

According to TGD theory, both self- and partner-directed pursuits influence outcomes. That being said, self- and partner-directed pursuit may differ in how each affects outcomes, and the two types of pursuit (means and effort) may also interact to influence outcomes. When Alice engages in behavior to promote John's weight loss, he might exert less effort in pursuit of his own weight loss (Fitzsimons & Finkel, 2011). If she chooses a means that interferes with his own pursuit, that might also undermine outcomes.

Goal Outcomes → Goal Qualities and Pursuit

In a transactive system, specific goal outcomes can feed back to alter the goal qualities of both partners, which in turn shapes subsequent pursuit. If Alice has dieted successfully in the past, that success has the potential to increase the extent to which John values his own weight loss (Lockwood & Kunda, 1997), which can inspire him to work especially hard at his diet. Or perhaps Alice's promotion at work increases John's standard for how much money he would like Alice to earn.

The interplay of goal outcomes with goal qualities and goal pursuit is also relevant to Carver and Scheier's (1998) well-known test–operate–test–exit (TOTE) feedback loop analysis of self-regulation, especially in terms of monitoring goal progress, and adopting a transactive perspective yields new insights into the nature of monitoring. Alice might be the one who tracks John's weight over time, and this monitoring might influence John's and Alice's sense of efficacy about his ability to lose weight or what the optimal means for doing so should be.

The two partners' goal outcomes can interact to influence their subsequent goal qualities and pursuit. For example, imagine that John and Alice both resolve on January 1 to lose 2 pounds per month over the next 12 months. Imagine further that Alice has stayed on target through June, losing 12 pounds, whereas John has fallen behind his goal standard, losing only 6 pounds. If John had been pursuing this goal in a social vacuum, his modest success might have caused him to lower his standards from 6 pounds to, say, 1.5 pounds per month. However, witnessing Alice's success might moderate this tendency by steeling his resolve that 2 pounds per month is indeed the appropriate standard.

Goal-General Constructs → Goal Qualities, Pursuit, and Outcomes

Goal-general constructs affect both partners' goal qualities, pursuit, and outcomes, again for all goals in the TGD system. Such effects can be direct, as when John's poor self-regulatory skills weaken the effectiveness of his pursuit of Alice's goal outcomes, or indirect, as when John and Alice have better relationship outcomes when they have complementary tendencies to pursue goals in an eager versus a vigilant fashion (Bohns et al., 2013).

USING THE TGD PROCESS FRAMEWORK TO INTEGRATE DISTINCT RESEARCH PROGRAMS

Of course, the examples in the preceding section merely skim the surface of the links that emerge between two goal-pursuing partners. All links can interact, can be mediated and moderated by other transactive processes, and can lead to cycles of cross-partner effects and feedback loops. These complex patterns of effects across partners ultimately lead to the emergence of so much overlap and so much mutual influence that the two partners form one self-regulating system.

In this section, we provide three detailed examples to illustrate how the TGD process framework can serve as an integrative model for conceptualizing seemingly disparate findings. Adopting this framework allows scholars to clarify the processes through which an individual phenomenon likely occurs, recognize conceptual distinctions among processes hypothesized in the literature, and make connections among distinct phenomena and disparate literatures.

The Michelangelo Phenomenon

The *Michelangelo phenomenon* refers to “a congenial pattern of interdependence in which close partners sculpt one another in such a manner as to bring each person closer to his or her ideal self” (Drigotas, Rusbult, Wieselquist, & Whitton, 1999, p. 293). Research has shown that individuals who *affirm* their partner—who perceive the partner's current self as consistent with the partner's ideal-self goals (and behave as such)—help the partner approach those goals over time, bolstering both partners' well-being (Rusbult, Finkel, & Kumashiro, 2009).

As illustrated in the black pathway in Plate 15.1, in the Michelangelo phenomenon, Alice's high sense of efficacy regarding John's ideal-self goals causes him to internalize this perception (Path A), which in turn increases his effort toward those goals (Path B), and, ultimately brings him closer to achieving those goals (Path C). As illustrated in the purple pathway, Alice's or John's self-regulatory orientation toward assessment (critically evaluating goal-relevant options) and locomotion (movement from one goal state to another) reliably predict Michelangelo processes (Kumashiro et al., 2007). Specifically, the positive association of Alice's efficacy with John's efficacy in Path A is strengthened by strong locomotion tendencies and weakened by strong assessment tendencies from either partner (Paths D and E). In addition, as illustrated in the gold pathway (Path F), Path A is also moderated by Alice's previous self-oriented goal success, such that partners

who are successful in achieving such goals better facilitate the individual's growth (Rusbult, Kumashiro, Kubacka, & Finkel, 2009).

Self-Evaluation Maintenance

Tesser's (1988) *self-evaluation maintenance model* suggests that people sometimes seek to undermine others' goal pursuits when those pursuits have negative implications for people's self-image. For example, in one early study (Tesser & Smith, 1980), participants given negative feedback about their own task performance in a self-relevant domain gave less helpful clues to another person doing the same task if that person was a friend rather than a stranger, suggesting that they were seeking to undermine the friend's outcomes more than the stranger's. From a TGD perspective, as illustrated in the red pathway in Plate 15.2, John's poor performance on the task leads him to adopt a new goal for Alice to perform poorly in this domain (Path A), which causes him to undermine her goal to perform well by giving less helpful clues (Path B), which in turn causes her to perform poorly (Path C). As illustrated in the green pathway in Plate 15.2, the Path A association of John's outcome on the initial goal with his setting of a new goal for Alice to do poorly is moderated by John's assessment of the importance/self-relevance of the goal (Path D), which is in turn moderated by whether the other person in the experimental session is Alice rather than a stranger (Path E).

Another self-evaluation maintenance model prediction is that a partner's performance can alter an individual's self-oriented goal value. In one study (Tesser & Paulhus, 1983), relative to participants led to believe that they had outperformed another person on a measure of "cognitive perceptual integration," participants who were led to believe that the other person had outperformed them subsequently reported that this cognitive skill was less important to them. From a TGD perspective, as illustrated in the blue pathway in Plate 15.2, John's performance predicts how much he values the goal (Path F), an effect that is moderated by Alice's performance (Path G), an effect that is further moderated by the extent to which he believes that Alice is similar to him (Path H).

Goal Support

A large, scholarly literature has investigated the effects of social support on health and well-being outcomes (Uchino, 2009). However, even in those cases in which social support exerts robust positive effects, there is no consensus regarding the mechanisms through which it does so (Thoits, 2011). Among the dozens of proposed mechanisms are several related to efficacy and goal achievement, which are particularly relevant to the TGD process framework. Here, we present examples from one article that is particularly clear in terms of measurement of processes. In this paper, Brunstein, Dangelmayer, and Schultheiss (1996) operationalized support as that given by a romantic partner regarding ongoing goals. They measured three types of support: *assistance* (e.g., "My partner reliably assists my attempts to accomplish this goal"), *opportunity* (e.g., "My partner gives me many opportunities to work on this goal"), and *responsiveness* (e.g., "My partner is enthusiastic about my goal"). All three forms of goal support predicted successful goal outcomes.

From the perspective of the process framework, as illustrated in the dark blue pathway in Plate 15.3, *assistance effects* (“practical” or “instrumental” support) are captured by a direct effect of Alice’s pursuit—both means and effort—on John’s self-oriented goal outcome (Path A). As illustrated in the beige pathway in Plate 15.3, *opportunity effects* operate through the moderating influence of the means Alice employs in her self-oriented goal pursuit (Path C) on the association of John’s self-oriented goal pursuit with his goal outcomes (Path B). For example, if Alice pursues her mommy–daughter bonding goal by taking their daughter to the zoo, John has extra time to work on the manuscript due next week. Finally, as illustrated in the yellow pathway in Plate 15.3, *responsiveness effects* (the support provider’s enthusiasm for the goal) emerge when Alice’s partner-oriented goal value influences John’s self-oriented goal value (Path D), which in turn increase his effort exertion (Path E) and, ultimately, his goal outcomes (Path F).

Transactive Density, Illustrated

In Plate 15.4, we have integrated the pathways from Plates 15.1, 15.2, and 15.3 into one figure to underscore the central insight of the TGD process framework: Within a relationship, the goals that two partners possess, pursue, and achieve are tightly and multiply linked in a complex network of connective tissue across partners. In applying the process framework to the examples in Plates 15.1, 15.2, and 15.3, we seek to illustrate how the framework can capture a diverse set of existing effects from different social psychological literatures using a common language—and to offer clarity about the processes through which these effects arise. By depicting even just three examples of interpersonal goal pursuit phenomena, Plate 15.4 reveals a dense, almost overwhelming, pattern of associations. Try to imagine the density of the system if we sought to encompass all goal pursuits within a given dyadic system. Plate 15.4 underscores the point that thinking of the two partners as separate goal pursuers means artificially splitting the TGD system—tearing apart the countless connective sinews—and thus losing sight of this dense transactivity. In contrast, conceptualizing the two partners as subunits within a system sheds bright light on this crucial connective tissue.

CONCLUSION

From the perspective of the most well-known and well-established models in the psychological literature, people either succeed or fail at self-regulation as individuals, toiling in isolation toward goal achievement. From the 4-year-olds in the famous delay of gratification studies (Mischel, 1974), who sit by themselves trying not to eat a marshmallow, to the hungry participants in the seminal study of self-regulatory depletion, who sit by themselves eating radishes instead of cookies (Baumeister, Bratslavsky, Muraven, & Tice, 1998), psychological studies of self-regulation, and the theories that have inspired those studies, have predominantly focused on individuals pursuing their goals alone. Although studies of goal pursuit that ignore the complex and dynamic web of transactive sinews are tidier than studies of goal pursuit that examine that web, such studies neglect a great deal about how goal dynamics play out in people’s everyday lives.

As I (EJF) am writing this concluding text, my wife and daughter are at the grocery store while my son naps upstairs. If my wife were out of town instead, this text would

have gone unwritten and the groceries would have gone unpurchased. At this moment, two American robins are building a nest outside the window. Both of them—the male and the female—are gathering twigs, grass, and mud, and the female is doing the construction. If all goes well, the female will lay her eggs as soon as the nest is ready, and, with protective help from the male, she will hatch new chicks in about a fortnight. At that point, both parents will spend several days feeding and tending to the chicks.

This is how goal dynamics work in people and most animals—not as individuals who set and pursue goals in isolation, but rather as members of transactive systems whose goal dynamics are inextricably linked. *This* is how scholarly articles get written and how offspring get raised—indeed, how virtually all social species set, pursue, and achieve virtually all goals. For this reason, we believe that it is time for scholars to consider a new unit of analysis for understanding goal dynamics—the interdependent social unit rather than the individual.

NOTE

1. Tenet 6—that high density and strong goal coordination during the relationship can undermine goal outcomes after relationship dissolution—focuses on the challenges of extricating oneself from a dense and productive transactive system. It is also plausible, however, that some of the goal coordination skills one learned in the now-defunct relationship will transfer to a new relationship, which can facilitate the development of a well-coordinated transactive system with this new partner. Such an effect, presumably, is especially likely to the extent that the new partner is similar to the old partner on major goal-related and interpersonal tendencies.

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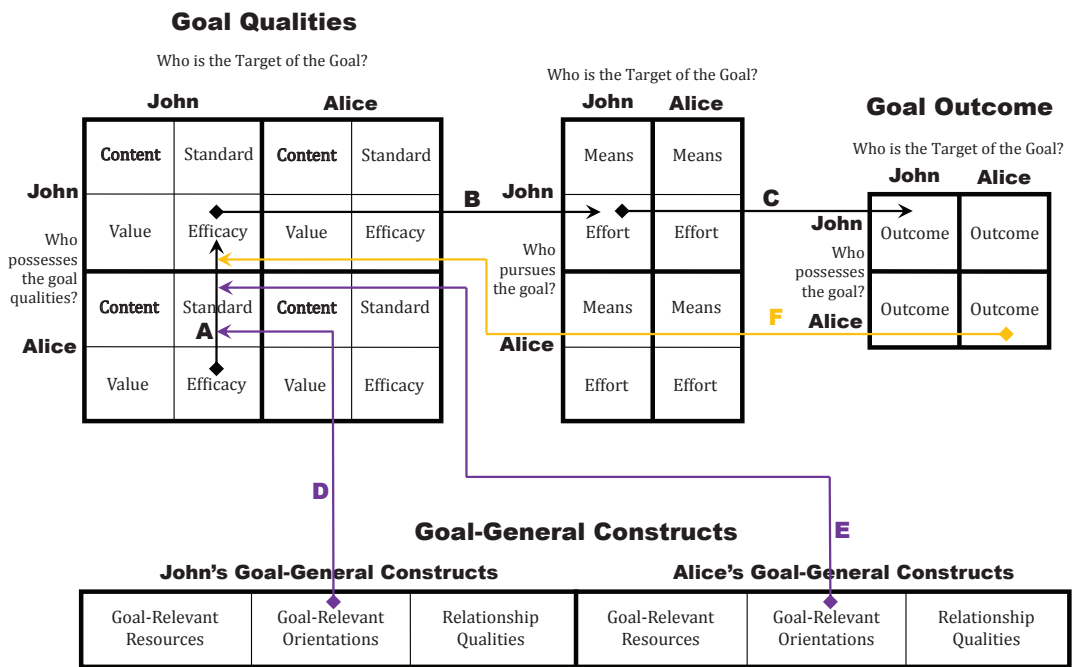


PLATE 15.1. Application of the TGD process framework: The Michelangelo phenomenon.

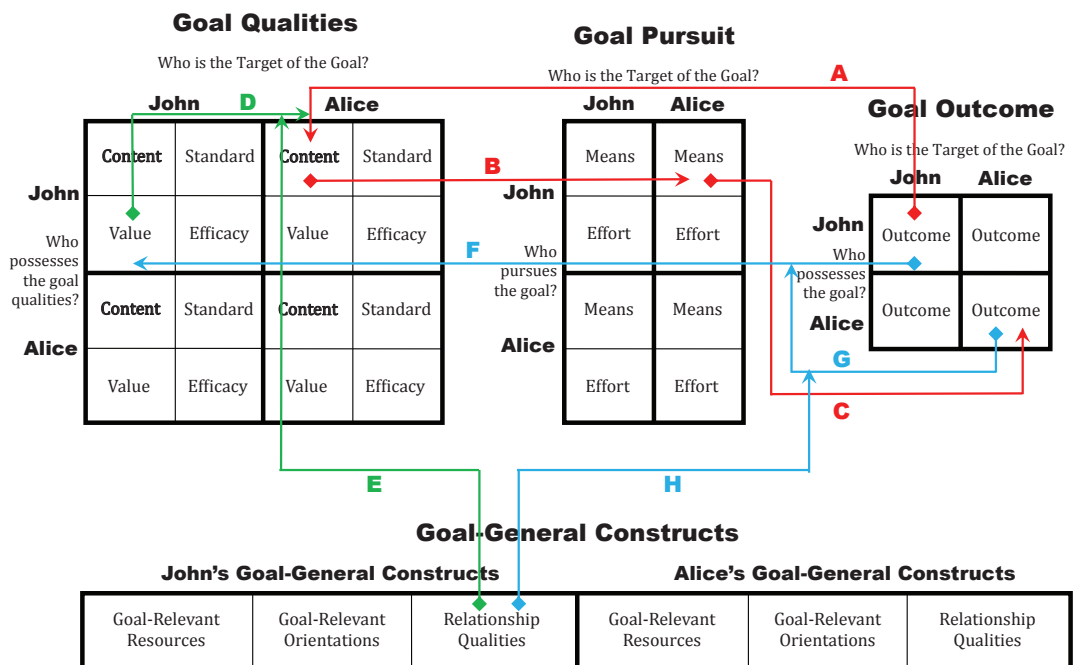


PLATE 15.2. Application of the TGD process framework: Self-evaluation maintenance.

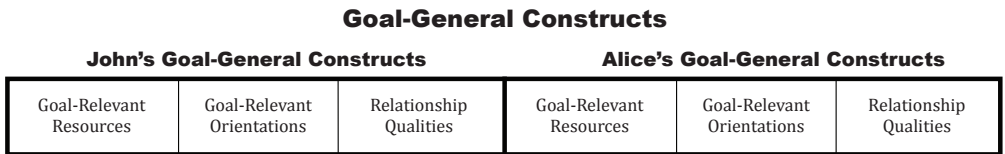
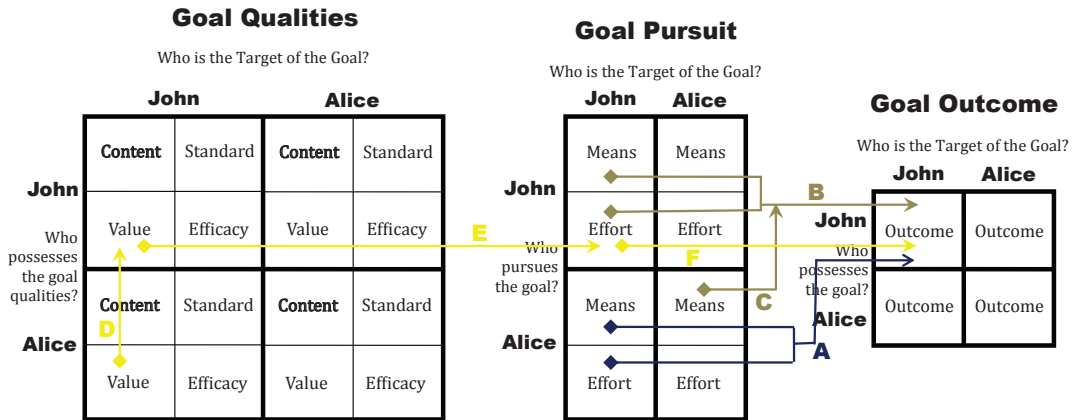


PLATE 15.3. Application of the TGD process framework: Goal support.

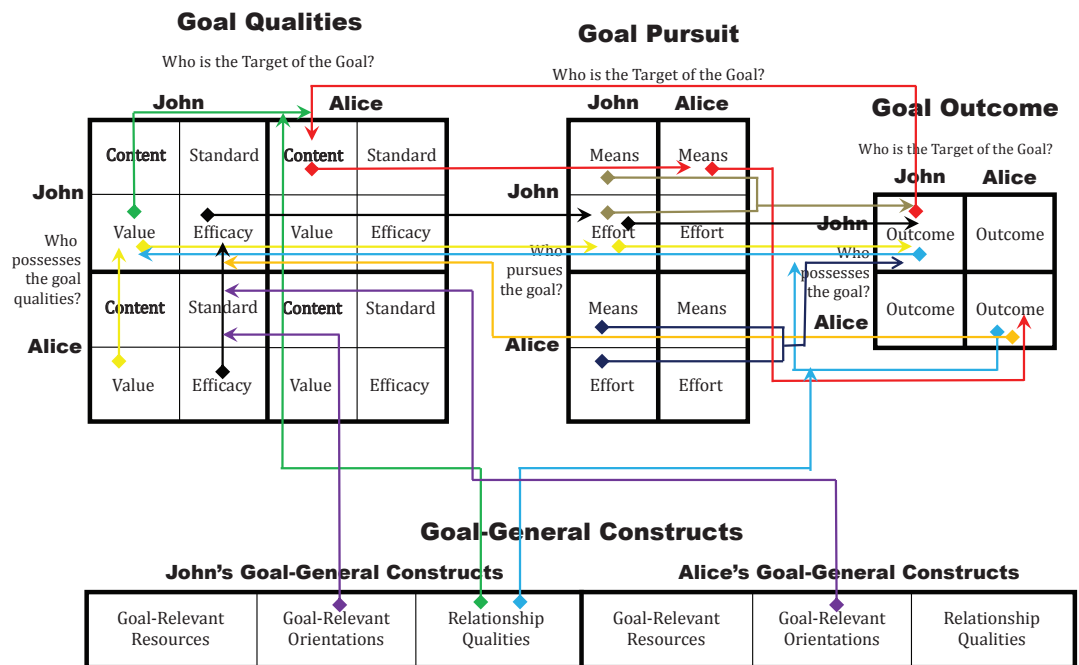


PLATE 15.4. Integrating three applications of the TGD process framework: Superimposing the effects from Plates 15.1, 15.2, and 15.3 to illustrate the transactive density construct.

CHAPTER 16

Regulation Processes in Romantic Relationships

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Jake and Sarah are in a committed romantic relationship. They are relatively happy, but like most couples, they disagree about some issues, which tends to cause conflict in their relationship. For example, Jake and Sarah argue about how to manage their finances, and they have difficulty coordinating their schedules to spend time together. When managing these common difficulties, Jake tries to get Sarah to prioritize time together over work commitments, whereas Sarah tries to persuade Jake to spend less money, and she encourages him to take opportunities that would enable them to be more financially secure in the future. Initially, these relationship improvement attempts seemed to make their problems worse. When Sarah discussed Jake's earning prospects, Jake would feel criticized and devalued by Sarah and react defensively by accusing Sarah of not caring for him. Such reactions made it difficult for Jake and Sarah to resolve disagreements.

Jake's insecure reactions were fueled by chronic concerns that Sarah would eventually abandon him. In past relationships, Jake felt as if he could never fully "measure up" to what his romantic partners wanted or expected, and some of his relationships ended badly. Jake really wanted to have a better relationship with Sarah, but he still worried that he might not be able to meet many of Sarah's hopes and expectations, especially when she voiced dissatisfaction or wanted him to change in some way.

As their relationship developed, however, Sarah became aware of Jake's insecurity and vulnerabilities. Because she valued their relationship and wanted it to last, Sarah started to change how she interacted with Jake. For instance, when they discussed areas of disagreement or aspects of the relationship with which she was dissatisfied, Sarah would clearly express her unconditional love for and acceptance of Jake, and she would go out of her way to reassure Jake

that she was strongly committed to him. When Sarah did this, Jake would feel less anxious, and his insecure tendencies would subside, which resulted in more successful problem resolution. As Jake's insecurity began to dissipate over time, he was able to respond to Sarah's relationship improvement attempts in more constructive ways, which helped both Sarah and Jake remain satisfied with their relationship.

This hypothetical relationship highlights an important and understudied set of processes that characterize most couples—intimate partners often try to influence and shape each other through dyadic regulation processes. Sarah's actions reflect the operation of two key dyadic regulation processes. First, Sarah's efforts to increase Jake's attention to finances reflect her attempts to influence or change his attributes that are causing conflict or dissatisfaction in order to improve their relationship (*partner regulation*). Second, Sarah's efforts to down-regulate or buffer Jake's negative reactions when he feels insecure reflect attempts to buffer the relationship from the damaging behaviors associated with attachment insecurity (*partner buffering*).

These two dyadic regulation processes are the focus of this chapter. We begin by reviewing key ideas and findings associated with self-regulation processes as they relate to close relationships. We then discuss *partner regulation*, which involves individuals trying to change dissatisfying attributes of their partners that cause conflict or problems in their relationships. We review evidence regarding the conditions that motivate this type of partner regulation, then consider how and why different types of partner regulation attempts differentially affect *agents of regulation* (i.e., individuals who want to produce change in their partners), *targets of regulation* (i.e., partners who are the subject of change attempts), and the quality of their relationship.

In the second half of the chapter, we turn to the second type of dyadic regulation process—buffering insecure partners. We overview specific ways in which individuals can soothe or down-regulate the negative thoughts, feelings, and/or behaviors that anxiously or avoidantly attached partners commonly exhibit during threatening relationship interactions. We also consider how partner buffering influences *agents of regulation* (i.e., the individual attempting to buffer attachment insecurity), *targets of regulation* (i.e., the reactions of the insecure partner), and the relationship as a whole.

SELF-REGULATION AND RELATIONSHIPS

Most self-regulation theories recognize the critical role that significant others play in self-regulation processes. For example, self-directed behavioral change usually occurs when individuals perceive discrepancies between their goals or ideals and their current standing on these goals/ideals (Carver & Scheier, 1998; Higgins, 1987). Large discrepancies between self-perceived goals and ideal standards or expectations make people feel uncomfortable and dissatisfied, which typically instigates actions intended to reduce these discrepancies. However, many of the standards and expectations governing people's self-regulation efforts are established by close others (Moretti & Higgins, 1999). Significant others also motivate and launch goal pursuit, sometimes unconsciously (see Finkel, Fitzsimons, & vanDellen, Chapter 15, this volume). For example, priming thoughts of close others (e.g., parent, close friend, or romantic partner) increases individuals' intentions

and commitment to obtain the attributes valued by primed others, which results in greater persistence and success on tasks related to those attributes (e.g., Fitzsimons & Bargh, 2003; Shah, 2003).

Besides guiding the goals and ideal standards that individuals strive to attain, the success of self-regulation efforts is also shaped by relationship processes. For example, individuals tend to be more successful at achieving their personal goals when their romantic partners support their pursuit of these goals (Feeney, 2007; Overall, Fletcher, & Simpson, 2010). Individuals are also more likely to move closer to their ideal self-concepts if they perceive that their partners treat them as if they already possess these ideal attributes (Rusbult, Kumashiro, Kubacka, & Finkel, 2009). Individuals also evaluate their partners and relationships more positively if their partners help them achieve their personal goals (Fitzsimons & Shah, 2008; Overall et al., 2010).

Self-regulation processes also play a key role in maintaining social connections with significant others. According to the sociometer model (Leary, 2004), for example, when people feel less valued as relationship partners, they tend to experience negative emotions and temporarily lower self-esteem. This, in turn, motivates individuals to increase their social inclusion with others in adaptive ways, for example, by meeting the wishes of others or being more helpful to them. The use of effective relationship building and maintenance behaviors, however, depends on how well individuals are able to control (regulate) their emotions and actions, especially in stressful or challenging situations. Those who have greater self-regulatory strength are better at controlling their negative impulses, which allows them to respond to hurtful or damaging partner behaviors in more constructive ways (Finkel & Campbell, 2001). As a result, well-regulated individuals are less likely to experience negative interpersonal outcomes, especially during stressful or difficult interpersonal exchanges (Ayduk et al., 2001).

Nearly all of this prior work examining regulation processes in relationships has focused on how *individuals* regulate themselves. Within relationships, however, partners also attempt to regulate *each other's* thoughts, emotions, and behaviors. In the next section, we describe how self-regulation models can be used to understand some of the causes and consequences of partner regulation.

PARTNER REGULATION IN RELATIONSHIPS

Almost by definition, the interdependent nature of close relationships implies that people's goals and desires often depend on their *partners* thinking, feeling, and behaving in desired and consistent ways (Kelley & Thibaut, 1978). Sarah, for example, might want to save money to buy a new house, but Jake may prefer to spend money on extravagant vacations. Jake may be motivated to spend more time with Sarah, but no matter how much time he devotes to their relationship, he cannot achieve this valued goal unless Sarah prioritizes time spent together. Such contrasting desires and goals are the foundation of many conflicts in close relationships, and they are also the reason individuals frequently try to change their partner's attitudes and behaviors—a process called *partner regulation*.

Figure 16.1 outlines some of the basic causes and consequences of partner regulation. The left-hand side of the figure applies basic self-regulation principles to identify when individuals should be motivated to regulate their partners. First, individuals not only

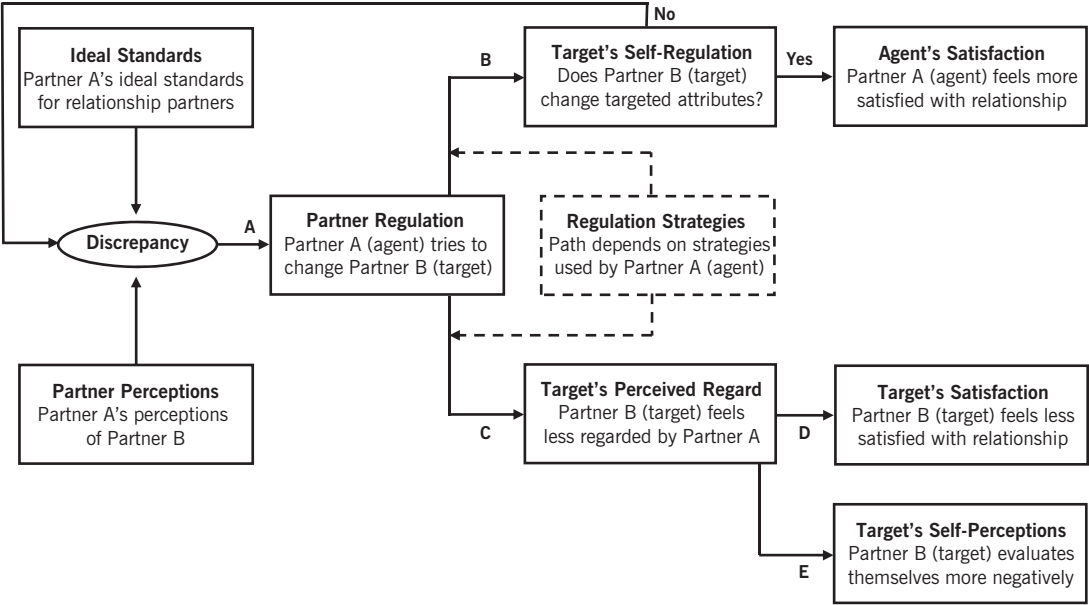


FIGURE 16.1. The causes and consequences of partner regulation attempts.

have expectations and ideal standards that motivate their own self-regulation but they also have ideal standards that are used to evaluate their relationship partners (Fletcher, Simpson, Thomas, & Giles, 1999). Second, just as discrepancies between self-related perceptions and standards produce dissatisfaction and spur self-regulation efforts, discrepancies between an individual's partner perceptions and partner ideals also produce dissatisfaction and an increased likelihood of relationship dissolution (Fletcher et al., 1999; Fletcher, Simpson, & Thomas, 2000). Thus, as shown in Path A in Figure 16.1, larger discrepancies between partner perceptions and ideal standards should instigate attempts to change the partner in order to move the relationship closer to an individual's ideal standards (Overall, Fletcher, & Simpson, 2006).

A key difference between self-regulation and partner regulation, however, is that partner regulation attempts may often make the situation worse rather than lead to intended relationship improvements. Indeed, Overall and colleagues (2006) found that more strenuous partner regulation attempts are typically associated with *lower* relationship quality. There are two reasons why greater partner regulation can have this damaging effect. First, as shown by Path B in Figure 16.1, the success of partner regulation attempts depends on whether targets respond by changing the targeted attributes. If Jake is successful at persuading Sarah to reduce her work hours in order to spend more quality time together, Jake's evaluation of Sarah and their relationship should improve. If Sarah, however, continues to work overtime, Jake is likely to become even more dissatisfied and believe that Sarah's commitment to their relationship is lower than he initially thought. In the studies reported by Overall and colleagues, regulation agents (those trying to change their partners) usually believed their regulation attempts were relatively ineffective at producing desired changes in targeted partners. As a consequence, regulation agents viewed their partners more negatively and developed even larger discrepancies between

perceptions of their partner and their ideal standards (see the “No” path near the top of Figure 16.1).

A second danger associated with partner regulation is that receiving regulation attempts may provoke negative feelings and behavioral reactions in targets. Overall and colleagues (2006), for example, discovered that stronger attempts to change the partner are associated with the targeted partner feeling less valued and less accepted. When Sarah tries to increase their joint savings by asking Jake to work more or improve his job skills, this may communicate to Jake that she is dissatisfied with his earning potential. Partner regulation attempts, therefore, can provide powerful signals regarding how the agent of regulation is thinking and feeling about the target of regulation. When individuals behave in a positive, prorelationship fashion, such as forgiving transgressions or accommodating negative behavior, these actions convey trust and acceptance to their partner (Weiselquist, Rusbult, Foster, & Agnew, 1999). However, when relationship behavior communicates discontent with the relationship or a desire for change, this conveys to the partner declining regard and potential rejection (Overall et al., 2006; Overall & Fletcher, 2010).

Path C in Figure 16.1 indicates how persistent regulation attempts can affect targeted partners' perceptions of regard. Supporting this pathway, Overall and Fletcher (2010) found that the more individuals receive regulation attempts from their partners, the more negatively regarded they feel across the next 6 months. As depicted by Path D, perceptions of a partner's regard and acceptance, in turn, strongly influence people's feelings of security and satisfaction in the relationship (Murray, Holmes, & Collins, 2006; Reis, Clark, & Holmes, 2004). Individuals who meet what their partner ideally wants or expects report being more satisfied (Campbell, Simpson, Kashy, & Fletcher, 2001), whereas those who realize they do not meet their partner's ideal standards report much lower satisfaction across time (Overall et al., 2006; Overall & Fletcher, 2010).

Perceptions of a partner's regard can also affect how well romantic relationships function in the long-term. People who believe their partners view them negatively often harbor chronic insecurities and react more negatively to relationship difficulties (Murray, Rose, Bellavia, Holmes, & Kusche, 2002). As a result, the reductions in perceived regard arising from partner regulation attempts may generate more negative responses by targeted partners that can negatively impact the relationship. Moreover, as shown in Path E of Figure 16.1, being the brunt of continued partner regulation attempts can also undermine the way targets view themselves. Relationship interactions can provide potent information about one's own qualities. When those interactions indicate that the partner's regard is low, individuals have more negative views of themselves (Murray, Holmes, & Griffin, 2000). Furthermore, because receiving regulation attempts conveys low regard, it can also damage targets' self-evaluations by producing more negative self-perceptions and eroding self-esteem across time (Overall & Fletcher, 2010).

In summary, the underpinnings of partner regulation processes are very similar to self-regulation processes: Discrepancies between how partners are perceived and the ideal standards that individuals hold for their partners motivate regulation attempts (see the left side of Figure 16.1). However, because partner regulation involves two people—the agent of regulation and the target of regulation—the outcomes of partner regulation are more complex and potentially perilous. As depicted by Path B in Figure 16.1, the success of partner regulation inevitably depends on whether (and the degree to which) targets change in ways that regulation agents desire. Although regulation attempts can motivate

change in targeted partners and thereby improve agents' relationship satisfaction, targets may often resist these influence attempts. Unsuccessful regulation attempts, in turn, may exacerbate agents' negative evaluations and dissatisfaction. And even regulation attempts that successfully produce desired change may leave negative effects on regulation targets' relationship satisfaction and self-perceptions because targets understand that agents are dissatisfied with targeted attributes. Returning to Jake and Sarah, the more Sarah tries to improve Jake's earning potential, the more Jake may (1) believe that Sarah is unhappy with his current status and income (Figure 16.1, Path C), (2) become less satisfied with the relationship (Path D), and (3) begin to view himself more negatively (Path E).

Partner Regulation versus Self-Regulation

At first glance, partner regulation appears to be problematic even though it may often be intended to improve relationships. Unlike self-regulation attempts, the potential harm that targeted partners can experience when subjected to partner regulation suggests that these attempts may often be detrimental to relationships. Many relationship therapies, in fact, claim that relationship improvement requires partner acceptance (Christensen et al., 2004), not blaming the partner for his or her personal deficits, and not focusing on aspects of the partner that might be creating or perpetuating relationship problems (see Halford, Sanders, & Behrens, 1994). According to these views, a more constructive approach is to refrain from partner regulation altogether and focus on changing problematic features of the self instead.

To explore these issues, Hira and Overall (2011) compared partner-focused and self-focused attempts intended to improve romantic relationships. They found that blaming and trying to regulate the partner was less successful in producing desired relationship changes, and it was associated with lowered relationship quality. Successful change of self-attributes, conversely, was related to greater improvement of the targeted problem(s) in the relationship, but successful self-change did not yield greater relationship satisfaction.

Why does successful self-change that apparently improves relationship problems not translate into better relationship quality? The most plausible explanation is that improving relationship problems requires change by *both* partners. An improvement made by one individual is not likely to resolve dissatisfaction if the partner's contributions to the problem remain unchanged. Consistent with this notion, Hira and Overall (2011) also found that when *partners* were perceived as attempting to change themselves and *partners* also reported being more successful at their own self-regulation attempts, individuals experienced greater relationship improvement *and* reported more positive relationship evaluations.

These findings illustrate the importance of the differences between partner regulation and self-regulation by highlighting that partner regulation has different consequences and outcomes for the agent of regulation and the target of regulation. Although partner regulation can carry costs for the targeted partner in terms of lower felt regard (Figure 16.1, Path C), more negative relationship evaluations (Path D), and reduced self-esteem (Path E), the satisfaction of regulation agents improves only when the targeted partner makes the desired changes (see Path B). Moreover, the studies documenting the harmful effects of regulation on targeted partners (Paths C, D, and E in Figure 16.1) have found that targets frequently respond to their partner's regulation attempts by trying to

One explanation that may resolve these seemingly countervailing sets of findings involves partner regulation processes. Directly addressing a major problem and engaging in conflict may result in actually resolving the problem, perhaps because doing so motivates targeted partners to change their problematic attitudes or behaviors (Gottman & Krokoff, 1989; Heavey, Christensen, & Malamuth, 1995). Interestingly, most of the negative behaviors that predict positive long-term relationship outcomes in longitudinal studies are active, direct, and partner-focused (e.g., criticism or blame), whereas most of the positive behaviors that predict poorer relationship outcomes are “soft” and tend to dampen overt conflict through the use of humor (e.g., validation or affection).

To address these ideas, Overall, Fletcher, Simpson, and Sibley (2009) classified communication strategies in terms of their valence (positive or negative) and directness (direct or indirect). This resulted in four global strategies (see Table 16.1; see also Overall & Simpson, 2013). Direct strategies are explicit, overt, and partner-focused. *Positive-direct* tactics (i.e., the specific behaviors used to enact a given strategy) include providing logical reasons for the desired change, weighing the pros and cons of different possible outcomes, and offering workable solutions. *Negative-direct* tactics include demanding change, insisting on getting one’s way, and derogating or threatening the partner. Both positive and negative direct tactics involve clear expressions of discontent and strongly convey to the target the need for change. In the short term, these actions are likely to produce defensiveness and reduced felt regard in the targeted partner. By directly communicating the severity and importance of the problem, however, direct tactics should also motivate targets to make stronger and more consistent efforts to alter the problematic behavior.

Indirect strategies entail passive or covert ways of resolving issues and inducing desired change. *Positive-indirect* tactics include attempts to soften the conflict and convey positive regard to the targeted partner by minimizing the problem or focusing on positive partner characteristics. In the short term, this warm, accommodating behavior should reduce conflict and communicate greater regard. These tactics, however, also downplay the severity of the problem and, consequently, are less likely to spur appropriate changes within the targeted partner. *Negative-indirect* tactics include appealing to the partner’s love or relationship obligations or portraying oneself as an innocent victim. These tactics should also be ineffective because they place the responsibility for change on the partner, without suggesting how improvements might be made.

Overall and colleagues (2009) examined the success of these four regulation strategies by measuring the degree to which each strategy was exhibited when romantic partners discussed specific aspects of the other that they wanted to see change. Each couple was then followed across time to determine whether the targeted partner actually changed the targeted attributes over the next 12 months. When agents used more negative-direct or positive-direct regulation strategies during their discussions, both partners perceived the discussions as being ineffective in motivating behavior change immediately postdiscussion. However, both positive- and negative-direct strategies forecasted *greater* change in targeted features over the subsequent year. That is, even though the use of direct approaches elicited more negative affect and lower regard in the short term, they successfully motivated the targeted partner to change his or her problematic behavior in the long run. Additionally, the more targeted partners changed, the more agents reported reductions in problem severity, and the happier they became with the relationship across time.

change the targeted attributes (Overall et al., 2006; Overall & Fletcher, 2010). Thus, the more Sarah tries to change Jake's financial security, the more Jake will try to improve these attributes, despite the fact that he feels less well regarded by Sarah's actions. The resulting improvement, however, helps Sarah feel more satisfied (Path B "Yes"). These divergent outcomes suggest that the key to successful partner regulation is propelling targets to make desired changes (Path B) without undermining their perceived regard, self-evaluations, and relationship satisfaction (Paths C, D, and E). As indicated by the dashed lines in the middle of Figure 16.1, whether both positive outcomes can be achieved depends on how partner regulation attempts are enacted.

Partner Regulation Strategies and Successful Outcomes for Agents and Targets

The manner in which individuals try to regulate their partners should provide diagnostic information to the targets of change. Being repeatedly subjected to negative influence strategies from one's partner, such as criticism, punishment, or threats, clearly conveys contempt and disregard to the targeted partner. Indeed, Overall and Fletcher (2010) found that the more partners used hostile and critical regulation strategies, the more targets reported declines in perceived regard and judged their relationships more negatively. Conversely, the use of more positive regulation strategies, such as expressing affection or validation during regulation attempts, appeared to offset the negative effects of partner regulation by communicating care and respect to the targeted partner. Cushioning regulation attempts with positivity and affection, in other words, seems to curtail the potentially damaging effects of partner regulation attempts for targeted partners (Path C, D, and E in Figure 16.1).

The use of positive influence strategies may not only convey higher regard to targeted partners, but it may also motivate them to work harder to change their problematic attributes. Jake's nagging and constant demands for change, for instance, are not likely to motivate Sarah to sacrifice her work to spend more time with him. Indeed, Overall and Fletcher (2010) found that targets are more reluctant to change when they perceive that their partners are using more negative regulation strategies, but they report being more receptive and responding better when their partners display more positive forms of influence. These findings fit nicely with other research showing that hostile communication tends to incite defensiveness and resistance in partners during couple conflict discussions (e.g., Gottman & Notarius, 2000; Karney & Bradbury, 1995; Weiss & Heyman, 1997).

On the other hand, as with the partner regulation processes outlined in Figure 16.1, the impact of negative communication ought to differ depending on whether an individual is the target of influence (who still wants to be valued) or the agent of influence (who is pressing for partner change). Several researchers have found that criticizing, blaming, or pressuring partners to make changes during conflict discussions predicts small but discernible *increases* in relationship satisfaction across time for the agent who is engaging in these negative influence or regulation strategies (e.g., Cohan & Bradbury, 1997; Heavey, Layne, & Christensen, 1993; Karney & Bradbury, 1997). Paralleling these results, a few studies have indicated that positive forms of communication, such as agreement and humor, predict more negative long-term relationship evaluations by the agent expressing positivity during conflict, along with a *higher* probability of divorce (e.g., Cohan & Bradbury, 1997; Gottman & Krokoff, 1989).

TABLE 16.1. The Consequences of Different Regulation Strategies for Targets and Agents of Regulation (Overall & Simpson, 2013)

Regulation strategies	Associated tactics	Outcome for target of regulation	Outcome for agent of regulation
<u>Direct strategies</u>			
Positive–direct	Outlining the causes and consequences of the problem, exploring potential alternatives, weighing up pros and cons, and facilitating constructive discussions to generate solutions.	Clearly expresses desire for change and dissatisfaction but provides direct course of action so targets are more likely to change. Positive approach helps to protect targets' feelings of regard and satisfaction.	Target change leads to greater perceived improvement and relationship satisfaction of agent. Positivity maintains closeness and facilitates mutual responsiveness.
Negative–direct	Directly criticizing, blaming or invalidating the partner, using threats, expressing anger and irritation, demanding or commanding change, or adopting a domineering and non-negotiable stance.	Clearly conveys problem severity and need for change so targets are more likely to change. Harsh negativity elicits defensiveness and reduces perceived regard so targets likely to suffer dissatisfaction even if change is produced.	Target change leads to greater perceived improvement and relationship satisfaction of agent. Negative target reactions undermine closeness and might limit positive impact of target change.
<u>Indirect strategies</u>			
Positive–indirect	Softening regulation by using charm, humor and affection, minimizing the problem, focusing on positive aspects of the partner/relationship, conveying optimism for improvement, and holding back negative reactions.	Reduces conflict and communicates regard so it maintains targets' relationship satisfaction. Downplays the severity of the problem so targets do not understand the need for change and thus alter very little.	Lack of target change conveys low responsiveness and regard. Agent feels unappreciated and unvalued, reducing closeness and damaging relationship satisfaction.
Negative–indirect	Attempts to induce guilt by focusing on past transgressions or appealing to targets' obligations, love, or concern. Using emotional expressions of hurt and portraying the self as a powerless victim to induce sympathy.	Does not clearly outline specific changes or how change can be made so targets are less likely to change in desired ways. Negative and manipulative tone likely to create resistance and resentment, undermining regard and satisfaction.	Lack of target change and responsiveness exacerbates negative feelings and dissatisfaction. Combination of low change and high negativity might create cycle of mutual unresponsiveness.

In contrast, even though the use of positive–indirect strategies was associated with initial perceptions of success and less distress during the discussions from both partners, there was no connection between positive–indirect strategies and behavior change across time. A soft, tactful approach may protect targets’ perceived regard and relationship satisfaction in the short term, but such tactics lessen the salience and visibility of the problem. This, in turn, may make the targeted partner less aware of the extent of the problem, leaving the target oblivious to his or her partner’s dissatisfaction (also see Drigotas, Whitney, & Rusbult, 1995).

The different outcomes for agents and targets of regulation are listed in Table 16.1. For example, a negative–direct approach is damaging to targets of regulation, but it can have benefits for agents of regulation. The bluntness of direct tactics may trigger defensiveness and reduce targets’ perceived regard in the short term, but by clearly communicating the severity of the problem, targets should be more inclined to change, resulting in desired improvement and greater long-term satisfaction for agents of change. On the other hand, a positive–indirect regulation approach may benefit targets but result in considerable costs for agents. Targets may not fully understand the need for change and may still feel sufficiently regarded by their partners; therefore, they fail to adjust their problematic behavior(s). The agent who wants change, however, may become increasingly dissatisfied as the targeted partner does nothing to improve the situation (Overall, Sibley, & Travaglia, 2010).

These very different outcomes for agents and targets of regulation suggest which types of regulation strategies might be most beneficial to relationships. Agent benefits should be greatest when direct strategies are used because these strategies motivate targets to enact necessary changes (shaping the direction and strength of Path B in Figure 16.1). In contrast, target benefits should be greater when positive strategies are used because these communications convey the partner’s care, positive regard, and responsiveness (shaping the direction and strength of Path C in Figure 16.1). Improvements in problem resolution stemming from the use of direct regulation strategies, therefore, might be best accomplished when tactics that convey care and positive regard are displayed at the same time. Thus, a positive–direct strategy may often be the best one for improving relationships because it not only protects the satisfaction of agents and targets by motivating target change (Path B), but also the targeted partners’ feelings that they are valued and loved (Path C).

All of this implies that successful partner regulation requires a well-balanced consideration of the needs of *both* partners, making this a truly dyadic process. Agents of regulation need to communicate in ways that maintain targets’ felt-regard and self-worth, and targets must be sufficiently responsive to agents’ desires and constructive influence attempts. The proper balance, however, may shift depending on several contextual factors. For example, when large discrepancies create serious relationship problems, it should be more important to utilize direct communication strategies to resolve issues, even if well-intentioned criticism and hostility needs to be expressed. However, direct and negative communication strategies are likely to be damaging when minor problems do not warrant a direct, tough approach (e.g., McNulty & Russell, 2010). Similarly, a more positive communication approach should be most beneficial when targeted partners’ behaviors are not too discrepant from one’s ideals or they are responding well to regulation attempts, but it may be very costly when protecting targets’ regard means that

problems and discrepancies remain unresolved and continue to fester across time (e.g., McNulty, O'Mara, & Karney, 2004).

In summary, relationship partners need to adjust their regulation strategies to the importance and severity of particular problems (see Overall & Simpson, 2013). Regardless of whether problems are severe or minor, however, a positive–direct approach might be the optimal strategy in most situations. Direct communication provides the understanding and motivation necessary to help targets alter their problem-inducing attitudes and behaviors. Successful change by the target, in turn, should improve conditions within the relationship by communicating higher levels of commitment and responsiveness, thereby increasing the satisfaction of the partner who initially sought change. And by conveying care and positive regard, a positive–direct strategy should achieve all of this without undermining the targeted partner's felt security and self-worth. However, because some targets are likely to be especially sensitive to the declines in regard that partner regulation (and other threatening relationship interactions) may pose, it is important that agents of regulation behave in specific, context-dependent ways that soothe and reduce target defensiveness, and convey greater commitment, trust, and/or acceptance. As highlighted in the development of Jake and Sarah's relationship, described at the beginning of this chapter, some individuals may need to soothe their partner's insecurities in order to reduce target defensiveness before they can attempt to regulate dissatisfying attributes. This involves another type of dyadic regulation process: partner buffering.

REGULATING ATTACHMENT INSECURITY: BUFFERING VULNERABLE PARTNERS

To this point, we have discussed how individuals involved in romantic relationship seek to achieve their own relationship goals and happiness by attempting to change aspects of their partners that fail to match their partner/relationship ideal standards. We now turn to a different type of partner regulation process that is just as prevalent and important to do well in order to enhance relationships. Rather than trying to attain relationship ideals, this type of partner regulation focuses on helping targeted partners manage challenging relationship interactions well. We now discuss various ways in which individuals involved with insecurely attached romantic partners (i.e., those who are anxiously or avoidantly attached) are able to buffer these “vulnerable” partners from experiencing negative thoughts and feelings, and expressing destructive behaviors in potentially threatening situations. Similar to the partner regulation processes discussed earlier, successful buffering requires being sensitive to the needs of regulation targets (insecure individuals), as well as balancing the needs of the agent of regulation, who is attempting to care for his or her insecure mate. We begin by describing how anxiously and avoidantly attached individuals react to different kinds of threatening contexts, then describe a model outlining how individuals can buffer (regulate) the reactions of their insecurely attached partners. Following this, we review a series of studies documenting that partner regulation behaviors can improve the relationship for *both* partners by effectively reducing the likelihood that anxious and avoidant targets experience negative thoughts and feelings, and enact relationship-damaging behaviors.

Attachment Insecurity and Relationship Functioning

According to attachment theory (Bowlby, 1969, 1973), humans evolved to form strong emotional bonds with their caregivers (attachment figures) because doing so increased the chances of survival. Attachment bonds operate in both childhood and adulthood, and the attachment system becomes activated when individuals feel threatened, distressed, or challenged (Simpson & Rholes, 2012). Depending on how they were treated by earlier attachment figures (e.g., parents, friends, romantic partners), individuals develop different ways of viewing and relating to their current attachment figures that reflect their specific attachment orientation. Securely attached people have received good, consistent care and support from their past attachment figures, so they develop positive views of themselves and others and turn to their attachment figures for comfort and support to reduce negative affect when they are upset. This collaborative, problem-focused style of coping helps securely attached people forge greater closeness and intimacy with their partners (Mikulincer & Shaver, 2003).

There are two primary forms of attachment insecurity. Anxiously attached people, who have received mixed or inconsistent care and support earlier in life, yearn for acceptance and closeness, yet they also worry that their partners may leave them (Mikulincer & Shaver, 2003). For this reason, anxious individuals look for indications of their partner's love and possible rejection, which often generates considerable distress and sometimes dysfunctional behavior in relationship-threatening situations, particularly during relationship conflicts (Simpson, Rholes, & Phillips, 1996) or when partners do not offer sufficient support (Collins & Feeney, 2000). This hypervigilant form of coping allows anxious individuals to monitor and gain the attention of their partners, which makes them feel less insecure, at least temporarily. This form of coping, however, tends to generate anger and dissatisfaction in their romantic partners (Rholes, Simpson, & Oriña, 1999).

Avoidantly attached people have been consistently ignored or rejected by earlier attachment figures. Consequently, they learn that they cannot trust and depend on close others, especially in times of need. In response to this, they suppress their natural impulse to attain closeness and intimacy and become emotionally independent and self-reliant. When they are upset, avoidant individuals usually withdraw from their partners (Pietromonaco & Barrett, 1997) and are less inclined to seek or give support to their partners (Simpson, Rholes, & Nelligan, 1992). This distancing strategy permits avoidant people to defensively maintain sufficient autonomy and independence so they can regulate their negative emotions and resolve distress on their own terms (Mikulincer & Shaver, 2003).

Both forms of insecurity typically destabilize relationships by undercutting satisfaction, aggravating relationship problems, and short-circuiting the positive experiences that might be gained from having happier partners and better functioning relationships (Feeney, 2008). However, the *partners* of insecure individuals may be able to regulate these individuals' insecurity to protect and stabilize the relationship (Overall & Lemay, 2015; Simpson & Overall, 2014). We now describe how we have conceptualized and studied the different ways in which relationship partners can (and do) buffer the typically negative thoughts, feelings, and/or behaviors of anxiously and avoidantly attached individuals in relationship-threatening situations, focusing principally on conflict situations.

The Dyadic Regulation Model of Insecurity Buffering

Our recent research on this topic has been guided by the dyadic regulation model of insecurity buffering (Simpson & Overall, 2014), which addresses the way relationship partners can behave in attachment-relevant dyadic interactions (i.e., those that usually activate the attachment system). As shown in Figure 16.2 (top left), certain types of stressful or threatening events tend to trigger the prototypical concerns of insecurely attached people (targets). Their partners (agents), however, may be able to engage in buffering behaviors that reduce (down-regulate) the target's distress and therefore soothe him or her. Buffering behaviors can be enacted deliberately (consciously and intentionally) or automatically (nonconsciously or unintentionally) by agents. They can include offering reassurance of continued love and support, accommodating the target's wishes or needs, and/or providing the right type or amount of support the target needs to manage his or her emotions more effectively.

Buffering should be most successful when the agent's behavior is responsive to the specific concerns and needs of the target and his or her attachment orientation. Anxiously attached targets, for example, should benefit most from buffering behaviors that reassure them that they are loved and supported, such as the provision of clear and strong emotional support, direct attempts to meet their needs or desires, and/or easing their core relationship-relevant concerns. Avoidantly attached targets, on the other hand, should benefit more from buffering behaviors that allow them to maintain their autonomy and independence, such as using softer influence tactics when trying to change their problematic characteristics, providing instrumental forms of support designed to fix (resolve) the problem, and/or meeting their needs, while allowing them to retain a sense of control and still feel self-reliant.

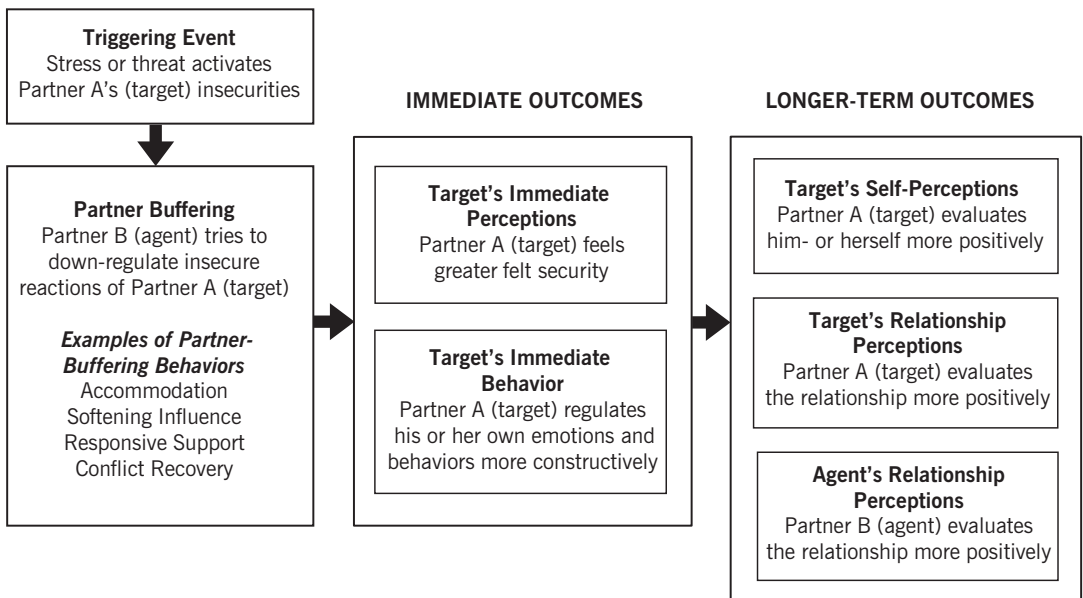


FIGURE 16.2. The dyadic regulation model of insecurity buffering (Simpson & Overall, 2014).

If the buffering enacted by an agent works, insecure targets should report greater felt security during stressful or threatening interactions. This, in turn, should lead them to feel less distressed, manage their emotions more effectively, and behave more constructively (see the middle of Figure 16.2). If this pattern of stress/threat → responsive partner buffering → positive relationship perceptions and behaviors occurs repeatedly, targets should gradually come to view themselves more positively and report greater relationship satisfaction, and agents should report better relationship outcomes with their better-adjusted and happier insecure partners (see the right side of Figure 16.2).

Returning to Jake and Sarah, if Jake (who is anxiously attached) feels threatened by a major disagreement he and Sarah are having, Sarah may directly reassure Jake of her unwavering love, mention his many endearing traits, and clarify why she is so resolutely committed to their relationship (also see Lemay & Dudley, 2011). This buffering attempt should make Jake feel more secure during the discussion, which should allow him to feel better, gain control of his emotions, and act more constructively toward Sarah. If this cycle is continually repeated, Jake should begin automatically to associate Sarah with the dissipation of negative thoughts and feelings when he feels threatened, which should strengthen their emotional bond (especially for Jake; see Simpson, 2007). Over time, Jake should come to view himself as a truly valued partner, he should trust Sarah more, and their relationship ought to improve.

Dyadic Behavioral Observation Studies: Support for the Model

We have tested components of our model in several behavioral observation studies with romantic couples (see Figure 16.2). Most of these studies have examined conflict because this threatening context reliably elicits the cardinal insecurities of anxiously and avoidantly attached people, albeit for different reasons.

Buffering Anxiety during Conflict

Some of our research has investigated ways in which partners can and do buffer the destructive responses to conflict that anxiously attached individuals often display. Tran and Simpson (2009), for example, videotaped married couples while they discussed important habits that each spouse wanted to change in the other. This task should activate concerns about rejection, particularly in anxiously attached people. The authors assessed each spouse's emotional reactions in each discussion (one in which the husband discussed changes he wanted his wife to make, and the other in which the wife discussed changes she wanted her husband to make). Trained observers then coded the accommodation behaviors enacted by each partner (e.g., inhibiting the urge to hurt or retaliate against the partner, trying to maintain the relationship by calming the partner and working to solve the problem). On average, anxiously attached individuals felt more negative emotions and exhibited fewer accommodation behaviors during the discussions than did less anxious people. However, the partners of anxious individuals displayed more accommodative behaviors if they were more committed to the relationship, and this led anxious individuals to feel greater acceptance and more positive emotions during their discussions. Illustrating the immediate benefits of partner buffering (see the middle of Figure 16.2), greater partner commitment and more behavioral accommodation by the partner assuaged the negative emotions and improved the behavioral reactions of

anxiously attached individuals, yielding both greater felt security and more constructive emotions and behaviors.

Buffering Avoidance during Conflict

We have also investigated the behaviors that buffer avoidantly attached individuals. Overall, Simpson, and Struthers (2013), for example, videotaped romantic couples as they discussed relationship problems identified by one partner (the agent) who wanted change in the other partner (the target). Considering their strong need for autonomy and independence, being targeted for change should be particularly threatening to avoidantly attached individuals. As predicted, avoidant targets felt more anger and displayed more observer-rated withdrawal during these discussions, which resulted in less successful problem resolution. Some partners, however, were able to buffer avoidant defenses by “softening” their influence attempts. They did so by being sensitive to the target’s autonomy needs, validating his or her viewpoint, and/or acknowledging his or her constructive efforts and positive attributes. Avoidant targets whose partners displayed more of these softening behaviors showed less anger and behavioral withdrawal, and their discussions were more productive and successful.

Simpson, Winterheld, Rholes, and Oriña (2007) had romantic partners complete the Adult Attachment Interview, which measures attachment orientations to one’s parents based on memories and interpretations of how one was treated as a child by one’s parents. One week later, each couple was videotaped trying to resolve their most serious relationship problem. At peak distress points during each discussion (the triggering event in Figure 16.2), observers rated the extent to which (1) the less distressed partner (the agent) displayed emotional, instrumental, and/or physical caregiving behaviors, and (2) the distressed partner (the target) appeared to be calmed by his or her partner’s caregiving attempts. Securely attached individuals were rated as more calmed when their partners gave them more emotional care by, for example, encouraging them to talk about their emotions/experiences associated with the problem or communicating strong emotional support. Because avoidantly attached individuals suppress their emotions and retract from emotional intimacy when they are upset, emotional caregiving should exacerbate their distress. As hypothesized, avoidant individuals were rated as more calmed when their partners gave them more instrumental caregiving, such as advice or suggestions on how to solve the problem, or discussing the problem in an intellectual/rational way. These results illustrate that in order to be effective, partners’ buffering behaviors must be tailored to the specific needs, concerns, and defenses of insecure targets.

Most recently, Farrell, Simpson, Overall, and Shallcross (in press) examined how romantic couples fare during a specific kind of conflict situation—strain tests. In *strain tests*, one partner (the asker) requests cooperation with a very important personal plan or goal that he or she really wants to achieve, but one that requires the other partner (the responder) to make major personal sacrifices. Strain tests should be particularly difficult for avoidantly attached people when they are in the responding role (i.e., when they are being asked to make a major personal sacrifice) because doing so may reduce their autonomy and independence. Farrell and colleagues videotaped romantic couples having strain test discussions and assessed how avoidant individuals (responders) reacted when their romantic partners (askers) requested a major personal sacrifice of them. On average, highly avoidant responders had more negative relationship perceptions and

behaved in a less accommodating manner when asked to make a major sacrifice. However, two behaviors enacted by asking partners—expressing confidence that the responding partner would facilitate the important plan/goal and acknowledging (giving credit for) the responding partner's likely sacrifices—led highly avoidant responders to react and behave more positively during these strain test discussions. The most likely reason for these buffering effects is that openly acknowledging and “giving credit” for the sacrifices that highly avoidant responders may have to make circumvents defensive reactions associated with the potential loss of autonomy and makes them feel as if their sacrifice will be manageable and appreciated. In addition, highly avoidant responders who received more of these buffering behaviors reported significant pre- to postdiscussion increases in trust in their partners, as well as increases in commitment to the partner and the relationship assessed 3 months later (see longer-term outcomes in Figure 16.2). Other generally positive behaviors, such as specifically expressing caring and affection during the discussion, did not buffer the negative responses of avoidant responders as well as acknowledgment of their sacrifices or expressions of confidence in their support did, providing further evidence for the need for tailored buffering.

Buffering Insecurity Following Conflict

We have also investigated what individuals do to buffer their insecure partners in the aftermath of conflict discussions. In a unique longitudinal study by Salvatore, Kuo, Steele, Simpson, and Collins (2011), one partner in each couple had been studied since birth, so childhood attachment scores (rated in Ainsworth's Strange Situation; Ainsworth, Blehar, Waters, & Wall, 1978) were available for these partners. Immediately after discussing and trying to resolve the major problem in their relationship, each couple did a “cool-down” discussion task, during which the partners talked about the most positive aspects of their relationship. Salvatore and colleagues assessed how quickly and completely each partner “recovered” from the prior conflict discussion. Insecurely attached individuals (rated as insecure as children 20 years earlier) had more difficulty recovering and were more inclined to “reengage” the conflict during the positive cool-down task. When their partners displayed better conflict recovery, however, insecure individuals reported feeling more positive about the relationship, and these couples were more likely to still be dating 2 years later. Hence, as depicted on the right side of Figure 16.2, partner buffering resulted in more beneficial, longer-term outcomes, including greater relationship stability over time.

In summary, these behavioral observation studies of romantic couples embroiled in conflict highlight the pivotal role that partner buffering assumes in protecting relationships that contain an insecurely attached partner. Attachment insecurity does not spell doom for insecure people or their relationships; partners who enact appropriately tailored behaviors can—and often do—buffer the typically negative cognitive, emotional, and behavioral reactions of their insecurely attached partners. It is important to emphasize, however, that partner buffering behaviors differ in effectiveness depending on how well they meet the underlying motives and reasons for a target's regulation difficulties. Even the “right kind” of buffering behaviors must be delivered skillfully, as we discuss in greater detail below. When buffering attempts repeatedly fail, agents may stop trying to console insecure targets, which is likely to exacerbate agents' dissatisfaction (Lemay & Dudley, 2011). But when partner buffering counteracts the worries and defenses of insecure people, persistent partner buffering ought to generate greater security in targeted

partners across time. Partner buffering, in other words, may be a primary “agent of change” in fostering greater attachment security (Overall & Simpson, 2015).

Regulating Felt Insecurity in Everyday Life

Individuals can also attempt to regulate their partner’s insecurities during daily exchanges. Lemay and Dudley (2011) propose that people learn about their partner’s insecurities from the strong affective and behavioral reactions to threat commonly exhibited by highly anxious (as well as low self-esteem) partners. People also come to understand the many difficulties that such insecurities can generate in relationships, which may motivate them to develop preemptive strategies to avoid upsetting their insecure partners in the first place. Besides attempting to short-circuit anger and hostility in threatening situations, individuals can also accomplish this goal by displaying strong and clear expressions of affection or concealing negative feelings and dissatisfaction with either their partner or their relationship.

Lemay and Dudley (2011) tested these ideas by asking friends to rate each other’s level of security (i.e., each person’s self-esteem and attachment anxiety) privately, then evaluate each other more globally (e.g., how much they valued their friend and were committed to the relationship). Some participants were then unexpectedly asked to provide their evaluations again but were told that, this time, their friend would see the information. When participants perceived that their friend was more insecure, they concealed their negative evaluations from him or her, and they offered more positive ratings when the information was public compared to the first set of ratings that was not seen by their friend. But when individuals perceived that their friend was more secure, there were no significant differences between their private and public ratings. In a follow-up diary study, Lemay and Dudley also found that exaggerated positive sentiments helped insecure partners feel more valued. Specifically, on days when individuals perceived that their partners felt more insecure (e.g., more negatively regarded or worried about the relationship), individuals were more concerned about upsetting their partners, more cautious of how they treated them, and more prone to exaggerate positive feelings and conceal negative feelings to them. This “affective exaggeration” in turn predicted *decreases* in their partner’s insecurity on the following days.

Viewed together, these findings indicate that individuals often strive to avoid eliciting their partner’s insecure defenses by camouflaging their unhappiness and accentuating their positive feelings about their partners and the relationship. This regulation strategy works well, in that insecure partners feel more valued and more highly regarded. However, this strategy can also backfire. Lemay and Clark (2008), for instance, found that insecure people are more inclined to believe that their partners express inauthentic or exaggerated expressions of regard at times, especially in response to their persistent reassurance seeking. Harboring doubts about the authenticity of expressed regard from their partners may also elevate their concerns about rejection, which could generate destructive reactions, such as derogating the partner. Thus, unless it is enacted well, insecure individuals may detect their partner’s overcompensation efforts, which may further undermine their sense of security in the relationship.

On the flip side, continually censoring legitimate complaints, exaggerating affection, and trying not to ruffle hypersensitive partners—that is, “walking on eggshells”—may carry heavy costs for individuals involved with insecure partners. Having to provide

constant reassurance and continually feeling the need to build up and reinforce the self-esteem of insecure partners ought to take a toll on even highly committed individuals, whose *own* needs may often be ignored or overlooked. Accordingly, Lemay and Dudley (2011) found that the more partners reported engaging in exaggerated affection, the less positively they viewed their relationship that day.

In conclusion, just as with the partner regulation processes displayed in Figure 16.1, the outcomes of the partner buffering processes shown in Figure 16.2 ought to differ depending on the agent of regulation (the person trying to regulate the insecurity of his or her partner) and the target of regulation (the insecure person receiving additional love and attention). Similar to partner regulation, the ultimate outcome of partner buffering for regulation agents rests largely on the responses of the targeted partner. In particular, the outcomes for both partners should be more favorable across time if buffering attempts increase the level of trust and self-esteem in insecurely attached individuals, resulting in more constructive and smooth interactions in which relationship conflicts are resolved more effectively. In this case, agents are also likely to experience boosts in relationship satisfaction (see the longer-term outcomes in Figure 16.2). If, however, buffering behaviors must be continually enacted by agents in response to the hypersensitivity of the targeted partner and regulating the partner's insecurity fails to work as intended, then agents' commitment may decline over time. Thus, similar to the partner regulation processes discussed earlier (see Figure 16.1), it is crucial that the specific strategies used by agents to buffer their partner's attachment insecurity effectively address the particular concerns of insecure targets, while also generating the relationship improvements that are needed to promote positive long-term outcomes for *both* partners.

CONCLUSION

We began this chapter by discussing a hypothetical relationship between Jake and Sarah. We did so to showcase some important but understudied processes that occur in nearly all relationships—the ways in which partners regulate one another's thoughts, feelings, and behaviors. Jake and Sarah, for example, attempted to resolve important issues in their relationship by trying to change the amount of attention each partner paid to career and finances versus intimacy and fun together. Although such partner regulation processes can improve relationships and resolve conflicts, they can also produce negative feelings and defensiveness, especially when partner regulation attempts are not sensitive to the targeted partner's feelings of regard and self-worth. This is especially true if targeted partners are like Jake and harbor chronic insecurities about whether their partners truly love and are committed to them.

As relationships develop, however, people such as Sarah learn about the insecurities of their partners and may frequently try to soothe and buffer their partner's concerns and vulnerabilities, particularly in threatening situations. Sarah's effective partner buffering eventually helped Jake manage his own emotions and behaviors more constructively, which resulted in more positive outcomes for Jake, Sarah, and their relationship. And once Jake developed a stronger sense of security, he had the confidence to change other aspects of himself and the relationship that caused difficulties in their relationship, which also helped improve aspects of the relationship that Sarah wanted to change. Over time, these joint dyadic regulation processes enhanced their relationship.

Partner regulation and buffering processes can also have some clear costs. By continually working to bolster Jake's self-esteem and security, Sarah may grow tired of being the constantly supportive partner, and she may come to realize that some of her own important needs are not being fulfilled. For example, because she needs to protect Jake's feelings of regard by adopting soft, positive regulation strategies when attempting to resolve relationship problems, Sarah's attempts to attain desired relationship improvements are likely to be a long, slow process. On the other hand, taking a more direct, blunt approach would produce more rapid and successful change and bolster her satisfaction, but it might seriously undermine Jake's perceptions of himself and their relationship. These complex benefits and costs highlight an important point: A complete understanding of how dyadic regulation processes function and affect relationships requires understanding and modeling the consequences of dyadic regulation for *both* agents and targets of regulation.

Adopting a dyadic perspective on regulation processes in close relationships introduces a vast array of interesting and important avenues for future research. Future work should continue to test the models we outline in this chapter, particularly the long-term outcomes for both partners resulting from dyadic regulation processes. Additionally, we know little about how targets of regulation perceive regulation and buffering attempts in the moment. Future research should examine how targets interpret their partners' behavior and how these perceptions might mediate the effectiveness of partner regulation and partner buffering. We hope that this chapter sparks new ideas and hypotheses at the intersection between self-regulation and partner regulation processes in close relationships.

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usually includes a set of beliefs, often concerning supernatural agents, and the way these agents interact with the world and with humanity. Second, particular behaviors can be associated with these beliefs. These behaviors often aim to influence supernatural agents or to comply with their requirements. Third, by definition, religious beliefs and behaviors take place within the context of a more or less cohesive community of others who share similar beliefs and engage in similar behaviors. And finally, binding all of these elements together, religions typically offer a moral code, telling people what they must do to be “good” people.

Although this definition reflects an emerging consensus among religious scholars (e.g., Johnson et al., 2015; Norenzayan et al., in press; Saroglou, 2011), the literature linking religion with self-regulation has not tended to distinguish between these different elements, nor has it paid them equal attention. For instance, some studies combine measures of belief and attendance into variables reflecting “latent religiosity” (Carter, McCullough, & Carver, 2012; see also Desmond, Ulmer, & Bader, 2013; Kim-Spoon, Farley, Homes, Longo, & McCullough, 2014; Reisig, Wolfe, & Pratt, 2012; Watterson & Giesler, 2012), and studies have asked far more often about what participants believe than about their religious community. The resulting collection of studies can give us useful information about how religion, broadly speaking, relates to self-regulation, but they also lead us to our second call to action, which invites researchers to more fully integrate modern theories of religion into their work on self-regulation.

CONNECTING RELIGION WITH SELF-REGULATION

With these definitions in mind, we can explore how religion and all of its components connect with the skills and motivation that underlie self-regulation. We first review the sizable body of research on the idea that religion relates to people’s *ability* to self-regulate; afterwards, we turn to the sparser set of findings that relate to people’s *motivation* to self-regulate.

Religion and Self-Regulatory Abilities

Self-Regulation as a Skill

Scholars who treat self-regulation as a skill often characterize it as a continual feedback loop that involves a series of sequential steps: Once students, for instance, have set an appropriate goal or standard for their grade point average (GPA), they must continually note their performance, compare it to the standards they have set, detect any discrepancy, and if they find one, act to reduce it (Carver & Scheier, 1998). All else being equal, people have better self-regulatory skills if they can perform any of the following actions more effectively: if they can set more appropriate goals; if they are better at self-monitoring or at comparing their current state to their desired state; or if they can more consistently direct their behavior in pursuit of their goals, consciously or not.

A number of factors contribute to people’s general ability to self-regulate, seen through this lens. Some research has considered the micro-level skills that go into the feedback loop. One such skill that has particular relevance for this chapter is self-monitoring (e.g., Carver, 1974, 1975; Gendolla, Richter, & Silvia, 2008; Gibbons, 1978; Macrae, Bodenhausen, & Milne, 1998; Scheier, Fenigstein, & Buss, 1974). Those who

CHAPTER 17

Religion and Self-Regulation

Integrating Skills-Based and Motivation-Based Accounts

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The study of ideology has recently (re)emerged as a major area of study in the psychological sciences, thanks in large part to new theoretical and conceptual models that integrate ideological beliefs with basic psychological processes. In particular, the past decades have seen a great deal of work linking self-regulation with social, political, and—most prominently—religious belief systems. In this chapter, we offer a comprehensive review of the various ways in which religious belief has been connected to self-regulatory processes, along with some recommendations and considerations we hope will help to advance this rapidly expanding new field.

This volume in its entirety provides a much more authoritative and comprehensive definition of self-regulation than we could hope to offer in a few introductory words in this chapter; for our purposes, then, we simply state that effective *self-regulation* means guiding and correcting one's behavior in the service of pursuing goals and achieving psychological well-being (Barkley, 1997; Carver & Scheier, 2011; Kanfer & Karoly, 1972; Muraven & Baumeister, 2000). In spite of widespread agreement surrounding this definition, scholars have used two different lenses to study self-regulation. Some have assumed that effective self-regulation requires a general set of abilities (Carver & Scheier, 1998), whereas others have emphasized the idea that effective self-regulation depends on *motivation*, or a situation-specific willingness to engage self-regulatory skills (Bandura, 1997; Vroom, 1964). One of our goals in this chapter is to highlight the fact that religion researchers have primarily explored self-regulation from the perspective of abilities, and our first call to action is for researchers to take seriously the perspective that self-regulation also requires the *motivation* to apply these abilities.

Defining religion is another topic to which other scholars have devoted countless pages. For our purposes here, we define *religion* as a set of four interlocking elements (Johnson, Li, & Cohen, 2015; Norenzayan et al., in press; Saroglou, 2011). First, religion

self-monitor more regularly have a clearer idea of their current state, more regularly compare that current state to their standards and, as a result, more often note discrepancies between the two. Noticing these discrepancies is what cues people to take action, which makes self-monitoring a key contributor to the process.

Most research, though, takes a more holistic approach to examining self-regulatory skills. For example, *conscientiousness* is a collection of traits that describe people who regularly engage in self-control, work hard, and follow rules (Roberts, Jackson, Fayard, Edmonds, & Meints, 2009). At a more specific level, individuals can differ in their self-control abilities as measured by a self-report scale (Tangney, Baumeister, & Boone, 2004). Finally, proponents of one dominant perspective have argued that self-regulation depends on a critical, finite resource, and that the strength of this resource can be indexed by people's ability to persist in their self-regulatory efforts (e.g., Muraven & Baumeister, 2000). Recent work has called into question the universality of this resource-based model of self-regulation, and has proposed other factors that can influence people's ability to persist (e.g., the mere belief that one has the capacity to persist; Clarkson, Hirt, Jia, & Alexander, 2010; Job, Dweck, & Walton, 2010). That being said, many approaches to studying self-regulation as a skill examine people's ability to persist in the face of depleted resources.

Religion Linked to Better Self-Regulation Skills

So how might religion relate to the skills of self-regulation? The bulk of the work has linked religion with *better* self-regulation abilities. At a correlational level, this work comes from three separate streams of research. First, religion has consistently been linked with conscientiousness, the personality trait of self-regulation (e.g., Saroglou, 2010). In what may be the most definitive study on the subject, an analysis of data drawn from millions of Facebook users identifies the personality traits associated with more than 20 different denominations including atheism and agnosticism (Kosinski, Laurin, Youyou, Stillwell, & Leskovec, 2016). In this analysis, identifying with just about any world religion predicts above-average levels of conscientiousness (as well as above-average levels of extraversion and agreeableness, and below-average levels of neuroticism and openness to experience).

Second, moving to more specific personality traits, a large number of studies have found a link between religion and the more specific skill of self-control. McCullough and Willoughby's (2009) foundational review of religion and self-regulation identified 11 such studies. Since then, at least a further 10 studies have emerged, documenting this positive relationship (Aldwin, Park, Jeong, & Nath, 2014; Carter, McCullough, & Carver, 2012; DeWall et al., 2014; Hosseinkhanzadeh, Yeganeh, & Mojallal, 2013; Kim-Spoon et al., 2014; Klanjšek, Vazsonyi, Trejos-Castillo, 2011; Laird, Marks, & Marrero, 2011; Pirutinsky, 2014; Reisig et al., 2012; Vazsonyi, & Jenkins, 2010), and one of the previous 11 studies, which was unpublished at the time, has appeared in print (Desmond et al., 2013).

Third, some evidence suggests that religion can promote the micro-level skills necessary for effective self-regulation. As we mentioned earlier, one such skill is self-monitoring: Those who self-monitor regularly are more apt to notice discrepancies between their current and desired states, which is what prompts them to act. Indeed, one of the reasons that more religious people have more self-control is that they self-monitor more (Carter et al., 2012; Kim-Spoon et al., 2014).

Can we take this collection of correlational data as evidence that religion *causes* better conscientiousness, self-control, or self-monitoring? The three streams of research have taken different theoretical stances on this question. The work on conscientiousness typically posits the reverse: that conscientiousness causes religiosity, presumably because personality is assumed to be heritable and stable across the lifespan (e.g., Bouchard, Lykken, McGue, Segal, & Tellegen, 1990; Loehlin, 1992), leaving no possibility for religion to influence it. Consistent with this idea, three different papers show that adolescent conscientiousness predicts religiosity later in life (McCullough, Tsang, & Brion, 2003; Regnerus & Smith, 2005; Wink, Ciciolla, Dillon, & Tracy, 2007), controlling for earlier religiosity, and one shows that, in contrast, adolescent religiosity does *not* predict conscientiousness later in life (Wink et al., 2007). In other words, adolescents who are conscientious become more religious as adults, but religious adolescents do *not* become more conscientious as adults. Likewise, in the Facebook study mentioned earlier, users who started out identifying with a religion, but whose personalities were more like those of atheists (i.e., who were less conscientious, and also less extraverted and agreeable, and more neurotic and open) were more likely to have abandoned their religion by the end of the study (Kosinski et al., 2016). Thus, although more religious people tend to be more conscientious, it does not appear that religiosity can induce this broad-level personality trait that subsumes self-control.

The work on trait self-control more specifically, though, typically posits that religion can indeed increase people's self-control, often citing religious teachings that encourage adherents to practice and develop their self-control skills (e.g., Kim-Spoon et al., 2014). Only one of the correlational studies cited earlier can speak to this question, but it does support the idea that religion increases self-control: Using data collected every 6 months for a period of 7 years, Pirutinsky (2014) found that convicted adolescents who felt a personal connection with religion reported better impulse control, and that increases in religiosity during the study period were followed by improvements in impulse control.

The work on self-monitoring has not provided any empirical tests of causality; however, various authors have argued that religion may cause self-monitoring (1) because of religious practices (e.g., confessing one's sins) that elicit self-monitoring directly (Baumeister, Bauer, & Lloyd, 2010), and/or (2) because more religious people more often feel monitored by others (Carter et al., 2012). In particular, more religious people may monitor themselves because they feel constantly monitored by an all-knowing God. Indeed, explicit or implicit reminders of an all-knowing God lead people to be more aware of how they appear to others (Gervais & Norenzayan, 2012).

Thus, three streams of research have linked religion with better self-regulation abilities at a correlational level, but together they have offered mixed evidence on the question of causality. The best evidence on this front may instead come from other research that has tackled the link between religion and self-regulation using the paradigm of self-regulatory depletion. In a prototypical depletion experiment, participants either do or do not complete a first task, which is known by researchers to require self-regulation. Then, all participants complete a second task, also known to require self-regulation. In this prototypical experiment, participants who completed the first task, compared to those who did not, perform less well on the second task, presumably because the first task did indeed deplete participants' resources, leaving them with a limited supply of resources with which to perform the second task.

Four articles have linked religion with variation in this depletion effect. The first established this link at a correlational level. Participants who scored high on a composite

index of religiosity showed no evidence of depletion: They persisted just as long on an unsolvable anagrams task regardless of whether they had first expended their self-regulatory resources squeezing a handgrip for as long as they could. By contrast, participants who scored low on the index of religiosity showed less persistence at the anagrams task if they had first completed the handgrip task (Watterson & Giesler, 2012). In other words, more religious participants appeared to have a larger store of self-regulatory strength.

All the other existing research using the depletion paradigm has provided causal evidence for the idea that religion can improve self-regulation. In a study using a scrambled sentence task to prime thoughts of God, unprimed participants persisted less at an impossible puzzle task if they had first completed a depleting typing task, but priming participants with thoughts of God eliminated this effect (Rounding, Lee, Jacobson, & Ji, 2012). Similarly, a pair of studies manipulated whether participants had first engaged in prayer, and found that participants who prayed showed no evidence of depletion: They performed equally well on a Stroop task regardless of whether they had first completed a depleting task (suppressing either their thoughts or their emotions). Participants who did not pray, however, showed typical depletion effects (Frieze, Schweizer, Arnoux, Sutter, & Wänke, 2014; Frieze & Wänke, 2014). Thus, religious cognitions or behaviors—incidental thoughts of God, or prayer—can enable people to escape the effects of depletion or to persist longer in their self-regulatory efforts.

In summary, religious people tend to have—or at least to say that they have—better self-control skills. Most researchers have theorized that this is because religion increases people's self-control. The correlational studies offer only weak evidence for this causal statement, but studies done with depletion paradigms provide direct evidence for it: Religion can make people better able to exert self-control over an extended period of time without tiring. Some have argued that this happens because certain religious practices and beliefs can encourage people to regularly check in with themselves and evaluate their progress, which is an essential component of their ability to regulate behavior in pursuit of their goals; we return to the question of mechanism in a later section.

Religion Linked to Worse Self-Regulation Skills

Although the balance of the evidence supports the idea that religion improves self-regulation skills, a few theorists have posited that some aspects of religion can make people worse self-regulators. For example, let's return to the idea of self-monitoring. Good self-regulators not only monitor their current state but also compare it to their ideal state in order to correct any discrepancies. But Galen (2012) has argued that most religious worldviews offer a lot of flexibility regarding this ideal state, which could lead people to rationalize any discrepancies rather than take action to minimize them. Put differently, a religious person's ideal self may depend in part on her vision of what God wants her to be, so if she finds herself lacking in some respect, instead of striving to improve herself, she can instead decide after all that God wants her to be something more like who she already is. Consistent with this possibility, people who want to repair their relationship with someone who harmed them subsequently endorse religious prescriptions about forgiveness, whereas people who want to avoid their transgressor instead endorsed images of God as harsh and unforgiving (Tsang, McCullough, & Hoyt, 2005). According to this perspective, instead of helping people self-regulate in pursuit of their goals, religion can

instead encourage complacency by allowing people to reconfigure their goal states as equivalent to their current states.

Others have argued that religion's emphasis on forbidding certain actions can lead to self-regulatory problems. Avoiding temptations can be mentally taxing: It involves a dual process whereby people automatically detect temptations in their environments, then use their more deliberative—and limited—resources to avoid them (Wegner, 1989, 1994). Even if, as studies have shown, more religious people can persist with their self-regulatory efforts longer than less religious people, eventually even they will experience depletion. Once that happens, they will be left with a strong awareness of temptations from the automatic detection process, and no resources left with which to resist them (Janoff-Bulman & Sheikh, 2011).

No empirical evidence exists either for or against this particular idea; however, some researchers have found that people with stronger religious commitments have more unrealistic views of their own ability to resist temptation (Garos, Beggan, & Kluck, 2004). This finding carries two implications. First, it indicates a way in which religious people may be more vulnerable to self-control failure: Those who overestimate their ability to resist temptation may exert less caution than they should and may end up succumbing more often (Nordgren, van Harreveld, & van der Pligt, 2009). Second, and perhaps more importantly, this finding casts doubt on the self-report-based evidence for the link between religion and self-control: If more religious people exaggerate their ability to resist temptation, they might also exaggerate their ability to exert self-control more generally. Even the longitudinal evidence could be reinterpreted as indicating that religion causes people to exaggerate their views of their own self-control, as opposed to indicating that religion causes actual self-control. Of course, many of the studies that use self-reports of self-control also show that this self-reported self-control predicts better outcomes, such as less criminal behavior and substance abuse, so clearly these effects cannot be entirely discounted. Nevertheless, given this potential issue, we call for future researchers on this topic to use behavioral indicators of self-control rather than (or at least in combination with) self-report measures.

How Might Religion Enhance Self-Regulatory Skills?

This last issue notwithstanding, the balance of the evidence favors the idea that religion can make people better self-regulators. Why might this be the case? Which of the four facets of religion can explain this association? These are questions to which we do not yet have clear answers. As discussed previously, studies vary widely in how they operationalize religiosity, and a large proportion of studies combine disparate elements such as intrinsic religiosity (i.e., being religious because one has internalized religious values) and time spent attending religious service into a single index (e.g., Watterson & Giesler, 2012). Moreover, many studies that have sought to isolate a single component of religion have done so in problematic ways. For example, one article operationalized the complex construct of “religious belief” as the answer to a single question about belief in the afterlife (Reisig et al., 2012). Two articles purporting to examine the influence of prayer compared a prayer condition to a condition that involved not only no prayer but also no mention of religion (Friese et al., 2014). Consequently, the results could have arisen simply because participants in the prayer condition had been reminded of their religious beliefs or communities.

Setting these issues aside, the evidence at hand offers four tentative conclusions. First, more religious people say, and in some cases demonstrate, that they have better self-control skills than less religious people. Second, these skills may come from people's belief in an all-knowing God and their awareness of others in their community monitoring them, both of which contribute to their own self-monitoring. Third, these skills may come from religious practices that help people get in the habit of engaging their self-regulatory skills (Baumeister et al., 2010). For instance, meditation is one religious practice that has been linked with activity in the prefrontal cortex of the brain, which is the seat of executive control (Cahn & Polich, 2006; McNamara, 2002).

Finally, intrinsic, as opposed to extrinsic, religiosity appears to play a key role in the association between religiosity and self-regulation skills (see also Pargament & Park, 1995). *Intrinsic religiosity* occurs when people have internalized their religious values and use those values to guide their behavior; *extrinsic religiosity* occurs when people value religion because it provides them some other benefit—status, sociability or security (Allport & Ross, 1967). Four articles have compared these two forms of religiosity. In each case, intrinsic religiosity was positively associated with self-regulation. By contrast, extrinsic religiosity showed a negative association twice (Abar, Carter, & Winsler, 2009; Bergin, Masters, & Richards, 1987), no association once (Hosseinkhanzadeh et al., 2013), and inconsistent associations once (Klanjsek et al., 2011).

On the surface, we might be tempted to conclude that because intrinsic religiosity is more closely associated with self-regulation than extrinsic religiosity, beliefs and morality play a larger role than behaviors and communities. Indeed, beliefs and morality are more internal, whereas behaviors and community are externally observable. But this conclusion falls apart under further scrutiny. A person might easily have extrinsic reasons for adopting, say, a belief in a benevolent God, which might bring her solace in times of crisis. Likewise, a person might have intrinsic reasons for participating in religious rituals: He or she may be doing so not because it allows connection with other people, but because he or she truly believes it is the virtuous thing to do. Thus, the intrinsic–extrinsic religiosity distinction does tell us something about when religion is likely to lead to self-regulatory skills, but it does not help us understand which elements of religion might be responsible.

To summarize, to date, we know that religion seems to promote self-regulation abilities, but we know little about why. Current findings point to the importance of belief in a God and the presence of a community that monitors one's activity, certain executive-function-enhancing religious practices, and intrinsic religiosity. Future research that takes into account the most up-to-date theories of religion might help sharpen our understanding of these mechanisms.

Future Research

The primary question that emerges from this synthesis is the one we have just asked: How, exactly, does religion promote self-regulatory skills? One approach to answering this question might be to study the differences between religions. Religions differ recognizably along the four dimensions we have identified (beliefs, behaviors, communities, and moral codes), so this is one way of integrating theories of religion into research on self-regulation. To give a specific example, take the idea that superior self-regulation skills come from the “exercise” of having to comply with the demands of religion (Baumeister et al., 2010). If this is true, then we should see differences depending on whether

a particular religion makes demands that are more proscriptive (e.g., do not mix dairy and meat), or more prescriptive (e.g., confess your sins every week). If a person's religion makes him or her "practice" complying with proscriptive demands, he or she might become a better self-regulator when it comes to avoidance- or prevention-oriented tasks. By contrast, if a person's religion makes him or her "practice" complying with prescriptive demands, he or she might become a better self-regulator when it comes to approach- or promotion-oriented tasks (Elliot, 1999; Higgins, 1997). As another example, some religions may promote specific beliefs that facilitate self-regulation. The belief that God will not give you more than you can handle (Corinthians 10:13), for example, is akin to the belief that your self-regulatory resources will never be fully depleted, which can enable persistent self-regulation (Job et al., 2010). All else being equal, these religions may be especially good at fostering self-regulation.

A different, but related, reason why religion might promote self-regulation skills pertains instead to the moral code dimension. A strict moral code that offers clear guidelines for determining right and wrong can serve as a useful heuristic for choosing one's course of action. Making choices can be depleting (e.g., Vohs et al., 2008); to the extent that a religion has a strict moral code, it might alleviate some of that burden. If this is true, then religions with strict moral codes might be most likely to enhance self-regulatory resources. These kinds of religions might in effect make certain choices on behalf of their adherents, leaving them with more resources with which to tackle daily life.

A second area for further exploration relates one of the critical steps of the self-regulation process that until now we have not discussed: Once one has assessed one's current state, perhaps as a result of self-monitoring, one must accurately compare it to one's ideal state or standard, and react appropriately to any discrepancies. In other words, self-regulation requires detecting and responding to errors. Recent evidence suggests that religion may relate to people's anxiety about errors, and their ability subsequently to correct them, although this evidence is highly contradictory. In one pair of studies, believers who either wrote a paragraph about what their religion meant to them or completed a task that primed them with thoughts of God, showed a less pronounced neural response to errors on a Stroop task, and in one of the studies, believers primed with thoughts of God also made fewer errors compared to believers who wrote (Inzlicht & Tullett, 2010). In a contrasting study, participants primed with thoughts of God reported greater anxiety after having completed an unsolvable anagram task, and persisted longer on that task than participants who were not primed (Toburen & Meier, 2010).

In other words, on the one hand, we have evidence that religion reduces anxiety in response to error, and that decreased anxiety may lead to better performance; on the other hand, we have evidence that religion increases anxiety in response to error, and that this increased anxiety may lead to more persistence. Future research might sharpen our understanding of the relationship between religion and error-related anxiety, as well as performance (for one possible way forward, see Tullett, Kay, & Inzlicht, 2015).

Finally, one area for future research involves defining effective self-regulation. In particular, many of the studies we have reviewed employ as a measure of self-regulation persistence on an impossible task. Although, as a rule, persistence in goal pursuit is an admirable trait, it is also important to know when to abandon goals (Gollwitzer & Sheeran, 2006; Wrosch, Scheier, Miller, Schulz, & Carver, 2003). If religion causes people to persist at tasks that, objectively speaking, are impossible, it is not clear that we should necessarily label that effective self-regulation.

Religion and Self-Regulatory Motivation

Self-Regulation as a Will

We now shift perspectives and consider how religion might contribute to people's motivation to apply their self-regulatory skills if given a particular challenge. Recent controversy notwithstanding (e.g., Job et al., 2010; Molden et al., 2012), it is undeniable that exerting self-control relies on some forms of limited resources. If a person receives a dinner invitation from a friend on a night on which he or she planned to stay home to work on a couple of important papers, he or she cannot be in both places at once. Likewise, the more time he or she spends working on the paper, the less time will be spent working on the other. This example illustrates how self-control comes not only from a person's absolute ability to exert it but also his or her analysis of the costs and benefits of doing so (Kurzban, Duckworth, Kable, & Myers, 2013).

Others have identified three key questions on which this cost-benefit analysis—and therefore motivation—rests (Bandura, 1997; Vroom, 1964). First, can I do it?: Do I believe that I have the ability to self-regulate in this instance? Second, will there be a reward? Will successful self-regulation bring with it some kind of benefit? Third, do I care? Is this benefit something that I value? According to this framework, a person will only have the motivation to apply self-regulatory skills if the answer to all three of these questions is “yes.” For example, if a dieter is faced with a fragrantly fatty plate of fries, she will only try to resist eating them if she believes that she can, if she believes that not succumbing to the temptation will help her lose weight, and if she believes that losing weight will grant her desires: the ability to jump higher and run faster, perhaps, or compliments and attention from desirable others. As another example, a scientist will only be motivated to work hard on a paper if he believes he can write a good paper, that if he writes a good paper, a prestigious journal will publish it, and that publishing a paper in a prestigious journal will bring the kinds of professional accolades he craves.

Given this basic framework, then, how might religion affect people's motivation to self-regulate? Although the body of research on this topic is small, we are not the first to have posed the question: Harrison and McKay (2013) argued that the depletion studies we reviewed earlier (e.g., Rounding et al., 2012) could be explained not by religion granting people the ability to self-regulate but rather by motivating them to *show* their ability to self-regulate. In this section, we explore how religion might influence each of the three beliefs that underpin self-regulation, although, because of the sparse literature, many of the ideas we review are not fully tested. We then outline some ideas about plausible mechanisms and propose some ideas for future research.

Religion and Believing That You Can

Little research has directly examined the question of how religion might influence people's beliefs about their skills. On the one hand, some religious factors may decrease people's sense that they can accomplish certain tasks. For example, believers subliminally primed with the word *God* felt that they had played less of a role in causing events that occurred on their computer screen (Dijksterhuis, Preston, Wegner, & Aarts, 2008). More broadly, a theoretical model of compensatory control (Kay, Gaucher, Napier, Callan, & Laurin, 2008) suggests that perceptions of God's control have a hydraulic relationship with perceptions of personal control: The more control I ascribe to myself, the less

I ascribe to God, and vice versa. In other words, to the extent that religion encourages people to believe in external sources of control, it may make them feel less able to produce desired actions (but see below for a complementary take on the compensatory control model related to people's faith that rewards will follow these actions). Consistent with these ideas, our own past research suggests that reminders of a powerful, interventionist God decreases people's willingness to invest their own efforts in pursuit of important goals (Laurin, Kay, & Fitzsimons, 2012).

On the other hand, religion may grant people a dangerously misplaced *overconfidence* in their abilities. We reviewed one study earlier demonstrating that more religious people overestimate themselves, at least in the domain of temptation resistance (Garos et al., 2004), which can reduce their motivation to apply themselves to such tasks (Nordgren et al., 2009). Likewise, the notion of a benevolent, protective God can make people feel shielded from danger: Across seven studies, participants primed with thoughts of God, particularly those who felt a secure attachment to God, took greater risks because they felt negative consequences were less likely (Kupor, Laurin, & Levav, 2015). This last set of findings in particular illustrates the dangers of unwarranted confidence: Confidence in one's skills when one does not in fact possess those skills can lead to an unwillingness to act responsibly.

To summarize, from a motivational perspective, religion can make people less confident in their abilities, which decreases their motivation and therefore impairs self-regulation. At the same time, religion can make people *overconfident*, which also impairs self-regulation. On the surface this seems like a contradiction: How can religion make people both more and less confident, and how can both under- and overconfidence impair self-regulation? One way of resolving this apparent inconsistency is to consider two different forms of confidence: on the one hand, realistic beliefs about what is likely to occur (i.e., expectations), and on the other, unsubstantiated hopes about what one would *like* to occur (i.e., fantasies). Religion may fill people's minds with the image of success, or the confidence that positive outcomes *will* emerge. But at the same time it may remind them that they have limited influence over their likelihood of success, or reduce their confidence in their own ability to *cause* these outcomes. Both can result in people engaging in fewer efforts in pursuit of success (e.g., Oettingen, 2012; Oettingen & Mayer, 2002).

Religion and Believing a Reward Will Follow

Another way of putting this might be to say that to the extent that religion gives people more confidence, what it really gives them is confidence that God will give them what they are seeking. Religions that promote beliefs in an interventionist, morally concerned God (i.e., most world religions; Norenzayan, 2013) tell adherents that God rewards good people. In other words, these religions may convey to believers that rewards come from morally good behavior, and *only* from morally good behavior. This may lead to enhanced motivation to self-regulate in moral domains, but *decreased* motivation in nonmoral domains. If a person wants to achieve professional success and he believes that his professional success is in God's hands, that might motivate him to do the things he thinks God wants him to do (e.g., avoid adultery, theft, and murder). But, conversely, it might make him think that as long as he succeeds morally, he does not need to invest efforts in directly pursuing his professional dreams because God will fulfill them (Laurin et al., 2012; see also Laurin, Shariff, Henrich, & Kay, 2012).

Compounding this problem, the same religions that promote the idea of God as an interventionist, morally concerned being also portray God as omniscient and all-knowing. On the one hand, this means religious people sense that they are being watched (Carter et al., 2012; Gervais & Norenzayan, 2012), which may serve to remind them that their actions have consequences—a fundamental prerequisite to believing that efforts lead to rewards (Kay, Laurin, Fitzsimons, & Landau, 2014). On the other hand, it also helps amplify the effects described earlier. If God is always watching, we must continually focus on self-regulating in the service of being good people, and we will have no time left—and perhaps no energy—to self-regulate in pursuit of our career goals.

No researchers have directly tested these ideas, although some findings hint at their validity. For one thing, although reminders of God make people more interested in amoral risky activities such as skydiving and backwoods camping, they make people *less* interested in taking moral risks such as engaging in bribery or embezzlement (Chan, Tong, & Tan, 2014, Kupor et al., 2015). This suggests that people may intuitively believe God is on their side and will tip the scales in their favor even if they take impulsive risks, but that this benevolence depends on them not crossing any moral lines.

Also consistent with these ideas, of those studies that have linked religious self-control to further downstream consequences, the overwhelmingly majority have focused on morally tinged consequences (e.g., substance abuse, criminal behavior, underage drinking; Aldwin et al., 2014; Desmond et al., 2013; deWall et al., 2014; Klanjšek et al., 2011; Laird et al., 2011; Pirutinsky, 2014; Reisig et al., 2012), whereas very few have examined consequences divorced from morality (e.g., academic performance; Abar et al., 2009). Of course, this imbalance could be due to chance or to researchers' own intuitions. But we suspect that instead it reflects the fact that religion motivates people to apply their self-regulatory skills to the kinds of tasks they think God will reward (i.e., moral tasks). Conversely, it may instead *demotivate* them when it comes to tasks that God does not specifically require because they may believe their moral goodness, and not their actual performance, will determine their reward on such tasks (e.g., Laurin et al., 2012).

However, other research provides a counterpoint to the idea that religion should *only* aid self-regulation in moral domains. A different take on the idea of compensatory control we referenced earlier suggests that beliefs in an interventionist God can actually increase people's confidence that their efforts will be rewarded in a more general sense. When people imagine a controlling God, they may not simply imagine that this God influences their outcomes directly, as we described earlier. They might also imagine that this God organizes the world in a sensible fashion and provides contingencies between actions and outcomes (see Landau, Kay, & Whitson, 2015). These contingencies are crucial for making people feel that their efforts will lead somewhere (Kay et al., 2014). Indeed, recent research demonstrates that priming a mysterious God, who provides contingencies that can never be known, decreases long-term goal pursuit, whereas priming a predictable God, who provides clear and knowable contingencies, increases it (Landau & Kay, 2015).

Thus, beliefs in an interventionist, controlling God may give people a general sense that they live in a world with sensible contingencies; therefore, their efforts in all domains will receive the relevant rewards. However, it also seems likely that religion provides an *especially* strong sense of contingency in the domain of morality. This line of thinking leads to the idea that different religions should differ in the kinds of self-regulation they most strongly promote. Indeed, religions differ in how they define moral goodness. Some religions, such as Judaism, Hinduism and Islam, emphasize dietary restrictions;

adherents to these religions may be more motivated to regulate their eating behavior because they expect God to reward those who follow these rules. Within Christianity, different denominations preach different attitudes toward the accumulation of wealth; specifically, some have argued that whereas Catholic teachings emphasize social solidarity and sharing resources, European neo-Calvinism views wealth as a sign of God's favor (Hommel & Colzato, 2010). As a result, Calvinists may be more motivated than Catholics to self-regulate in pursuit of wealth because they may expect God to reward the wealthy.

To summarize, from a motivational perspective, religion provides more or less clear ideas about what kinds of behaviors will receive divine reward. As a result, religion may motivate people to engage their self-regulatory efforts in moral domains, or domains that they believe God will reward. By the same token, religion may demotivate people—or at least motivate them less—when it comes to self-regulating in nonmoral domains because people may believe that those material rewards come from good, moral behavior more than they come from hard work and directed efforts.

Religion and Believing That the Reward Has Value

The final component necessary for motivation to exist is the belief that the promised reward has value. Many instances of self-regulation require people to choose to forego an immediate pleasure in favor of a future reward. Therefore, valuing long-term pleasures over short-term pleasures should enhance people's motivation to self-regulate. Accumulating evidence indicates that religion may cause just that. Many religions emphasize long-term outcomes, such as social harmony and an eternal afterlife, and devalue fleeting hedonistic pleasures, such as sex and gluttony. Perhaps as a result, people who are either more intrinsically religious or more committed to their religion are also more future-oriented and less likely to engage in what is known as *delay discounting*, or choosing to receive a smaller reward now rather than waiting for a larger reward (Carter, McCullough, Kim-Spoon, Corrales, & Blake, 2012; Roelofsma, Koole, & McCullough, unpublished manuscript cited in McCullough & Willoughby, 2009; Weatherly & Plumm, 2012).

That being said, this evidence is correlational rather than causal, and other elements of religion might work in opposite directions. For instance, Weatherly and Terrell (2011) found that among their primarily Christian sample, those who attended church more often were *more* likely to discount financial rewards in the long-term (see also Weatherly & Plumm, 2012). Moreover, extrinsic religiosity and religious fundamentalism also predicted a preference for short-term rewards (Weatherly & Plumm, 2012). Also, one of the articles we reviewed earlier suggests that religion causes people to feel less anxious about their errors, which may mean they place less value on success (Inzlicht & Tullett, 2010, but see Toburen & Meier, 2010).

Which Elements of Religion Contribute to These Effects?

This work, compared to the work on religion and self-control as a skill, has been more specific in terms of which components of religion matter. Beliefs in a big, moralizing God can make people less confident in their abilities to bring about the outcomes they want, yet simultaneously more confident that those outcomes actually will appear, both of

which can decrease people's motivation to engage in effortful self-regulation. However, the concept of divine reward can reinforce any religion's specific moral code, motivate people to avoid violating that code and, to the extent that people believe in a predictable interventionist God, bolster their sense of contingency, which can encourage motivation across all domains. Finally, different theological emphases can either promote or discount long-term thinking, which can motivate or demotivate people when it comes to self-regulation in pursuit of long-term goals.

Thus, most of the existing findings about religion and the motivation to self-regulate have explored the role of beliefs and morals. By contrast, little research has examined the role of religious communities and behaviors. Each of these elements could, however, play an important role. In the case of behavior, many religious rituals require people to exert significant amounts of self-control. For example, most religions require that their members deny various sexual temptations, adherents to many Christian denominations must annually forego certain luxuries for Lent, and dietary rules require Jews to resist the delicious smell of pepperoni pizza. Repeated experiences with these kinds of exercises in self-control may not only increase people's self-regulatory resources (see Baumeister et al., 2010), but also help them realize that they have the ability to persevere and engage in self-control. In other words, they may give people more confidence in their abilities to self-regulate.

Moreover, some forms of religious behavior may elicit cognitive dissonance that can enhance the value of divine reward. If a person must engage in this unpleasant ritual in order to please God, then he or she may rationalize the unpleasantness by exaggerating the extent to which he or she values pleasing God, either for its own sake, or for the sake of the rewards God may heap upon him or her. In other words, effortful religious compliance may lead people to increase the value they place on achieving those goals they believe are sanctioned by God.

In the case of communities, the presence of an interested, monitoring moral community might motivate people to engage in self-regulation. They may feel they can turn to this community to help support their various endeavors, which might make them feel more likely to succeed. Furthermore, because members of this community may monitor each other (Carter, McCullough, & Carver, 2012), it may remind people of the social approval they will receive for good behavior and motivate them to self-regulate in pursuit of community-sanctioned goals (Baldwin & Holmes, 1987; Bateson, Nettle, & Roberts, 2006; Bering, McLeod, & Shackelford, 2005; Dahl, Manchanda, & Argo, 2001; Latané, 1981; Leary, 1995).

Future Research

Aside from exploring these predictions about the roles of behavior and communities, future research is needed to test the validity of the ideas we have discussed throughout this section. Most of the links we described between religion and the motivation to engage in self-regulation rely, at most, on one or two studies. These studies must therefore be replicated and extended before we can have confidence in their results.

One specific area that we believe warrants further attention involves a reexamination of the findings we covered earlier in the self-regulatory skills section. The prevailing assumption in the literature linking religion with self-regulation has long been that religion can make people more skilled self-regulators. However, many of the individual

studies purporting to demonstrate this idea could be easily reinterpreted (see Harrison & McKay, 2013). If religious primes make people persist longer at an unsolvable task that the experimenter has asked them to complete, it may be that religion replenishes self-control resources *or* it may be that religion reminds people of the importance of preserving social order and obeying authority figures, and thereby motivates them to persist. If more religious people engage in fewer criminal acts, and if their self-reported self-control explains this relationship, it may be that religious people are more skilled self-regulators and therefore can better avoid the temptation of petty theft and aggressive impulses *or* it may be that religious people are aware of being constantly monitored by a God and a community that approves of good behavior, and that the appeal of gaining this approval motivates them to regulate their behavior. In short, a clearer understanding of the relationship between religion and self-regulation requires not only a clearer application of modern theories of religion but also cleaner operationalizations of the skills and will that underlie self-regulation.

CONCLUSIONS

We conclude this chapter by reiterating four important calls to action that we hope will guide future research in this domain. The research we have reviewed strongly suggests that many aspects of religion can improve people's self-regulation skills, but it leaves the question of motivation with, at best, an incomplete answer. Therefore, our first call to action is for more researchers to consider how religion might influence people's motivation to self-regulate. Relatedly, we believe more research is needed on the skills side, research that eliminates the possibility that religion simply predicts exaggerated self-reports of self-regulatory skills. Finally, we call for future research to undertake a more thorough analysis of the different dimensions of religion in seeking to understand how, exactly, these different elements contribute to effective self-regulation.

NOTE

1. One intriguing finding that does not quite fit this picture is that, at least among religious participants, positive religious images produce a "challenge" physiological response, whereas negative religious images produce a "threat" response instead (Weisbuch-Remington, Mendes, Seery, & Blascovich, 2005). In other words, positive religious reminders make believers see difficult tasks as obstacles they can overcome, whereas negative religious reminders make believers see difficult tasks as insurmountable barriers.

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CHAPTER 18

Focusing in on the Emotion Laborer

Emotion Regulation at Work

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The topic of emotional labor has received a great deal of attention within the organizational sciences. Research in this area spans three decades, thousands of articles, and a growing number of reviews (Grandey & Gabriel, 2015). *Emotional labor* typically refers to one of two separate processes. It can be understood as “[emotion regulation] performed in response to job-based emotional requirements in order to produce emotion toward—and to evoke emotion from—another person to achieve organizational goals” (Grandey, Diefendorff, & Rupp, 2012, p. 18). It can also refer to the nested intrapsychic and behavioral processes inherent to emotion regulation at work. The former process is best understood by unpacking the history of emotional labor research. The latter is best explored by unpacking the unique strategies employees use to manage emotions at work. We have organized this chapter accordingly. We open by tracing the origins, evolution, and current state of the emotional labor construct. Then, in the hope of better illuminating the experience of the emotion laborer, we examine the regulatory strategies used in the emotional labor process according to frameworks common to emotional labor theory (i.e., deep and surface acting; Hochschild, 1983) and an emotion regulation theory more generally (i.e., the process model of emotion regulation; Gross, 1998). With this approach we both review what emotional labor research has revealed to date and articulate ways in which broader emotion regulation frameworks can advance the study of emotion at work into the future (Grandey, 2000).

HISTORICAL OVERVIEW

Emotional labor as a topic of social science research began with the publication of *The Managed Heart: The Commercialization of Human Feeling* (1983), in which Arlie Hochschild (a sociologist) opined on the silent commoditizing of workers’ emotions.

Hochschild stated: "I use the term emotional labor to mean the management of feeling to create a publicly observable facial and bodily display; emotional labor is sold for a wage and therefore has exchange value" (p. 7). As opposed to emotion regulation more generally, which may occur in any context, Hochschild's stipulation that emotional labor is procured "for a wage" indicates its complexity as a psychic and behavioral phenomenon that is both internally and externally controlled (i.e., by both the self and the organization). Whereas the basic tenets of Hochschild's early propositions have tended to persist over time, interpretations and applications of the construct over the decades have been widely diversified. What has resulted is three unique "lenses" through which emotional labor has been viewed within the literature (Grandey et al., 2012). Together, these three perspectives illustrate a broad process of emotional labor, which begins with workplace emotion expectations, ends with employee emotion displays, and is intermediated by the laborious regulation after which the construct has been named.

At the start of this process, emotional labor can be seen through the first lens as the job requirements that pertain to the expression of emotions, referred to as *emotional display rules*. These rules govern how employees are supposed to feel (or at least "appear" to feel), and subsequently act, regardless of their internal state. Initially, only certain so-called "emotional labor jobs" jobs were thought to be subject to these rules in such a way that they warranted scrutiny (i.e., customer service jobs; Hochschild, 1983; Wharton, 1993). In such jobs, employees participate in frequent, often emotionally demanding interactions with the public, during which they must ensure a particular emotional experience for others (e.g., a pleasant airline flight; Hochschild, 1983). Display rules can be assessed subjectively at the individual level by asking employees or managers to report on perceived organizational expectations, or by using more objective means (e.g., job requirement databases, such as the Occupational Information Network).

At the end of the process, emotional labor research, as studied through the second lens, considers employees' observable expressions of emotions in response to work role requirements (Ashforth & Humphrey, 1993). In couching emotional displays as the output of emotional labor, emotional labor can be viewed in terms of employees' capability to sustain compliance to organizationally sanctioned emotional demands. Of course, there is often a gap that grows between how an employee "ought" to feel and how he or she actually feels (e.g., Bono & Vey, 2007; Rafaeli & Sutton, 1987). When the gap is too wide, producing the expected emotional displays demands significant effort, resulting in inauthentic or deviant emotional displays. Other times, when the emotion demands-ability fit is more favorable, emotional authenticity may come easily to an employee, leading to better outcomes for the individual and organization (Arvey, Renz, & Watson, 1998). This line of research suggests that it is the fit between the individual and the emotional requirements, not the requirements themselves, that determine whether emotional labor is harmful for employees (Bono & Vey, 2007; Chi, Grandey, Diamond, & Krimmel, 2011). This perspective therefore argues that creating conditions in which required emotions are engendered naturally and displayed authentically is key to securing benefits for both employees and organizations (Ashforth & Humphrey, 1993; Côté, 2005).

The third lens or perspective on emotional labor acts a bridge between research on emotional display rules and research on emotion displays by examining the intrapsychic emotional processes embedded within the experience of emotional labor. This "process within a process" seeks to account for how employees generate the emotional displays required for their jobs (Grandey, 2000; Morris & Feldman, 1996). Historically, the methods for crafting desired emotional outputs have been categorized as two strategies,

initially described by Hochschild (1983) as analogues of different kinds of theatrical acting: deep and surface acting. *Surface acting* involves modulation of the way an individual expresses emotions in order to meet job demands, though these expressions often fail to match how an employee really feels. *Deep acting* serves to modulate the emotional experience entirely, helping employees to transform the way they feel to better meet the emotional expectations of the job (Grandey et al., 2012). Surface acting is most often described as the “bad” form of emotional labor because it is considered to be the least authentic response and relates most strongly to undesirable outcomes, such as emotional exhaustion (Hülsheger & Schewe, 2011). Deep acting’s relationship with outcomes is more complex because it not only weakly relates to feelings of accomplishment and job satisfaction, but it also predicts burnout (Kammeyer-Mueller et al., 2013). We review these strategies and their associated outcomes in more depth below.

Independently, each of the three perspectives outlined above has contributed uniquely to an evolving description of emotional labor. However, no lens offers a complete view, and it is difficult to make sense of the complexities fully in one without the help of the others. Using all three together as a “trifocal” lens, we gain a comprehensive view of emotional labor as a process whereby occupational emotional requirements activate emotional regulatory processes, which result in emotional displays of varying authenticity and outcomes (Grandey et al., 2012; Grandey & Gabriel, 2015). Whereas this integrated perspective offers us a more complete bird’s-eye view of emotional labor, it simultaneously obscures what might be called the “experience of emotional labor,” which resides solely within the employee. This is revealed through the nested intrapsychic regulatory processes within the third lens/perspective. Thus, we now unpack the processes by which employees govern their emotional states, first in the form of deep and surface acting, followed by a more nuanced view informed by the broader emotional regulation literature.

EMOTIONAL LABOR AS DEEP AND SURFACE ACTING

Armed with the knowledge of what emotional labor is, we must ask ourselves why emotional labor matters. Hochschild (1993) questioned the ethics of emotional labor in stating: “In a capitalist, postindustrial culture, what [the commoditization of emotions] means, I think, is that a commercial logic will penetrate deeper and deeper into what we used to think of as a private, psychological, sacred part of a person’s self and soul” (p. 333). Decades of research suggests that the practice of commissioning emotions for a wage rarely results in an equitable transaction, leading some researchers to call for the explicit eradication of emotional display rules all together (Grandey, Rupp, & Brice, 2015). While workers can often feign the needed emotional responses to get by, sustained emotional compliance in the face of experienced noncompliant emotions can lead to burnout, costing both the individual and the organization (Hülsheger & Schewe, 2011; Kammeyer-Mueller et al., 2013). On the other hand, when properly supported or incentivized, the same job with the same emotion display rules can be satisfying (Duke, Goodman, Treadway, & Breland, 2009) and even rewarding (Ashforth & Humphrey, 1993; Grandey, Chi, & Diamond, 2013; Humphrey et al., 2015).¹ In other words, it is the way an employee experiences emotional labor that dictates the nature of its outcomes, for both the organization and the individual.

Hochschild (1983) argued that employees respond to the need to regulate emotionally, mainly by using surface and deep acting. An employee surface-acts when he or

she feigns the required role without true investment. This may involve an obligatory (but meaningless) smile at a customer or coworker, or the scripted empathy a call center agent might offer to a frustrated customer. When surface acting, employees act out the expected emotional behaviors without actually achieving the congruent state. Conversely, deep acting occurs when the employee imaginatively elicits emotion-laden memories and thoughts in order to present an authentic emotional performance that matches the expectations of the work context. This may incorporate taking on the views and values of the employer, structuring interpretations of events or others into the schema acceptable to the organization, or merely drawing from unrelated emotionally laden memories to produce a desired emotional state. Importantly, while deep acting still requires some effort in producing the resultant emotional state, the end product is supposedly a genuinely felt emotion that is congruent with emotional display rules.

Across the board, neither strategy (i.e., surface acting or deep acting) tends to bode particularly well for the individual, though exceptions exist. Overall, surface acting is strongly and consistently linked to a long list of negative outcomes, including emotional exhaustion, depersonalization, burnout, psychological and physiological distress, and lowered job satisfaction and organizational attachment (Hülsheger & Schewe, 2011).² Deep acting maintains the links to burnout and physiological complaints but also seems to lead (weakly) to higher job satisfaction and feelings of accomplishment (Hülsheger & Schewe, 2011; Kammeyer-Mueller et al., 2013; Mesmer-Magnus, DeChurch, & Wax, 2011). But why does acting for a wage result come at such a high price?

Why Are Deep and Surface Acting Laborious?

Both surface and deep acting involve self-regulation. Accordingly, and consistent with the dominant models of self-regulation, each has been assumed to take a toll on employees' regulatory capacities (Festinger, 1962; Hochschild, 1983). Hochschild also contended that both strategies create an internal state of dissonance, or psychoemotional strain, brought on as the hidden emotional experience becomes increasingly disconnected from the external world. These two mechanisms have become the top culprits behind emotional labor's deleterious effects on employees, and evidence supports both of these positions.

Limited Resources

According to ego depletion theory, individuals have a limited amount of regulatory energy, which is used to manage different aspects of performance (Baumeister, Bratslavsky, Muraven, & Tice, 1998). As such, expending extra effort in one area can lead to decreases in performance in others (Muraven & Baumeister, 2000). A number of laboratory studies focused on emotional labor have demonstrated ego depletion as a result of emotional display rules; that is, when participants have been subjected to emotional requirements and directed to suppress their emotional responses (i.e., to surface-act), self-regulatory performance has been shown to decrease (Goldberg & Grandey, 2007; Zyphur, Warren, Landis, & Thoresen, 2007). Daily surface acting at work has also been shown to predict diminished regulatory abilities at home in the form of strain-based work-to-family conflict, off-work emotional exhaustion, anxiety (Wagner, Barnes, & Scott, 2014) and even depression (Erickson & Wharton, 1997).

Deep acting has not been found to have quite the same effect—or at least, the effect has not been as strong. For example, Wallace, Edwards, Shull, and Finch (2009) found evidence that deep acting (i.e., reappraisal of the situation) may help employees avoid regulatory decrements because, in such instances, the regulatory demand is reduced. This may free up such employees to focus on the task at hand, resulting in relatively higher performance. Consistent with this perspective, employees also benefit from “refreshing” their regulatory reserves. For example, work breaks have been shown to improve subsequent emotional experiences and performance³ (Troughakos, Beal, Green, & Weiss, 2008).

Cognitive Dissonance and Inauthenticity

Hochschild (1983) used cognitive dissonance theory (Festinger, 1962) to argue that deep acting would produce the greater ills for employees, compared to surface acting. She reasoned that deep acting requires “deceiving oneself as much as deceiving others,” which would lead to the suppression of and disconnection from the “real self” (pp. 33–34). So what does research on the inauthenticity mechanism of emotional labor say about Hochschild’s claim? As Hochschild expected, research has largely shown that the greater the gap between the “real self” and the emotional requirements of the job, the greater the distress (Hülshager & Schewe, 2011). However, this is contrasted with findings that between surface and deep acting, surface acting appears to be more damaging (Bono & Vey, 2005; Hülshager & Schewe, 2011; Kammeyer-Mueller et al., 2013; Mesmer-Magnus et al., 2011). Consistent with the dissonance model, suppression, a central component of surface acting, is consistently and strongly associated with the two major outcomes of emotional labor: burnout and job dissatisfaction (Diefendorff, Richard, & Croyle, 2006; Mesmer-Magnus et al., 2011). Deep acting does not follow this same pattern of relationships. Although it is weakly related to burnout, it is actually positively related to job satisfaction (Hülshager & Schewe, 2011; Kammeyer-Mueller et al., 2013) and shows inconsistent relationships with other negative outcomes (e.g., work–family conflict, anxiety; Wagner et al., 2014). On the other hand, it also has a connection to somatic symptoms and complaints (e.g., upset stomach, pain, or dizziness; Hülshager & Schewe, 2011), which have been linked with dissonant self-perceptions in other emotional labor research (Hülshager, Alberts, Feinholdt, & Lang, 2013). Thus, regardless of whether one’s acting is superficial or deep, acting out discrepant emotions often wears employees down in a number of ways.

That being said, research also suggests that this effect is not universal. Perceived rules that require the amplification of positive emotions do not themselves relate to strain, and in fact are weakly associated with job satisfaction (Kammeyer-Mueller et al., 2013). In addition, it seems that in some cases, what may begin as faking (i.e., surface acting) can over time become authentic, either through emotional contagion (Barger & Grandey, 2006) or perhaps due to positive social feedback and support (Côté & Morgan, 2002). In both of these cases, acting incongruously can actually eventuate in increased mood and job satisfaction. Also, for employees possessing characteristics similar to emotional requirements, such as extraversion, both surface and deep acting appear to be less stressful (i.e., laborious) activities (Chi et al., 2011; Judge, Woolf, & Hurst, 2009). Conversely, when worker characteristics are ill-suited to emotional acting, such when employees highly value authenticity, negative effects have been shown to be particularly pronounced (Pugh, 2014). Clearly, emotional labor is a heavier burden for some than for others, which we expand on below.

Who Is the Emotion Laborer?

The assumption in early studies examining emotional labor in terms of high versus low emotional demands was that only employees in jobs with high customer or public interaction were subject to emotional labor (Hochschild, 1983). Current emotional labor research, however, is decreasingly reflective of this view, falsifying the previously used high versus low emotional labor jobs dichotomy. Acknowledging that nearly all employees at all levels (including management; Ashkanasy & Humphrey, 2011; Gardner, Fischer, & Hunt, 2009) engage in emotional labor while interacting with coworkers and authority figures (Diefendorff et al., 2006; Grandey et al., 2012; Greguras & Diefendorff, 2009; Ozcelik, 2013; Sloan, 2004; Tschan, Rochat, & Zapf, 2005), the focus is now on factors that change the experience of emotional labor across individuals rather than jobs.

This shift in viewpoint has led to a focus on the personal characteristics predictive of the outcomes of emotional labor. In general, individuals with lower emotion regulation abilities experience lower well-being, income, and even socioeconomic status (Côté, Gyurak, & Levenson, 2010). In the workplace, those with higher emotional labor variability from day to day suffer in terms of job satisfaction and increased work withdrawal (Scott, Barnes, & Wagner, 2012). Culture, values, and even gender play a part as well. Workers from individualistic cultures, who may find external controls on emotional displays more unpleasant than do their collectivistic counterparts, experience emotional labor in a more negative way (Allen, Diefendorff, & Ma, 2014). Similarly, although women have been proposed to be better equipped to handle the labor of complying with emotional demands (Grandey, 2000), they often report more negative effects from emotional labor than do men (Hopp, Rohrmann, Zapf, & Hodapp, 2010; Johnson & Spector, 2007; Scott & Barnes, 2011). This may be due to strain incurred from violating a collective social identity that prioritizes warmth and genuineness (Grandey & Gabriel, 2015). Personality factors play a role as well. While capable of surface acting, introverts do not experience the same financial gains (e.g., tips) enjoyed by their extraverted colleagues, and they suffer higher decrements in emotional performance (Chi et al., 2011). In service simulations carried out in the laboratory, when directed to maintain a friendly persona, participants with higher level of neuroticism experienced higher blood pressure and heart rate compared to those scoring lower on the trait (Hopp et al., 2010).

Emotional display rules are frequently perceived to be a formal part of job requirements (Diefendorff et al., 2006). Thus, identifying which employees may be best suited to jobs associated with certain emotional labor expectations (and coaching or training those already employed) can help to increase emotional demands–abilities fit for newly hired employees (Diefendorff, Greguras, & Fleenor, 2016) and assist companies in mitigating negative consequences for struggling workers already employed (Diefendorff & Croyle, 2008; Hülsheger et al., 2013; Trougakos et al., 2008).

BEYOND EMOTIONAL LABOR AS ACTING

Significant insights have been gained by exploring deep versus surface acting as the main strategies by which employees seek to comply with organizationally sanctioned emotional display rules. However, just as we have replaced the notion of high versus low emotional labor jobs with the idea that all jobs vary in emotional labor demands, it is

increasingly recognized that similarly dichotomizing emotional labor strategies into surface and deep acting alone artificially compresses a more nuanced reality (Ashforth & Humphrey, 1993; Diefendorff, Richard, & Yang, 2008; Grandey & Brauburger, 2002). Nearly two decades ago, Grandey (2000) offered a “new way” to conceptualize emotional labor—showcasing it as *emotion regulation* in the workplace. As the definition offered early in this chapter indicates, and the research reviewed thus far suggests, most emotional labor scholars now tend to recognize the role of emotion regulation (more broadly) in complying with emotion display rules at work. That being said, acknowledging emotion regulation’s role in emotional labor is not the same as truly integrating the two literatures, which diverge at many points.

Grandey (2000) offered Gross’s (1998) process model of emotion regulation as an expanded parallel to emotional labor’s deep and surface acting split. Taken from the broader emotion regulation literature (Gross, 1998, 2014), the model contains five families of response strategies and offers a more comprehensive taxonomy of interrelated emotional regulatory methods that are well studied in many contexts. As a bridge, Grandey pointed out rough parallels between certain regulatory strategies in Gross’s model and deep and surface acting (see Figure 18.1), although she hesitated in finding a place for each of Gross’s strategies in the workplace.

Emotional labor research has been slow to immerse itself fully in the emotion regulation literature. Nevertheless, there is good reason to expand the study of emotional labor beyond the dichotomy of deep and surface acting. For example, new research dispels the idea that workers use “either” deep or surface acting (Gabriel, Daniels, Diefendorff, &

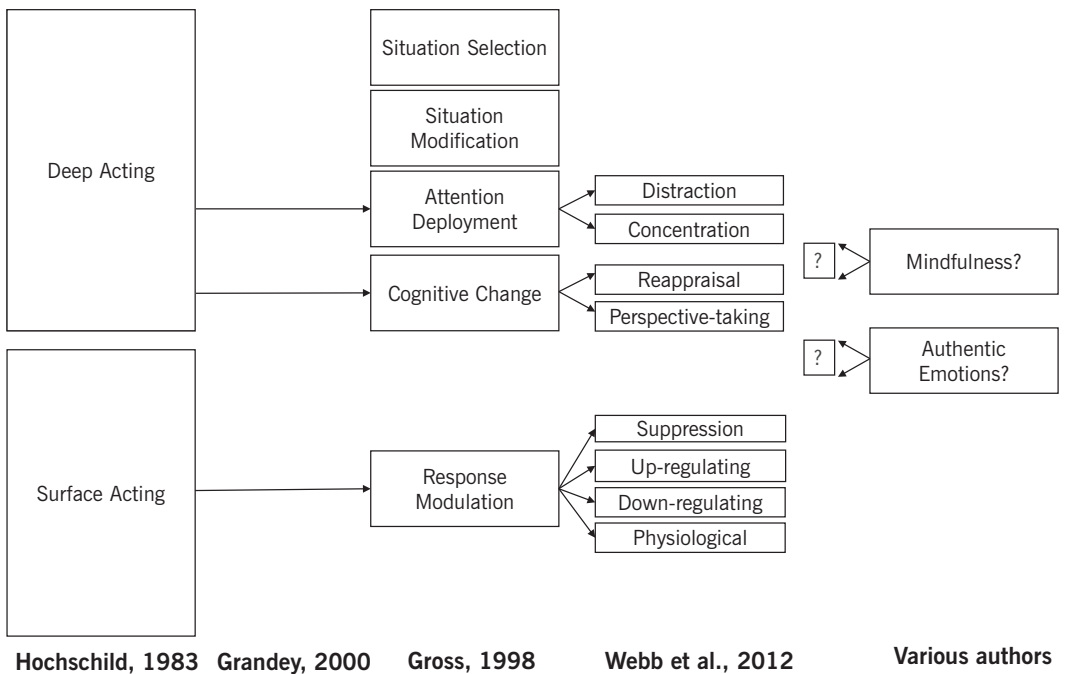


FIGURE 18.1. Gaps between traditional emotional labor strategies (Grandey, 2000), the process model of emotion regulation (Gross, 1998), and other emotional labor research.

Greguras, 2015); that is, latent profile analysis revealed five emotional labor profiles that describe different patterns of alternating deep and surface acting use, which were shown to differentially predict employee outcomes. These profiles were labeled nonactors, low actors, surface actors, deep actors, and regulators. In another study, employees, when allowed to report strategies other than deep and surface acting, reported using analogues of deep and surface acting (e.g., cognitive change and response modulation) only at intermediate levels, with other strategies (e.g., attentional deployment, situation selection, and situation modification) being chosen more commonly (Diefendorff et al., 2008).

Surface acting is traditionally described as “faking” via emotion suppression. However, expressive suppression represents only one of a number regulatory responses. When surface-acting measures have incorporated additional strategies (e.g., amplifying emotions and expressing inauthentic emotions, which we describe in more detail below), they are still referred to as simply surface acting, making it difficult to tease apart the antecedents and consequence of more specific strategies (see Grandey & Gabriel, 2015). Meanwhile, deep acting is often described as generalized attempts at reshaping ones current emotional state, without reference to the specific strategies that may be used to do so. As a further confound, findings of studies measuring authentic emotional responses are often lumped together with those measuring deep acting as a regulatory strategy (Hochschild, 1983). Collapsing the choice and effects of disparate emotional labor response options into two blunt categories (i.e., deep and surface acting) risks washing out differential effects.⁴

To address these issues, in the remainder of this chapter we revisit Grandey’s (2000) reconceptualization of emotional labor according to Gross’s (1998) process model of emotion regulation, which may offer insights into the conflicting findings in emotional labor research. Grandey initially argued for the rough equivalence of the process model of emotion regulation and the deep–surface acting depiction of emotional labor (see Figure 18.1). However, she and others have since emphasized that these are imperfect parallels (Diefendorff et al., 2008; Grandey, 2000, 2015; Grandey & Gabriel, 2015; Gross, 2012). As similar as the models may be at times, in the subsequent pages we invite the reader to contemplate how an emotion regulation framework *differs* from the way that emotional labor has thus far been described (i.e., involving only two primary regulatory strategies). We believe that embracing the complexity of emotion regulation can actually clarify our understanding of emotions labor.

Emotional Labor as a Specific Form of Workplace Emotion Regulation

Gross’s model, which plays a prominent role within the emotion regulation literature, organizes emotion regulatory strategies according to a temporal continuum of emotion generation (Gross, 1998, 2014). At different points along the emotion generation process, different strategies can be used. *Antecedent-focused strategies* are those used before an emotion fully emerges, and *response-focused strategies* reference those relied on to manage emotions that have already formed. Updates to the model make it clear that individuals typically jump back and forth between strategies as situations develop, creating interrelationships and feedback loops (Gross, 2015). In this way, over the course of a day—or even within a single encounter—an individual may utilize one or many strategies. Contrary to the more dichotomous approach taken in the emotional labor literature, this perspective argues that throughout an emotional experience, individuals may enter

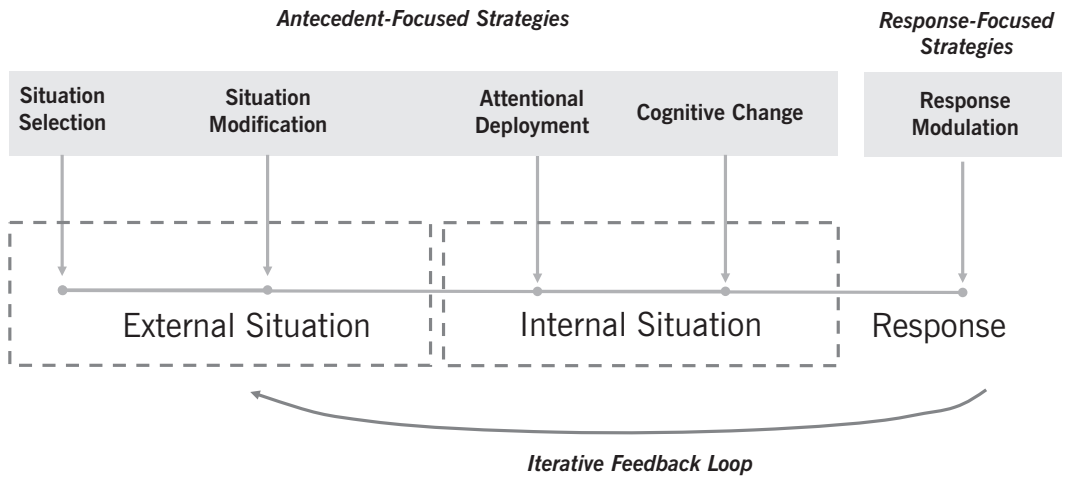


FIGURE 18.2. Emotion regulation families, strategies, and targets throughout the emotion generation process as described by the process model of emotion regulation (Gross, 1998, 2014).

into a range of regulatory processes that can differentially influence the development of affective states (and subsequent displays; see Figure 18.2). Also unlike deep and surface acting, emotion regulation strategies often extend beyond the intrapsychic in that they may behaviorally target the situation or other people (e.g., taking a break from a stressful event, punching a pillow, or stress eating).

To be clear, by recasting emotional labor as emotion regulation, we are *not* seeking to dissolve the differences between these two phenomena. As modern definitions of emotional labor remind us, *emotional labor is emotion regulation at work, in response to emotional display rules, and for a wage*. The context matters—as does the motivation. It is the commoditization of emotion regulation that specifies emotional labor and makes it a unique phenomenon in its own right. Applying the insights gleaned from the more general emotional regulation literature can enhance our understanding without restraining our domain of inquiry.

Antecedent-Focused Strategies

The antecedent-focused family of emotion regulation strategies include four categories of regulatory responses chosen prior to the point of emotion formation: situation selection, situation modification, attentional deployment, and cognitive change. These are the strategies undertaken preemptively to forestall negative affective states or to encourage desirable emotions. The relevance of situation selection and situation modification to employees has been traditionally discounted in the emotional labor literature. For example, Grandey (2000) stated, “Employees may choose their jobs, but for service employees there may be little opportunity for situation selection as a method to regulate emotions” (p. 98). This reflects the aforementioned traditional view that emotional labor is only abundant within service-type jobs, and that jobs lack discretion and autonomy. As these assumptions are reflected in contemporary research, we see a need for emotional labor scholars to reconsider the regulatory strategies employees direct toward the situation.

Situation Selection

Situation selection refers to approaching or avoiding people, places, or objects in order to regulate emotion preemptively (Gross, 1998). It entails choosing an optimal situation over a less desirable one with the hope that one might fare better emotionally in the end. At work, employees across a number of jobs and contexts do indeed have—and use—a host of situation selection options when regulating their emotions (Diefendorff et al., 2008). Examples include a manager choosing to have a lighthearted chat with one employee rather than a sensitive conversation with another, or an employee strategically vying to work with a less emotionally taxing team than the one assigned.

Other examples of situation selection might fall within the realm of what organizational scholars label *work withdrawal* or *counterproductive work behaviors* (Hulin, 1991; Krischer, Penney, & Hunter, 2010). Consider, for example, an employee who takes more sick days than allotted (selecting to stay home) or chooses to offer extra assistance to a colleague rather than working on a project with his or her cantankerous boss (selecting coworker vs. supervisor interaction), or chooses to read newspapers or play video games on company time (selecting nonwork activities over work activities). Citing the connection between increased emotion regulation and counterproductive behaviors (Matta, Erol-Korkmaz, Johnson, & Biçaksiz, 2014), Grandey and Gabriel (2015) recommended that emotional labor scholars consider such behaviors as outcomes of emotional labor. We advocate that researchers push this proposition further still by positioning some counterproductive behaviors as a situation selection (i.e., an antecedent-focused regulatory strategy).

Including situation selection as a part of the emotional labor experience can benefit organizational scholars at large by clarifying when counterproductivity is response-based reaction, and when it is an emotion-focused regulatory strategy. It also opens the door to research exploring when and why some regulation strategies are chosen over others. For example, we might explore how providing situational alternatives already shown to improve emotional performance, such as work-free breaks (Troughakos et al., 2008), decreases the selection of counterproductive situations. van Jaarsveld and Poster (2013) illustrated via data from call center employees that human resources practices, such as increasing job discretion, institutionalizing the right to resist abusive treatment by customers, and manipulating pay based on emotional demands, can lessen the negative consequences of emotional labor (which may include destructive situation selection). Clearly, there is still much to be uncovered and understood regarding situation selection as a regulatory strategy employed in the face of emotional labor.

Situation Modification

When stuck in a situation wherein there is no foreseeable ability to avoid an undesired emotion, an individual may “select out” of the situation entirely. However, if it seems that adaptations to the situation may favorably change its emotional impact, situation modification may occur (Gross & Thompson, 2007). Grandey (2000) argued that service employees often do not have the breadth of situation modification opportunities available at work that they would otherwise have in a nonwork situation. Whereas this may be generally true in some instances, we argue that in today’s work environments, employees do often engage in situation modification as a part of an emotional labor process. Consider the example of a call center worker transferring a call with an irate customer to a supervisor, or tidying one’s work area in advance of an important meeting.

One distinguishing feature of situation modification, as compared to situation selection, is the presupposition of ability that guides employees to try and modify a situation rather than escape it. Hochschild (1983) described emotional labor as “the silent work of evoking and suppressing feeling—in ourselves *and in others*” (p. 40, emphasis added). Attempting to change others’ emotional states is often referred to as *extrinsic* emotion regulation, and is considered both an essential companion to intrinsic emotion regulation and a form of situation modification (see Gross & Thompson, 2007). Emotional labor researchers might make use of the classification of interpersonal affect regulation strategies developed by Niven, Totterdell, and Holman (2009) to determine which extrinsic strategies are most often used at work by the emotion laborer, and to what effect.

Attentional Deployment

If individuals are unable or unwilling to select out of an emotionally undesirable situation and lack the ability to change it, they may attempt to regulate emotions via internal strategies. *Attentional deployment* refers to strategies used for selectively directing attention to a given object or aspect of a situation in order to influence an emotional experience (Gross & Thompson, 2007). These strategies are directed internally, toward the self, rather than at the external environment. We introduce two of these techniques here: distraction and concentration (Gross, 1998).

Distraction involves selectively focusing attention on a particular aspect of the situation—or shifting attention from the situation altogether. This may occur through directing attention to objects or events in the physical environment, or turning thoughts inward to memories or images that invoke the desired emotional state (Gross & Thompson, 2007). In meta-analyzing the experimental emotional literature, Webb and colleagues (2012) identified four distinct distraction methods in experimental research. These included active and passive positive distractions, and active and passive neutral distractions, all of which had positive effects on mood, with active strategies carrying the strongest effects. *Active distractions* are those wherein the individual explicitly attempts to divert attention from the focal emotional stimulus by thinking about positive or neutral thoughts, whereas *passive distractions* refer to activities that divert attention away from the focal stimulus but are not purposefully undertaken in order to change mood. This is in contrast to findings from the cognitive and social sciences showing that certain passive distractions, such as mind wandering and daydreaming, drawn as a form of cognitive interference, are linked with self-destructive effects (Klinger, 1996a, 1996b).

We see a number of ways in which attentional deployment may be taken on as an emotional labor strategy in the workplace. Looking out the window while receiving a reprimand from a manager might represent an active neutral distraction, whereas looking at a picture of one’s children in order to bring a smile to one’s face might be an active positive distraction. In a survey of emotion regulation strategies used at work, employees reported using similar active distractions techniques, such as doing something enjoyable when their mood began to suffer (from boredom) or focusing on other things when coworkers started to annoy them (Diefendorff et al., 2008). Although we know the efficacy of these strategies in laboratory settings, it is unclear whether they are effective (for the individual or organization) in workplace settings.

Importantly, it seems likely that such actions, whatever their regulatory potential, may be seen as destructive by others. Absently playing solitaire or browsing the Internet after or while speaking with an argumentative customer, for example, could be considered

passive positive distractions, which have been shown to be effective emotion regulatory techniques (Webb et al., 2012). Whereas these acts might be acceptable when performed in one's free time, at work they may be seen as "nonwork presenteeism," a form of counterproductive work behavior wherein employees engage in personal activities instead of work (Wan, Downey, & Stough, 2014). Even a passive neutral distraction, such as fiddling with a pencil during a meeting, may be misperceived as boredom or disinterest in a work context rather than as a regulatory effort, and thus a violation of (in)formal job emotional requirements (Diefendorff et al., 2006). Emotional labor researchers should investigate the degree to which the use of distraction techniques results in third-party perceptions of emotional display rule violation. Rather than writing off distractions as merely counterproductive behaviors or ineffective emotional regulation strategies at work, the limits of distraction's efficacy in achieving the desired emotional state (as well as other unintended consequences of the strategy) should be a particular focus of inquiry. Researchers might compare job situations that disallow distractions as an emotional labor strategy (e.g., administering surgery) and job situations that allow for or encourage them (e.g., creative jobs).

A second attentional deployment technique is *concentration* (Gross, 1998). In a meta-analysis of emotion regulation strategies, Webb and colleagues (2012) identified three types of concentration: focusing on feelings, focusing on causes and implications of said feelings, and mixing the focus of concentration with feelings, causes, and implications. The authors acknowledged that these forms of concentration all focus on negative emotions, and results indicated that all forms of concentration had a negative relationship with positive emotional states. We are eager to see positive forms of concentration examined for their relative efficacy as well. Gross (1998) commented in early works that using concentration to regulate emotions may lead to periods of flow, transcendent states, or the transcendent state of intense, pleasurable productivity (Csikszentmihalyi, 2014). We challenge emotional labor researchers to explore this potential relationship, which may be moderated by the various emotional ability–demands fit variables described earlier in this chapter.

Concentration in the form of actively focusing on the present or a new task is reported by employees as a common emotion regulation strategy at work (Diefendorff et al., 2008). It also is studied as an outcome of other emotional labor strategies. For example, Wallace and colleagues (2009) demonstrated that suppression (a response-focused strategy argued to be part of surface acting) and reappraisal (an antecedent-focused response argued to be a part of deep acting) differentially led to negative or positive task-related job performance, respectively, as mediated by task focus. Taking a resource depletion perspective, they contended that suppression drained cognitive resources more than did reappraisal, making participants less able to focus on the task. Whether active or passive, negative or positive, we look forward to an influx of emotional labor studies placing concentration outside of an "acting" context as a strategy for the emotion laborer.

Cognitive Change

Cognitive change is the second regulatory strategy Grandey (2000) linked to deep acting. It refers to altering one's appraisal of the situation in such a way as to change its emotional effect, either by changing the way one perceives the situation or by altering one's capacity to handle the emotional demands presented (Gross, 2014). In early discussions,

Gross (1998) argued that cognitive change also included denial, isolation, intellectualization, and optimism biases. This wide breadth of potential substrategies notwithstanding, scholars have largely focused on researching a single strategy within cognitive change: *reappraisal*, which affects emotion by altering the meaning or significance of a situation. Successful reappraisal leads to less negative emotional experiences, reduced neural responses in brain regions tied to emotion generation, and a significant reduction of cognitive and social decrements (Gross, 2012). Via laboratory experimentation, a number of forms of reappraisal have been identified, including reappraising one's own emotional response, reappraising the emotional stimulus, taking the perspective of the other party, and a mixture of the all of these.

Reappraisal via *perspective taking*, which has been shown to produce a medium to large effect on positive mood achievement across studies, might be most closely related to the form of deep acting Hochschild (1983) described in her early depictions of airline workers thinking of stressful passengers as children. However, deep acting is rarely presented as perspective taking alone. One emotional labor study that did examine this technique in isolation showed that employees who engaged more in perspective taking experienced fewer detrimental effects from customer hostility (Rupp, McCance, Spencer, & Sonntag, 2008).

Other emotional labor research comes at reappraisal from different angles. In one case study, bill collectors were taught to use cognitive reappraisals to create emotional distance from debtors in order to generate the cool demeanor necessary for work (Sutton, 1991). Similar to when reappraisal is used, employees reported the use of cognitive change for multiple purposes (Diefendorff et al., 2008). When feeling annoyed, employees commonly reported searching for humor in the circumstance or otherwise engaging in positive reappraisal. They also relied on reframing their thoughts by thinking about how the other party feels when confused, angry, or frustrated with them. Some employees also utilized the mindfulness technique of acceptance when confronted with frustrating situations they could not change, while they thought of how things could be worse when frustrated with undesirable work. Webb and colleagues (2012) grouped mindfulness as a subtype of cognitive change, and found that it was moderately effective in producing positive outcomes. Mindfulness at work is a particularly promising research track for emotional labor scholars. With clear cognitive and neurobiological influences on the brain, mindfulness has been argued to improve social relationships, increase resiliency, and improve task performance (Glomb, Duffy, Bono, & Yang, 2011). Employees using mindfulness techniques have been shown to rely less on surface acting and to experience significantly less exhaustion and more job satisfaction than those who do not (Hülsheger et al., 2013). We see great value in further probing the effects of active and passive cognitive change on the experience of emotional labor.

Response-Focused Strategies: Response Modulation

As opposed to antecedent-focused strategies, response-focused strategies are used to target a fully developed emotional state and are collectively referred to as *response modulation*. According to Gross (1998), this family of response strategies includes strategies that strengthen, diminish, extend, or curtail the emotional experience, expression, or other (i.e., physiological) effects once emotion has fully emerged. These strategies may include efforts to affect physiological, experiential, or behavioral response to an emotion, and

are therefore not purely intrapsychic (Gross & Thompson, 2007). Because it often takes the form of emotion suppression, one of the most common types of response modulation, the *regulation of emotion-expressive behaviors*, was linked by Grandey (2000) to surface acting. Other strategies, such as physiological modulation techniques and mindfulness, have not garnished as much attention in emotion regulation or emotional labor research.

Regulating Emotion-Expressive Behaviors

Regulating the expression of felt emotions can occur through various kinds of suppression or by displaying unfelt emotions. The former is most often the focus of emotional labor research. Webb and colleagues (2012) further identified at least four ways in which emotion suppression is assessed in laboratory studies, including suppression of the expression of the emotion, suppression of the experience of the emotion, suppressing thoughts of the emotional stimulus, and mixed forms of suppressive efforts. The form of suppression most common to emotional labor scholars, *expressive suppression* (attempting to inhibit ongoing emotion-expressive behavior), has also been the most common form of suppression studied within emotion regulation research. By and large, expressive suppression is ineffective at reducing the impact of negative emotion experiences, while it has been shown to magnify feelings of inauthenticity and physiological responses to emotional distress, negatively affect memory, and produce a host of other negative social consequences (Webb et al., 2012). These findings echo those uncovered in the emotional labor literature when emotional labor is studied specifically as suppression.⁵

The ability to suppress or enhance displayed emotions has been shown to be variable across individuals, both in and out of the workplace (Côté et al., 2010). For instance, longitudinal emotion regulation research showed that individuals who were better able to flexibly up- or down-regulate their displayed emotions after a severely traumatic event (e.g., the 9/11 terrorist attacks) fared better overall in a laboratory environment and showed better adjustment in interpersonal functioning 2 years later (Bonanno, Papa, Lalande, Westphal, & Coifman, 2004). Meanwhile, emotional labor researchers revealed that even though suppressing negative emotions increased intentions to quit via reductions in job satisfaction, amplifying positive emotions actually increased job satisfaction (Côté & Morgan, 2002). Clearly, “faking” is not always “bad” or “good,” as we may be tempted to believe from studying emotional labor strategies collapsed as surface acting alone (Grandey et al., 2015; Humphrey et al., 2015).

Physiological Response Modulation

Gross (1998) introduced many other forms of response modulation without in-depth discussion. These included self-soothing behaviors (e.g., eating, smoking, and the use of alcohol or other drugs), and the later addition of relaxation, deep breathing, and meditative exercises (Gross, 2014). Both emotional labor and emotion regulation researchers tend to pass over these types of regulation and their direct connections to health and well-being. Nonetheless, evidence substantiates the inclusion of these types of behaviors as emotion regulatory response options—particularly for workers. In one mock-work experiment, for example, participants encountering a negative mock-customer persisted less at a challenging task (solving a puzzle) and engaged in more self-soothing behaviors (candy consumption) when given the opportunity (Zyphur et al., 2007). Candy undoubtedly is not

the only substance consumed on or after the job by workers struggling to meet emotional performance expectations. Given the mixed effects of caffeine, the stress-propelled preference for unhealthy foods (and consequential physical outcomes; Leigh Gibson, 2006), and shifting attitudes and behaviors pertaining to substance use (Substance Abuse and Mental Health Services Administration, 2014), the time is nigh for further investigation into the physiological responses to workplace emotions and their role within emotional labor processes.

CONCLUSION

In this chapter, we renewed the call by Grandey (2000) to emphasize and integrate emotional labor with the process model of emotion regulation (Gross, 1998, 2014), which we believe can enhance our understanding of the emotion laborer beyond the reach of “acting.” However, we acknowledge the imperfections of the traditional approaches of both genres. Neither places great emphasis on naturally felt emotions. Authentic emotional displays have been shown to be uniquely different from those resulting from both deep and surface acting, and in some cases authentic display is used more commonly than either deep or surface acting (Diefendorff, Croyle, & Gosserand, 2005). Already, we are aware of many factors that determine which employees are more likely to rely on authentic emotion expression (regardless of display rules), including workers’ age (Dahling & Perez, 2010), whether they interact with coworkers or the public (Tschan et al., 2005), how hostile a social encounter is (Grandey, Dickter, & Sin, 2004), relative power distance (Diefendorff, Morehart, & Gabriel, 2010; Greguras & Diefendorff, 2009), and culture (Grandey, Rafaeli, Ravid, Wirtz, & Steiner, 2010). Because authentic expressions can violate formal emotional demands inherent to job success (Diefendorff et al., 2006), we urge emotional labor researchers to confront the ethical implications of what amounts to penalizing workers for being—and feeling—themselves (for an expanded consideration of this matter, see Grandey et al., 2015).

We look forward to new approaches to the study of emotional labor that explicitly incorporate a wider range of regulatory strategies as has been taken in the past and suggest that researchers pull from alternative models of emotion regulation (Koole, 2009; Larsen, 2000; Parkinson & Totterdell, 1999; Thayer, Newman, & McClain, 1994) in developing new hypotheses regarding the management of emotions in the workplace. Equipped with this broadened perspective on the process of emotional labor (Grandey et al., 2012) and supported by the framework of emotion regulation (Gross, 1998), we anticipate a new wave of emotional labor research that more fully reflects the emotional experiences of individuals at work.

NOTES

1. Consistent with self-determination theory (Gagné & Deci, 2005), Grandey and colleagues (2015) suggest that by rewarding (rather than requiring) desired emotional displays, such behaviors may in fact be motivating.
2. Surface acting’s negative effects persist even when researchers control for individual differences, such as negative personality traits (Brotheridge & Grandey, 2002; Diefendorff,

Erickson, Grandey, & Dahling, 2011; Grandey, Fisk, & Steiner, 2005), or when considering its impact over time (Côté & Morgan, 2002; Hülsheger, Lang, & Maier, 2010).

3. assuming that activities carried out during the break are restful and not similarly resource-depleting.
4. This problem has been discussed in the broader emotion regulation literature as well (Koole, 2009; Webb, Miles, & Sheeran, 2012).
5. In fact, many emotional labor studies operationalize surface acting as some form of emotion suppression; therefore, findings from surface acting studies are also relevant here (Hülsheger & Schewe, 2011; Kammeyer-Mueller et al., 2013; Mesmer-Magnus et al., 2011).

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PART IV

PERSONALITY AND SELF-REGULATION

CHAPTER 19

Impulsivity as a Personality Trait

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Impulsivity is one of the most frequently examined constructs in psychology, and rightly so. Perhaps nothing better characterizes the dilemmas of human existence than the difficulty of balancing long-term goals against immediate impulses. No other species appears capable of planning explicitly for a distant future, but humans routinely adapt their behavior to goals that will not be obtained for weeks, months, or even years. Humans, therefore, are uniquely vulnerable to impulses that disrupt their plans. When human functioning goes wrong, impulsivity is often at the heart of dysfunction. No symptom, other than subjective distress, appears more often than impulsivity as a diagnostic criterion in the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* (Whiteside & Lynam, 2001); impulsivity is therefore a prime target for the emerging transdiagnostic, dimensional approach to understanding psychopathology (Robbins, Gillan, Smith, de Wit, & Ersche, 2012). Even in the range of normal, non-pathological functioning, impulsivity is perhaps the quintessential form of self-regulation failure, and *self-control* can be defined as the ability to avoid impulsivity.

Given the vast literature on impulsivity, we cannot hope in a brief review to be comprehensive. Following a discussion of definitions of impulsivity, we focus in this chapter on impulsivity as a personality trait—that is, a dimension of relatively stable individual differences in the tendency to be impulsive, roughly normally distributed in the general population. After developing a working definition of impulsivity, we consider methods of measuring impulsivity as a trait, then review research on different conceptions of impulsivity and the relation of impulsivity to broad taxonomies of personality, focusing primarily on the five-factor model or “Big Five” (John, Naumann, & Soto, 2008). We consider the psychological and biological mechanisms that underlie trait impulsivity in relation to a theory of the substrates of the Big Five and their higher-order factors (DeYoung, 2010a, 2015), with the goal of developing hypotheses about how and why people differ in their predispositions toward impulsivity.

DEFINING IMPULSIVITY

For a trait so important, impulsivity exhibits surprisingly little consistency in definition and measurement within psychology. Many authors have noted the heterogeneity that exists in descriptions of impulsivity as a trait (Depue & Collins, 1999; Evenden, 1999; Parker, Bagby, & Webster, 1993; Whiteside & Lynam, 2001; Zuckerman, 2005). What constitutes a single impulsive action may be easier to specify than the attributes of an impulsive person. In every impulsive action, two elements must be present: (1) an impulse—an urge, motivation, or desire—to act in some way and (2) a lack of inhibition, restraint, or control of that impulse (cf. Carver, Johnson, & Joormann, 2009; Hofmann, Friese, & Strack, 2009; Steinberg et al., 2008). Without the impulse, there would be no need for restraint; with sufficient restraint, the impulse would not be expressed in action.

The fact that impulsive action logically requires these two components suggests one reason for the existence of multiple conceptions of trait impulsivity: Individual differences either in the strength of impulses or in the ability and tendency to restrain impulses could cause variation in impulsivity. Before proceeding to a more thorough examination of the various conceptions of impulsivity, however, let us consider some additional definitional issues that stem from the question of when and why impulses should be restrained.

The International Society for Research on Impulsivity (ISRI) offers three definitions of impulsivity (<http://impulsivity.org>; retrieved March 10, 2015):

1. Behavior without adequate thought.
2. The tendency to act with less forethought than do most individuals of equal ability and knowledge.
3. A predisposition toward rapid, unplanned reactions to internal or external stimuli, without regard to the negative consequences of these reactions.

The first of these defines individual instances of impulsive behavior rather than a trait, and raises the question “Adequate for what?” The implication is that impulsive behavior must be inadequate to achieve some goal. The second definition avoids the question of whether the behavior is desirable; any action undertaken with less than average forethought is considered impulsive. The third is most specific and implies that impulsive action entails negative consequences, or at least some possibility of negative consequences, which would serve as the reason that impulses should be restrained.

One important question, therefore, is how crucial is the existence of negative consequences for a definition of impulsivity? Does impulsivity, as two of the ISRI definitions imply, necessarily involve action that is in conflict with the longer-term well-being of the individual? This question is not often considered explicitly. Unsurprisingly, given the clinical focus of much research on impulsivity, negative consequences for impulsivity are usually assumed as a given. However, Dickman (1990) proposed the existence of both “functional” and “dysfunctional” forms of impulsivity, suggesting that impulsivity could be beneficial in some circumstances. The scale he devised to measure functional impulsivity assesses comfort with acting, talking, and making decisions quickly, with little or no deliberation, when the situation calls for it, such as in fast-paced conversation or sport or in the presence of fleeting opportunity. Block (2002) has similarly argued that some degree of “undercontrol” is not detrimental because it allows spontaneous exploration

and utilization of unforeseen opportunities. Although impulsivity has typically been considered only as a dysfunctional tendency, the possibility of an adaptive form or level of impulsivity is worth keeping in mind when examining the association of impulsivity with other personality traits.

A more complex set of issues surrounds the question of how negative consequences of impulsive action are to be specified as such. Must they be negative for the individual committing the action, or might they be positive for that individual but negative for others? For example, someone might often steal impulsively, without getting caught, and never regret the action, though it would have negative consequences for others. This example raises a related question: Must the consequences of the action for the impulsive individual be judged as negative by that individual, or might they be judged as negative for that individual by others exclusively? A person who often steals impulsively, without getting caught, might not feel this to be a bad habit, though others might feel that he or she was taking unnecessary risks. Perhaps the most general claim that can be made about negative consequences of impulsivity is that impulsive action is inherently risky, regardless of its evaluation as positive or negative by anyone, because it involves acting on a present desire that might interfere with longer-term goals. Dickman (1990) acknowledged that even functional impulsivity is risky (though, by definition, usually worth the risk), in that the rapid responding it entails is likely to be error-prone.

One final definitional issue to consider is whether impulsive action must be rapid, as asserted by the third ISRI definition. What if someone experiences the urge to steal something, wanders around the store for 20 minutes weighing the desire to steal against the fact that stealing would be risky and unnecessary, then decides to steal the item and does so; is this impulsive? Ainslie (2001) would argue that whether this action should be deemed impulsive is related to whether the person's decision is stable—that is, whether he or she would have (1) made the same decision, prospectively, before actually being at the store and (2) regretted the decision at some later time. An *unstable choice*, one that is rejected in advance and regretted in retrospect, is typically considered impulsive, even if it does not involve the rapid response and lack of deliberation that some definitions of impulsivity require. Such a choice does follow the pattern of an action based on an impulse that fails to be restrained.

This kind of impulsivity with deliberation appears to be possible because people typically discount rewards in proportion to their distance in time from the present (Ainslie, 2001). As an example, consider the following situation: A person prone to shoplifting considers a trip to the store the next day. At that point, he vows to himself that he will not steal anything because he wants to avoid the likely consequences of being caught. In advance, he values staying out of trouble above the thrill of shoplifting. However, the next day in the store, faced with the immediate opportunity to steal, he deliberates and eventually decides that the thrill of shoplifting is sufficiently rewarding, so he steals something. Finally, after getting home, he changes his mind again and decides that the theft was foolish, not worth the risk. When both the short- and long-term reward were discounted (the day before), the long-term reward was perceived as larger than the short-term reward. When the short-term reward was immediate, however, and therefore not discounted, its value spiked above that of the long-term reward, which remained discounted. This spike in value led to the impulsive action, even though the action was previously undesired and subsequently regretted.

This chapter offers a working definition of impulsivity that encompasses both rapid impulsivity, without deliberation, and this slower form of impulsivity, with deliberation. As a personality trait, *impulsivity is the tendency to act on immediate urges, either before consideration of possible negative consequences or despite consideration of likely negative consequences.*

MEASUREMENT OF IMPULSIVITY

Many instruments have been designed specifically to measure impulsivity. The best established of these are questionnaires, including the Barratt Impulsiveness Scale, Version 11 (BIS-11; Patton, Stanford, & Barratt, 1995), the I₇ Impulsiveness Scale (Eysenck, Pearson, Easting, & Allsopp, 1985), the UPPS (Urgency, Premeditation, Perseverance, Sensation Seeking) Impulsive Behavior Scale (Whiteside & Lynam, 2001), the Control versus Impulsivity scale of the Multidimensional Personality Questionnaire (MPQ; Tellegen & Waller, 2008), and the Impulsiveness scale of the Revised NEO Personality Inventory (NEO PI-R; Costa & McCrae, 1992). Additionally, impulsivity is a central feature of attention-deficit/hyperactivity disorder (ADHD), and ADHD symptoms have been used as the basis for questionnaire assessment of trait impulsivity in nonclinical populations (Avila, Cuenca, Felix, Parcet, & Miranda, 2004; Kuntsi et al., 2004). For reasons we explain in the following two sections, we recommend using the latest version of the UPPS scale, the UPPS-P (Cyders, 2013; Cyders et al., 2007), if one wishes to measure impulsivity by questionnaire.

Impulsivity is one of the few traits for which the number of performance tests devised may rival the number of questionnaires. Such tests are desirable to circumvent biases present in self-ratings and even peer ratings, especially for socially undesirable characteristics such as impulsivity. Relative to questionnaires, however, less psychometric work has been done to ensure that these tests function properly as reliable measures of a trait. One needs to know the degree to which they are stable over time and the proportion of their stable variance indicative of latent impulsivity rather than task-specific performance. Initial examinations of test–retest reliability appear reasonably promising for several common performance tests of impulsivity, indicating that they have adequate temporal stability to be considered real trait measures (Kirby, 2009; Weafer, Baggott, & de Wit, 2013).

Factor analysis indicates that impulsivity tests assess multiple dimensions (Avila et al., 2004; Broos et al., 2012; Reynolds, Ortengren, Richards, & de Wit, 2006). Two of these factors may correspond to the distinction we made earlier between impulsivity with and without deliberation. The tests in these two factors have been described as measuring (1) “rapid response impulsivity,” which lacks “adequate assessment of context” before action, and (2) “reward discounting,” which involves “inability to wait for a larger reward” (Swann, Bjork, Moeller, & Dougherty, 2002, p. 988). These factors have also been described as “action impulsivity,” and “choice impulsivity,” respectively (Broos et al., 2012).

Many of the rapid response tests require inhibiting prepotent responses (e.g., the Stroop, go/no-go, and stop-signal tasks). In the go/no-go task, for example, subjects must respond quickly with a button press to a set of frequent stimuli (e.g., letters other than X) but inhibit responding to a set of infrequent stimuli (e.g., the letter X). Impulsivity is measured as individual differences in failures of inhibition (though variability in response

times has also proven to be an important indicator of impulsivity in this and other paradigms, perhaps because the impulsive person is easily distracted from the task at hand; Leth-Steensen, King Elbaz, & Douglas, 2000).

Reward discounting is often assessed by asking people to choose, without time pressure, between smaller rewards sooner, and larger rewards later. These paradigms have been demonstrated to have the long-term stability necessary to validate a trait measure, although scores appear to fluctuate somewhat based on mood (Kirby, 2009; Weafer et al., 2013). Stable individual differences exist in the degree to which people discount the future, and these should logically be associated with the frequency with which individuals succumb to temptation, despite not intending to beforehand and regretting it afterward.

One interesting fact regarding performance tests of impulsivity is that they appear to be only weakly correlated with questionnaire measures of impulsivity (e.g., Avila et al., 2004; Edmonds, Bogg, & Roberts, 2009; Reynolds et al., 2006; Swann et al., 2002). Two meta-analyses found that various performance tests of impulsivity were significantly associated with impulsivity questionnaires, but most of these correlations were around $r = .10$ – $.15$ (Cyders & Coskunpinar, 2011; Duckworth & Kern, 2011). (For contrast, questionnaire measures of intellect and self-reported intelligence are associated with performance tests of intelligence, such as IQ, with a correlation around $.30$; DeYoung, 2011.) Despite their low convergent validity, both types of measure appear to be valid indicators of trait impulsivity. Both have shown predictive validity for relevant outcomes in many studies, and one study pitting questionnaires against performance tests as predictors of health behaviors found that the two types of measure served as independent predictors, each accounting for variance that the other did not (Edmonds et al., 2009). One possible explanation for the weak association is that the performance tests have relatively poor convergent validity, even among themselves, due to task-specific or error variance. This suggests the utility of a latent variable approach; one study found that the shared variance of several rapid response tests was associated with the BIS-11 considerably more strongly ($r = .35$) than any of the tasks individually (Aichert et al., 2012).

Given that questionnaire measures of impulsivity are better validated and understood psychometrically than performance measures, we focus most heavily on questionnaire research in exploring the relations of impulsivity to broader models of personality. As with the performance tests, questionnaire measures of impulsivity reflect multiple underlying factors that vary greatly in the degree to which they are correlated. Mapping these factors onto broad structural models of personality can aid in understanding the psychological processes that cause impulsivity. Such a mapping reveals that impulsivity is a complex trait, with several different underlying dispositions contributing to it.

IMPULSIVITY IN PERSONALITY TRAIT TAXONOMIES

Understanding the consequences of impulsivity is relatively straightforward. Impulsive people are more likely than others to overeat, overspend, abuse drugs and alcohol, interrupt, get in fights, break the law, gamble, engage in risky sexual behavior, say things they regret, harm themselves, and so forth (Cyders & Smith, 2008; Deckman & DeWall, 2011; Dir, Karyadi, & Cyders, 2013; Krueger, Markon, Patrick, Benning, & Kramer, 2007). It is more difficult to understand the causes of impulsivity. What predisposes some people to act impulsively even when it runs counter to their own interests? Why are some

people consistently so much more impulsive than others? One approach to investigating these questions is to locate the trait of impulsivity within a hierarchical taxonomy of personality traits. Theories of personality that explain the underlying sources of major personality traits (e.g., DeYoung, 2015; Read et al., 2010; Van Egeren, 2009) may then help us to understand the sources of impulsivity.

Psychologists have long known that personality can be represented as a hierarchy, with specific, lower-level traits (e.g., talkativeness, sociability, assertiveness) varying together, such that one can deduce the existence of broader, higher-level traits (e.g., Extraversion, for the three traits just mentioned) that account for the covariation of the lower-level traits. A major project in personality psychology over the last 70 years has been the development of trait taxonomies, using correlations among the multitude of specific traits to identify a limited number of broader factors that represent the most important dimensions of personality. The fundamental challenge for this project is to find a sufficiently broad and unbiased pool of trait measurements in which to identify structure. A reasonably representative sample from the universe of all possible traits must be used to ensure unbiased results in factor analysis. No approach ensures a complete lack of bias in the pool of traits, but two of the most promising strategies are the lexical approach, which samples trait-descriptive words from natural language (Saucier & Goldberg, 2001), and the use of trait measurements from many existing questionnaires designed to capture a variety of different personality traits and structures (Markon, Krueger, & Watson, 2005). These two strategies have produced considerable evidence for a five-factor structure, known as the five-factor model or the Big Five, which includes dimensions of Extraversion, Neuroticism, Agreeableness, Conscientiousness, and Openness/Intellect (John et al., 2008).¹

In order to understand the location of impulsivity in the Big Five, it is helpful first to examine the development of Eysenck's personality taxonomy, which was perhaps the dominant model of trait structure prior to the emergence of the Big Five. Eysenck (1947) originally assigned traits to two "superfactors," Extraversion and Neuroticism, and located impulsivity within Extraversion. Eysenck later revised his model with the addition of a third superfactor, labeled "Psychoticism," though this label is widely considered misleading because the trait encompasses antisocial rather than psychotic tendencies (Zuckerman, 2005). In this revised model, Eysenck located impulsivity within Psychoticism, though "venturesomeness" and "sensation seeking," which he considered aspects of impulsivity, were retained within Extraversion (Eysenck & Eysenck, 1977).

Eysenck's three superfactors are largely compatible with the Big Five because Extraversion and Neuroticism are very similar in both systems, and Psychoticism (reversed) represents a blend of Agreeableness and Conscientiousness (Goldberg & Rosolack, 1994; Markon et al., 2005). The major addition in the Big Five is a fifth factor, Openness/Intellect, encompassing imagination, creativity, intellectual engagement, and aesthetic and artistic interests.

Eysenck located impulsivity in two different traits; the Big Five model adds a third. In the NEO PI-R, a widely used measure of the Big Five that divides each broad trait into six lower-level traits called "facets," Impulsiveness is a facet of Neuroticism (Costa & McCrae, 1992). Similarly, another questionnaire measure, based on the Abridged Big Five Circumplex (AB5C; Goldberg, 1999), locates Impulse Control as a facet of Emotional Stability, which is Neuroticism reversed. However, the location of impulsivity within the Big Five is not necessarily incompatible with Eysenck's scheme: In the lexical

version of the AB5C (Hofstee, de Raad, & Goldberg, 1992), the adjective *impulsive* has its primary loading on Conscientiousness, which would fall within Eysenck's Psychoticism, and Excitement Seeking, a facet of Extraversion in the NEO PI-R, is very similar in content to sensation seeking and venturesomeness. Impulsivity therefore appears to be spread across multiple Big Five dimensions, which may explain why it has been difficult to measure consistently.

Whiteside and Lynam (2001) have substantially clarified the diversity of conceptions of trait impulsivity and their relation to the Big Five. In a factor analysis of many of the most common impulsivity questionnaires, they found four factors, each of which was strongly marked by a facet of the NEO PI-R. Their labels for these factors are listed below, followed by their corresponding NEO PI-R facet and Big Five dimension:

1. Urgency (Impulsiveness, Neuroticism)
2. (lack of) Premeditation (Deliberation, Conscientiousness)
3. (lack of) Perseverance (Self-Discipline, Conscientiousness)
4. Sensation Seeking (Excitement Seeking, Extraversion).

Thus, there appear to be at least four different types of impulsivity. The items that best marked these four factors were used to create the four subscales of the UPPS Impulsive Behavior Scale. A follow-up study, analyzing the latent structure of the UPPS scale, found that Premeditation and Perseverance were strongly correlated and could best be described as separable but related facets of one broader trait (Smith et al., 2007)—hardly surprising, given that both are facets of Conscientiousness. Other factor analyses of smaller numbers of impulsivity questionnaires have found smaller numbers of factors, which are recognizable as subsets of the UPPS factors (Flory et al., 2006; Parker et al., 1993).

The UPPS model demonstrates that, in the Big Five, the traits most directly related to impulsivity are located in Conscientiousness, Neuroticism, and Extraversion. Consideration of the psychobiological mechanisms underlying these three traits, in conjunction with the two elements of impulsive action (discussed earlier), suggests why all three traits would be associated with impulsivity. Conscientiousness appears to reflect the ability and tendency to use effortful, top-down control to follow rules and pursue nonimmediate goals (DeYoung, 2010a, 2015; Van Egeren, 2009) and is associated with volume in the brain region (lateral prefrontal cortex) most strongly implicated in that form of control (DeYoung et al., 2010; Jackson, Balota, & Head, 2011; Kapogiannis, Sutin, Davatzikos, Costa, & Resnick, 2013). Thus, increased Conscientiousness should lead to more frequent restraint of impulses that are disruptive of rules and plans.² However, unless an impulse emerges in the first place, there will be nothing for the conscientious individual to restrain. Impulses are reactions to motivationally salient internal or external stimuli—rewards and punishments, or predictors thereof—and a large body of questionnaire, behavioral, and neurobiological evidence suggests that Extraversion and Neuroticism reflect the primary manifestations in personality of sensitivity to reward and punishment, respectively (DeYoung, 2015). Extraversion involves positive affect and approach behavior, whereas Neuroticism involves negative affect and reactivity to threat. At any level of Conscientiousness, increased Extraversion or Neuroticism would be associated with increases in the strength and frequency of urges to approach rewards or react to threats, respectively, and this should lead, in turn, to more instances in which the individual's effortful control is insufficient to restrain impulses. Thus, Extraversion

and Neuroticism may influence impulsivity independently of Conscientiousness (and of each other). Of course, this model also suggests the possibility of interactions. Increased Extraversion or Neuroticism may be particularly likely to lead to increased impulsivity in those with low Conscientiousness.

PREMEDITATION, PERSEVERANCE, SENSATION SEEKING, AND URGENCY

Because a tendency toward impulsive behavior is associated with four different factors, falling within three Big Five dimensions, Whiteside and Lynam (2001, p. 687) argued that *impulsivity* is “an artificial umbrella term” that should no longer be used as a trait descriptor. In subsequent articles, however, they softened this argument because the correlations among the UPPS subscales (even outside the Premeditation–Perseverance pair) tend to be moderate (e.g., Cyders, 2013; Miller, Flory, Lynam, & Leukefeld, 2003; Whiteside, Lynam, Miller, & Reynolds, 2005), “suggesting that in general the scales measure overlapping yet distinct constructs” (Whiteside et al., 2005, p. 564). This overlap among the UPPS traits does suggest the existence of a general tendency toward impulsivity, even if that general tendency is influenced by variability in multiple, distinct traits and their associated psychobiological systems. Nonetheless, discriminant validity has been demonstrated for each of the UPPS scales in relation to a variety of impulsivity-related criteria, such as aggression, psychopathology, and drug use (Cyders & Smith, 2008; Miller et al., 2003). Treating these different impulsivity-related traits as if they are interchangeable is inadvisable and may result in contradictory or ambiguous findings. Thus, it is worth considering each UPPS trait in more depth.

Premeditation reflects “the tendency to think and reflect on the consequences of an act before engaging in that act,” and lack of premeditation appears to be the most common conceptualization of impulsivity in psychology (Whiteside & Lynam, 2001, p. 685). Premeditation has a complicated status in the Big Five. Although it is a facet of Conscientiousness, it is less central to this broad dimension than perseverance or most other Conscientiousness facets. Deliberation (the NEO PI-R equivalent of premeditation) shows the weakest loading on Conscientiousness of any facet of that domain, in the normative data for the NEO PI-R (Costa & McCrae, 1992), and it loads relatively weakly on both industriousness and orderliness, the two major subfactors within Conscientiousness (DeYoung, Quilty, & Peterson, 2007). Perhaps the most informative demonstration of what is different about premeditation or deliberation, relative to other Conscientiousness facets, is a factor analysis of many traits conceptually related to Conscientiousness (Roberts, Chernyshenko, Stark, & Goldberg, 2005). In this analysis, deliberation was the only NEO facet to load primarily on a factor other than industriousness or orderliness, and this factor was also marked by two scales that have their primary loading on Extraversion (in the AB5C system) and their secondary loadings on Conscientiousness (Johnson, 1994). In the AB5C system, deliberation loads primarily on Conscientiousness but has a secondary, negative loading on Extraversion (Johnson, 1994). These findings suggest that premeditation, as a latent trait, may represent a roughly equal blend of high Conscientiousness and low Extraversion. This conclusion echoes that of Depue and Collins (1999), who argued that impulsivity is a compound trait reflecting the conjunction of high Extraversion and low Conscientiousness. Indeed, rapid action without deliberation

should be potentiated by Extraversion, which has been described as the “energizer” of behavior (Van Egeren, 2009), and Extraversion is negatively correlated with reaction time in many behavioral tasks (Zeidner & Matthews, 2000).

From a conceptual standpoint, Conscientiousness seems to be the most appropriate primary location for premeditation because planning is related to effortful control and functions of the lateral prefrontal cortex (Miller & Cohen, 2001). However, when considering research using impulsivity scales that primarily tap lack of premeditation (such as the BIS-11; Whiteside & Lynam, 2001), one must remember that effects may be attributable to variance shared with Conscientiousness (top-down restraint of impulses) or to variance shared with Extraversion (strength of reward-related impulses). Neuro-imaging research supports the idea that both reward- and control-related processes are associated with lack of premeditation. The BIS-11 has been shown, in functional magnetic resonance imaging (fMRI), to predict increased subcortical reward-system activity in response to cues of reward (Forbes et al., 2009), but it has also been shown to predict reduced activity in lateral prefrontal cortex associated with voluntary response inhibition in the stop-signal task (Farr, Hu, Zhang, & Li, 2012).

Perseverance reflects the “ability to remain focused on a task that may be boring or difficult” (Whiteside & Lynam, 2001, p. 685). A major factor in the ability to work at a task that is not immediately rewarding is the ability to avoid succumbing to the temptation to do something more immediately rewarding instead. Unlike premeditation, perseverance is quite central to Conscientiousness. Self-discipline, the NEO PI-R equivalent of perseverance, loads strongly on Conscientiousness generally and on its industriousness subfactor specifically (Costa & McCrae, 1992; DeYoung et al., 2007). Working hard requires the ability to restrain impulses that would conflict with one’s ongoing plan, and people low in perseverance are likely to act on such impulses, even when they are aware of the negative consequences for their longer-term goals. Although both premeditation and perseverance seem likely to depend on the top-down control of behavior associated with Conscientiousness and prefrontal cortex, individual differences in the neurotransmitter dopamine may differentiate perseverance from premeditation; high levels of reward-related dopaminergic activity (associated with Extraversion) are likely to reduce premeditation (Buckholtz et al., 2010), whereas they may actually increase perseverance (DeYoung, 2013).

Sensation seeking reflects “willingness to take risks for the sake of excitement or novel experiences” (Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993, p. 759). One might argue that high levels of sensation seeking need not entail impulsivity at all because those who decide to take risks for fun (e.g., hang gliding, mountain climbing, gambling, taking drugs) may do so with full consideration of possible negative consequences, may often take steps to ensure that the risk is not higher than they wish it to be (e.g., safety equipment for the mountain climber, a limited amount of money in the wallet of the gambler), and may have a stable preference for their behavior, eagerly anticipating the experience beforehand and having no regret afterward. Indeed, when sensation seeking has been used as a predictor while controlling for the other UPPS traits, “it consistently predicts, both concurrently and prospectively, the frequency of engaging in risky behaviors (such as drinking and gambling), but it does not relate to problem levels of involvement in those behaviors” (Cyders & Smith, 2008, p. 810). Notably, Dickman’s Functional Impulsivity Scale loads on the sensation-seeking factor, further suggesting that sensation seeking is not typically as problematic as other forms of impulsivity (Whiteside & Lynam, 2001).

Sensation seeking is less strongly related to the other UPPS dimensions than they are to each other, but it does have at least some relation to the other dimensions, except perseverance (Cyders, 2013; Miller et al., 2003; Whiteside et al., 2005). Sensation seeking's location in Extraversion suggests that it reflects a strong sensitivity to the possibility of reward, which should make impulsive action more likely, by increasing the strength and frequency of reward-seeking urges. Thus, although sensation seeking may not be inherently impulsive, it is at least weakly associated with impulsivity at the trait level.³ As one might expect, it appears to be those high in sensation seeking and also low in premeditation who are especially likely to take risks with negative outcomes, in addition to risks with positive outcomes (Fischer & Smith, 2004). Highlighting the importance of studying sensation seeking separately from other types of impulsivity, one study of over 7,000 adolescents indicated that sensation seeking and impulsivity have very different normative trajectories over adolescence and develop independently within individuals (Harden & Tucker-Drob, 2011). Sensation seeking increased sharply from ages 12 to 16 years, then declined slightly until age 24 (when the study ended), whereas an impulsivity scale that primarily reflects lack of premeditation showed high scores at 12 years that decreased steadily until age 22. These results are similar to those of an earlier study of 935 participants ages 10–30 years, which found similar patterns in adolescence but also found that both sensation seeking and lack of premeditation declined sharply from the early to the late 20s (Steinberg et al., 2008).

Urgency, in Whiteside and Lynam's (2001, p. 685) original conception, reflects "the tendency to experience strong impulses, frequently under conditions of negative affect," which lead to "impulsive behaviors in order to alleviate negative emotions despite the long-term harmful consequences of these actions" (e.g., overeating, abusing drugs, or speaking or arguing rashly). This type of impulsivity appears to be more important than the others for predicting many negative outcomes, such as alcohol problems, smoking, self-harm, aggression, and disordered eating (Dir et al., 2013; Miller et al., 2003; Settles et al., 2012; Zapolski, Stairs, Settles, Combs, & Smith, 2010). That urgency is associated with Neuroticism is in keeping with its emphasis on negative emotion as the trigger for rash action. However, since the original publication of the UPPS model, Cyders and colleagues (2007) have developed a measure of Positive Urgency that is part of the UPPS-P (renaming the original scale "Negative Urgency"), based on evidence that strong positive emotion can also lead to rash action with harmful consequences (e.g., celebratory binge drinking by college students or resumption of gambling by pathological gamblers). Like premeditation and perseverance, positive and negative urgency appear to be distinct facets of a single broader trait (Cyders & Smith, 2008). This general urgency trait appears to describe dysfunctional impulsivity in which emotions are particularly salient, whereas lack of premeditation and perseverance appear to describe impulsivity in which emotions are less salient.

One might expect positive urgency to be primarily associated with Extraversion and sensation seeking given that positive affect is a central component of Extraversion. Instead, however, positive urgency displays a profile of correlations with the Big Five similar to that of negative urgency (Cyders & Smith, 2008). Closer inspection of this pattern provides an additional insight into the nature of impulsivity as a personality trait. Despite the fact that impulsiveness (the NEO PI-R equivalent of negative urgency) is a facet of Neuroticism, it has the lowest loading on Neuroticism of any facet of that domain (Costa & McCrae, 1992). The trait that the general urgency dimension most strongly

reflects does not appear to be Neuroticism. Rather, it appears to be one of the higher-order factors of the Big Five.

IMPULSIVITY AND THE HIGHER-ORDER FACTORS OF THE BIG FIVE

The Big Five were originally conceived as orthogonal dimensions and the broadest level of personality description. However, measures of the Big Five display a consistent pattern of intercorrelation, which reveals the existence of two higher-order factors or meta-traits, labeled *Alpha*, or *Stability*, and *Beta*, or *Plasticity* (Chang, Connelly, & Geeza, 2012; DeYoung, 2006; Digman, 1997; Markon et al., 2005). Stability consists of the shared variance of Conscientiousness, Agreeableness, and Neuroticism (reversed), whereas Plasticity consists of the shared variance of Extraversion and Openness/Intellect. Stability appears to reflect a general tendency toward restraint and lack of disruption by impulses, whereas Plasticity appears to reflect a general tendency toward exploration and engagement with novel phenomena (DeYoung, 2006, 2015; Hirsh, DeYoung, & Peterson, 2009). Stability is associated with impulsivity generally, whereas Plasticity seems particularly likely to be associated with sensation seeking (indeed, sensation seeking is related to Openness/Intellect, as well as to Extraversion; Aluja, García, & García, 2003; Flory et al., 2006).

In a factor analysis of the 30 facets of the NEO PI-R and the two urgency scales, Cyders and Smith (2008) found that both positive (PU) and negative urgency (NU) showed a similar pattern of factor loadings in a five-factor solution, with each loading on Neuroticism (PU = .28, NU = .58), Conscientiousness (PU = -.39, NU = -.40), and Agreeableness (PU = -.30, NU = -.37). Additionally, in both their sample and the normative data for the NEO PI-R, a similar pattern of factor loadings is evident for the NEO PI-R impulsiveness facet (Costa & McCrae, 1992; Cyders & Smith, 2008). Cyders and Smith also examined a two-factor solution and found that PU and NU and impulsiveness strongly marked the Stability factor. Urgency, therefore, appears to be a form of impulsivity that is most clearly described in personality taxonomies as a manifestation of low levels of the meta-trait Stability.

Another scale that exhibited this pattern of correlations with the Big Five is the Self-Control Scale (SCS; Tangney, Baumeister, & Boone, 2004), in which nearly all items are face valid as markers of three of the four UPPS impulsivity factors (the SCS does not appear to include sensation-seeking items). The SCS was correlated almost equally with Neuroticism ($r = -.50$) and Conscientiousness ($r = .54$), and somewhat more weakly with Agreeableness ($r = .29$) (Tangney et al., 2004). In this context, it is interesting to note that “self-control” has been suggested as an alternative label for Stability (Olson, 2005). A study of personality items that specifically indicate Stability, rather than one of the Big Five, further highlight the degree to which Stability reflects self-control over disruptive impulses—for example, “I get out of control” and “I talk even when I know I shouldn’t” (DeYoung, 2010b). (For more detail on self-control and the SCS, see Hoyle & Davisson, Chapter 22, this volume.)

Finally, another variable that is even broader in scope than impulsivity, and clearly related to a lack of self-control, is associated with the same three Big Five dimensions and with the meta-trait Stability (DeYoung, Peterson, Séguin, & Tremblay, 2008; Miller & Lynam, 2001; Settles et al., 2012). This is externalizing behavior, which describes a broad

category of behaviors that tend to be correlated, including aggression, impulsivity, anti-social behavior, and drug abuse (Krueger et al., 2002, 2007). Behavior-genetic research indicates that the various types of externalizing behavior share a single underlying factor that is strongly genetically influenced and accounts for their correlation (Krueger et al., 2002). This factor appears to represent a continuous trait that is normally distributed in the general population (Markon & Krueger, 2006). Associations with broad personality models offer one approach to understanding the sources of this externalizing factor. In a sample of adolescent males, Stability was a strong predictor of externalizing behavior, as measured by both self- and teacher reports (DeYoung et al., 2008). Additionally, Plasticity predicted externalizing behavior positively, but only when controlling for Stability. In other words, if one compares two groups or individuals of equal Stability, the one with more of the exploratory tendency described by Plasticity will be likely to express higher levels of externalizing behavior.

The association of the meta-traits with various types of impulsivity and with externalizing behavior more generally is consistent with a theory of the neurobiological substrates of personality that links Stability to the neurotransmitter serotonin and Plasticity to the neurotransmitter dopamine (DeYoung, 2010a, 2013; DeYoung et al., 2008). Although many brain systems have been implicated in impulsivity, one consistent set of findings is that impulsivity and other forms of externalizing behavior are associated with serotonergic and dopaminergic function (Carver et al., 2009; Chambers, Taylor, & Potenza, 2003; Congdon & Canli, 2008; Cyders & Smith, 2008; Depue & Collins, 1999; Kruesi et al., 1990; Manuck et al., 1998; Zuckerman, 2005).

Serotonin acts very widely in the brain as a neuromodulator, with regulatory or inhibiting effects on mood, behavior, and cognition (Spoont, 1992). Serotonin not only potentiates the function of effortful control processes that allow the top-down restraint of impulses (Carver et al., 2009), but it also serves to suppress the bottom-up hypothalamic and brainstem systems (including the dopaminergic system) that generate impulses in the first place (Chambers et al., 2003; Gray & McNaughton, 2000). Serotonin acts to limit negative affect and aggression, while maintaining behavioral and motivational stability, and it has been directly linked to Conscientiousness, Agreeableness, and low Neuroticism, the traits constituting Stability (DeYoung, 2006, 2010a). Increasing serotonergic function therefore appears to modulate both elements of impulsive action—the impulses and the lack of restraint—so as to reduce impulsivity. Individual differences in serotonergic function are therefore likely to be a key substrate of all impulsivity-related traits, perhaps most strongly related to the dimension labeled “urgency” because this dimension explicitly describes both strong emotional impulses and weak restraint of those impulses.

Dopamine is another important neuromodulator, but with primarily activating effects on behavior and cognition. Dopaminergic circuitry modulates exploration and approach behavior, sensitivity to possible rewards, desire, and curiosity, as well as cognitive control and flexibility (DeYoung, 2013). Considerable evidence links Extraversion to variation in dopaminergic function, and a smaller body of evidence suggests that Openness/Intellect may also be related to dopamine (Depue & Collins, 1999; DeYoung, 2013). The association of Extraversion, a trait reflecting sensitivity to reward, with various aspects of impulsivity is consistent with the role of dopamine in potentiating impulses and increasing the subjective value of temptations. Interestingly, dopamine plays complementary and potentially conflicting roles in different brain areas: In the striatum, it

potentiates impulses, whereas in the prefrontal cortex, it enhances the ability to control attention (up to a point—either too little or too much dopamine disrupts prefrontal function) (Arnsten & Robbins, 2002; Depue & Collins, 1999). Associations of dopamine with impulsivity, therefore, may be more complex than those of serotonin. In summary, both biological and psychometric considerations indicate that the meta-traits and their biological substrates should be investigated in conjunction with impulsivity.

CONCLUSION

As a personality trait, impulsivity has been conceived in many different and often inconsistent ways, but personality psychology is beginning to clarify the different varieties of impulsivity. The development of the UPPS model (Whiteside & Lynam, 2001) has provided a set of dimensions, emerging from many questionnaire measures of impulsivity, that provides an excellent jumping-off point for research on individual differences in impulsive behavior. Research on performance tests of impulsivity is not as advanced psychometrically, but the basic distinction between rapid response tasks that require inhibition and future discounting tasks appears likely to be useful. The complex set of associations, reviewed in this chapter, of the UPPS traits with the Big Five and their meta-traits is likely to be indicative of multiple underlying processes that determine impulsive behavior, including multiple systems that generate impulses and multiple processes that restrain impulses. Individual differences in any of these processes are likely to affect the general tendency toward *impulsivity*, defined as acting on immediate urges, either before consideration of possible negative consequences or despite consideration of likely negative consequences.

As it becomes feasible to develop theories of the psychobiological sources of basic personality traits such as the Big Five and their meta-traits (DeYoung, 2010a, 2013, 2015), these theories may provide a useful lens to help us understand individual traits of interest, particularly traits as complex as impulsivity. Systems responsible for sensitivity to reward and punishment and for effortful control are likely sources of individual differences in impulsivity that can be mapped onto specific Big Five traits. Additionally, the association of impulsivity with the functions of the serotonin and dopamine systems (which overlap with the three systems just mentioned but are more broadly acting than any one of them) may help to explain the relation of different forms of impulsivity to the meta-traits Stability and Plasticity, which represent shared variance among the Big Five.

Although Whiteside and Lynam (2001) made an excellent case for considering Conscientiousness, Extraversion, and Neuroticism in relation to impulsivity, the evidence reviewed earlier suggests that we should cast our net even more widely. One limitation of the analysis that produced the UPPS model is that it did not include measures of Agreeableness and Openness/Intellect. Agreeableness predicts the tendency to restrain aggressive impulses (Meier, Robinson, & Wilkowski, 2006), and impulsive aggression is a major concern in research on impulsivity. Openness (but not Intellect) has been found to be associated with lack of premeditation, sensation seeking, and negative urgency (Kaufman, 2013). Both Agreeableness and Openness/Intellect are of interest because of their role in the meta-traits, which appear to be associated with impulsivity and externalizing behavior.⁴ All of the Big Five should be included in any future research on the relation of impulsivity to personality taxonomies.

The study of impulsivity as a personality trait cannot shrink from complexity, either in terms of the traits that may be related to impulsivity or the behaviors that are considered impulsive. One might question the wisdom of introducing the construct of externalizing behavior into this investigation given that it is an even broader construct than impulsivity. However, externalizing behavior is highly relevant to research on impulsivity because antisocial behavior, aggression, and drug abuse are among the most damaging failures of self-regulation, and they are common criteria for prediction by trait measures of impulsivity in psychological research. Conceiving of the general externalizing behavior factor as a target for research on impulsivity may help researchers identify the shared mechanisms influencing the great variety of behaviors that are likely to be performed impulsively.

Human impulsivity reveals the fundamental struggle between phylogenetically old brain systems that drive us to pursue immediate gratification of simple desires and the newer brain systems that evolved to restrain those systems in order to pursue complex and distant goals. Restraint of disruptive impulses is one of the most important forms of human self-regulation. On both sides of this struggle, the systems involved are multiple and complex; an effective explanatory model cannot be boiled down to a monolithic restraint system in conflict with a monolithic impulse system. Individual differences in impulsivity reflect this complexity, as is evident in the multiple dimensions of impulsivity as a personality trait. In this chapter we have attempted to describe trait impulsivity in a manner that respects the complexity of the systems involved, while rendering the logic of their manifestation in personality more comprehensible.

NOTES

1. Lexical research has suggested that a six-factor solution may be more widely replicable across languages than the Big Five (Ashton et al., 2004); however, this model appears to be only a minor variation on the Big Five, splitting Agreeableness between two factors (DeYoung et al., 2007). Social salience is likely to be a biasing factor in lexical studies, and traits within Agreeableness are highly socially salient because Agreeableness reflects cooperation versus antagonism in social relationships.
2. The kind of restraint or inhibition of impulsive behaviors associated with Conscientiousness, which has been described as “nonaffective constraint” (Depue & Lenzenweger, 2005), must be distinguished from behavioral inhibition associated with anxiety. Gray and McNaughton (2000) posited a behavioral inhibition system (BIS) that detects threats to the accomplishment of goals (regardless of whether they are immediate or distant goals) and generates anxiety that inhibits ongoing behavior, in order to avoid or resolve conflicts with one’s goals. However, this inhibition is automatic and emotional rather than voluntary and effortful and is not controlled by the prefrontal cortex. Someone who is anxious may well be less impulsive in relation to potential rewards (due to detection of conflicts between the distracting reward and longer-term goals) but more impulsive in relation to threats, given that the BIS automatically triggers threat-related impulses.
3. Note that Zuckerman’s (1979) Sensation-Seeking scale (SSS) is broader than the UPPS Sensation-Seeking scale or the NEO PI-R Excitement-Seeking scale. In addition to Experience Seeking, and Thrill and Adventure Seeking subscales, Zuckerman’s SSS also includes

Disinhibition and Boredom Susceptibility subscales. Whiteside and Lynam (2001) found that Disinhibition loaded equally on sensation seeking and lack of Perseverance, whereas Boredom Susceptibility loaded primarily on lack of perseverance. In keeping with these findings, the SSS is associated with low Conscientiousness at least as strongly as with high Extraversion (Zuckerman, 2005; Zuckerman et al., 1993). Due to this lack of specificity, we do not recommend use of the SSS to measure sensation seeking.

4. The association of impulsivity and externalizing behavior with Openness/Intellect is likely to be complex because, in addition to being associated with Extraversion, Openness/Intellect is the only Big Five trait that consistently is positively associated with intelligence (DeYoung, 2011). Intelligence, however, is negatively associated with impulsivity and externalizing behavior (DeYoung et al., 2008; Kuntsi et al., 2004). The apparent paradox can be resolved by the observation that Openness/Intellect is associated with intelligence independently of its association with Extraversion. Thus, there are two distinct pools of variance in Openness/Intellect, and we found them to be associated in opposite directions with externalizing behavior (DeYoung et al., 2008). This suggests that, to the degree that Openness/Intellect entails being exploratory, it may increase impulsivity, or at least sensation seeking, whereas, to the degree that it entails being intelligent, it reduces impulsivity.

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CHAPTER 20

The Emerging Field of Positive Emotion Dysregulation

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Regulating one's emotions is a critical part of life—from biting one's tongue while sitting in traffic to appearing excited about an unwanted gift. Scientific research on emotion regulation has highlighted its wide-ranging importance across a range of areas, including physical health, mental well-being, and even psychopathology (e.g., Denollet et al., 1996; Dillon, Deveney, & Pizzagalli, 2011). This work has provided insight into the regulation of both negative and, to a lesser extent, positive emotions. Studying positive emotion regulation is particularly important for understanding disorders that feature disturbances in positive emotion, such as bipolar disorder, depression, and substance abuse (Gruber, Dutra, Hay, & Devlin, 2014; Hechtman, Raila, Chiao, & Gruber, 2013). Given the significant public health costs associated with these disorders, it is critical to understand the role of positive emotion dysregulation in psychological health and well-being.

In this chapter, we provide an initial framework for studying positive emotion dysregulation. By *positive emotion dysregulation*, we refer to difficulty successfully managing positive emotional responses that include both failing to regulate positive emotions when it would be helpful to do so (i.e., positive emotion regulation failures) and using strategies that are poorly matched to the context (i.e., positive emotion misregulation). We begin with a brief overview of the positive emotion regulation literature, focusing on how positive emotions are typically regulated, as well as the psychological outcomes associated with both successful and unsuccessful attempts to regulate positive emotions. We then ask how and when positive emotion dysregulation occurs, highlighting key themes from the emerging literature. Next, we consider sources of individual variation in positive emotion dysregulation, including examples related to both key personality dimensions and lifespan development perspectives. We conclude with suggestions for future research.

POSITIVE EMOTION DYSREGULATION

Despite the historical focus on negative emotion regulation, recent work suggests that positive emotions are frequently regulated. Indeed, research suggests that people regulate the majority of their positive emotion experiences during the course of everyday life (Heiy & Cheavens, 2014). Positive emotion regulation is not only prevalent, but it is also of critical importance to well-being and health (e.g., Fredrickson & Joiner, 2002; Pressman & Cohen, 2005). Adaptive regulation of positive emotions is associated with improved resilience, diminished reactivity to stress, and increased longevity (Danner, Snowdon, & Friesen, 2001; Fredrickson, Mancuso, Branigan, & Tugade, 2000; Tugade & Fredrickson, 2004). Furthermore, difficulty regulating positive emotion is a core component of numerous psychiatric disorders, such as bipolar disorder, major depressive disorder, and substance use disorders (e.g., Gross, 2015; Gruber et al., 2014).

To provide clarity in discussing this emerging field, we briefly define positive emotion and positive emotion regulation. By *positive emotion*, we refer to brief, positively valenced affective states that involve coordinated subjective, physiological, and behavioral changes, and motivate goal-directed behavior (e.g., Clore & Colcombe, 2003; Rottenberg & Gross, 2003). Our use of the term *positive emotion* encompasses both transient states in which positive affect is elicited and longer lasting positive moods (e.g., Fredrickson, 1998). Although there are also more enduring patterns of individual differences in dispositional positive emotionality, we consider these to be outside the scope of the current chapter. By *positive emotion regulation*, we refer to the processes by which individuals modify the positive emotions they experience, and the timing, duration, and expression of these emotions in response to a goal (Gross, 1998; Gross & Thompson, 2007). By focusing explicitly on the regulation of positive emotional responses, we differentiate this chapter from extant work in the field of emotion dysregulation more generally (Gross & Jazaieri, 2014).

The majority of research on positive emotion regulation has focused on the benefits of experiencing positive emotion. Heightened positive affect is associated with a range of cognitive, social, and physical health benefits. Individuals who experience higher levels of positive affect demonstrate improved resistance to illness and greater longevity (Cohen, Alper, Doyle, Treanor, & Turner, 2006; Danner et al., 2001). Psychologically, successful positive emotion up-regulation has been repeatedly associated with heightened interpersonal functioning, including better social support networks (Fredrickson, 1998), increased cooperation (Forgas, 1998; Rand, Kraft-Todd, & Gruber, 2015), and more frequent helping behaviors (Isen, 1970; Isen, Clark, & Schwartz, 1976). Improved cognitive functioning—measured as augmented creativity, cognitive flexibility, and problem solving—has also been associated with increased self-reports of positive emotion (Fredrickson, Tugade, Waugh, & Larkin, 2003; Isen, 2008).

A Framework for Understanding Positive Emotion Dysregulation

Although it is often advantageous to cultivate positive emotions, there are significant costs associated with failing to regulate or inappropriately regulating positive emotions. For example, excessively heightened positive emotionality in young children predicts increased frequency of alcohol consumption, smoking, and greater mortality rates into

adulthood (Martin et al., 2002). Moreover, difficulties down-regulating positive emotions are associated with greater manic symptom severity (Giovannelli, Hoerger, Johnson, & Gruber, 2013; Gruber et al., 2009), suggesting that positive emotion disturbance is an important predictor of psychopathology. Our goal is to provide a simple framework to indicate ways in which positive emotion regulation failures may occur (see Table 20.1). Specifically, we discuss four possible ways that positive emotion can be regulated, including up-regulation of positive emotion, down-regulation of negative emotion via positive emotion, down-regulation of positive emotion, and down-regulation of positive emotion via negative emotion (e.g., Gross, 2015; Troy, Shallcross, & Mauss, 2013).

TABLE 20.1. Working Framework for Positive Emotion Dysregulation

	Up-regulating positive emotions	Down-regulating positive emotions	Down-regulating negative emotions via positive emotions	Down-regulating positive emotions via negative emotions
Size: Inappropriate magnitude	Increased positive emotion intensity	Decreased positive emotion intensity	Increased positive emotion intensity	Decreased positive emotion intensity
Situation: Incorrect context	Positive emotions increased in incorrect context (e.g., threat)	Positive emotions decreased in incorrect context (e.g., reward)	Negative emotions decreased, and positive emotions increased, in incorrect context (e.g., threat)	Positive emotions decreased, and negative emotions increased, in incorrect context (e.g., reward)
Seeking: Excessive pursuit	Increased pursuit of positive emotions	Avoidance of positive emotions	Avoidance of negative emotions via increasing positive emotions	Avoidance of positive emotions via increasing negative emotions
Stability: Heightened variability (higher peaks and lower valleys)	Increased height of positive emotion “peaks”	Decreased height of positive emotion “peaks,” increased depth of positive emotion “valleys”	Increased height of positive emotion “peaks,” decreased height of negative emotion “peaks”	Increased height of negative emotion “peaks,” decreased height positive emotion “peaks,” increased depth of positive emotion “valleys”
Self-regulation: Trouble regulating	Underregulate positive emotion intensity	Overregulate positive emotion intensity	Underregulate positive emotion intensity	Underregulate negative emotion intensity
	Misregulate positive emotion to context	Misregulate positive emotion to context	Overregulate negative emotion intensity	Overregulate positive emotion intensity
			Misregulate positive emotion to context	Misregulate positive emotion to context

Up-regulation of positive emotion occurs when a person maintains or enhances the magnitude of his or her positive emotion experience, often in service of immediate hedonic goals, such as feeling pleasure (Tamir, 2009). Up-regulating and experiencing positive emotions are typically associated with a wide range of benefits. For example, Fredrickson, Cohn, Coffey, Pek, and Finkel (2008) have demonstrated that individuals who up-regulate their positive emotions more frequently (as instructed through a 6-week meditation-based intervention) experience fewer illness symptoms, increased social support, heightened self-acceptance, and improved life satisfaction. While researchers have emphasized the benefits of experiencing and up-regulating positive emotions, fewer researchers have examined the consequences of failing to do so. Initial findings suggest that this may be a critical avenue for future research because failure to up-regulate positive emotion may be implicated in anhedonia, a component of major depressive disorder (Heller et al., 2009).

Next, *down-regulation of negative emotions via positive emotions* occurs when positive emotions are used to reduce or modify the intensity, duration, or type of negative emotion experienced (Fredrickson et al., 2000). Used in this way, positive emotions can aid in physiological recovery from stress (Brosschot & Thayer, 2003; Fredrickson et al., 2000). This is supported by research conducted after the 9/11 terrorist attacks, which demonstrated that experiencing positive emotions during times of stress and negative emotion can facilitate resilience and prevent increases in depressive symptoms (Fredrickson et al., 2003). This work highlights the importance of leveraging positive emotions to reduce negative affect, yet the consequences of failing to use positive emotions to reduce negative affect and the role of this process in psychopathology have not been empirically explored.

Positive emotion regulation also includes the *down-regulation of positive emotion*, or the process of decreasing the intensity or duration of a positive emotion experience. Rather than always wanting to feel positive emotion, people may down-regulate positive emotion in a wide range of contexts to achieve instrumental goals (e.g., Tamir, 2009; Williams & DeSteno, 2008). For example, a person may want to decrease his or her positive emotions to improve concentration (e.g., turning off happy music to minimize distractions when studying), to suppress inappropriate displays of positive emotion (e.g., laughing at a funeral), and to be considerate of others (e.g., suppressing pride when one succeeds and a friend does not) (Parrott, 1993). Researchers have long focused on the benefits of experiencing positive emotion and thereby the importance of up-regulating positive affect, and little empirical work has directly tested why and when individuals are motivated to down-regulate their positive emotions (e.g., Giuliani, McRae, & Gross, 2008; Gruber, Mauss, & Tamir, 2011; Samson & Gross, 2014).

Last, positive emotion regulation includes the *down-regulation of positive emotion via negative emotion*. This involves leveraging (i.e., increasing the magnitude or intensity of) negative emotions to regulate (i.e., decreasing magnitude or intensity of) positive emotions. Previous research has largely neglected the distinction between down-regulating positive emotion and down-regulating positive emotion using negative emotion. Although additional research is essential for a deeper understanding of how and when individuals use negative emotions to down-regulate positive emotions, this form of emotion regulation may be a central component of anxiety disorders and major depressive disorder, in which individuals experience low levels of positive affect and heightened intolerance of uncertainty, worry, and guilt (Yook, Kim, Suh, & Lee, 2010).

How Does Positive Emotion Dysregulation Occur?

Building upon the four ways in which positive emotions can be regulated, we point to several key themes in emerging literature that illuminate how positive emotion regulation failures might occur. These themes are intended to provide an orienting landscape for thinking about disturbances in positive emotion regulation. We acknowledge that these are a starting point and not an end point or definitive list of all such instances of positive emotion regulation failure. Our hope is that these initial key insights will spark curiosity and ignite emerging research on failures to regulate positive emotions. The themes of positive emotion dysregulation that we discuss in this chapter include the *size* or magnitude of one's positive emotion responses, the *situation* or context in which positive emotions unfold, the *self-regulation* of one's positive feelings, the *stability* or how positive emotions dynamically change over time, and the *striving* or the degree to which one exerts effort in pursuing or attaining positive emotion (Gruber & Purcell, 2015).

Magnitude of Positive Emotion

Although individuals who experience positive emotions often reap psychological and physical benefits, research suggests that excessively high levels of positive emotion are associated with negative psychological health outcomes. For example, high levels of positive emotions for adults with a clinical history of mania (i.e., bipolar disorder) can predict a more severe illness course, in addition to greater relapse rates (Johnson, 2005). Research suggests that experiencing excessively low levels of positive emotion is also related to negative outcomes such as anhedonia and depression. Indeed, *anhedonia*, defined as a loss of pleasure or diminished positive affect in response to stimuli that were previously rewarding, can be a core component of major depressive disorder that typically does not improve in response to medication (i.e., selective serotonin reuptake inhibitors [SSRIs]) and is associated with poorer treatment outcomes (Moos & Cronkite, 1999; Spijker, Bijl, de Graaf, & Nolen, 2001). Examining individuals with excessively high or low positive emotionality allows for a better understanding of how the normative function of positive emotion can break down, providing a view into the associated cognitive, biological, and social consequences of positive emotion dysfunction.

Situation or Context Sensitivity of Positive Emotion

Both positive and negative emotions help us pursue and attain important goals. Fear, for example, can help a person remain safe in a threatening situation. Similarly, positive emotions such as gratitude are useful when one wants to foster cooperation and collaboration with others (e.g., Forgas, 1998; Isen et al., 1976). This instrumental approach to emotion regulation suggests that whereas people generally prefer to feel positive emotions, they can be motivated to experience emotions that are useful in a given context (Tamir, 2009). Consistent with this, research suggests that experiencing positive affect indiscriminately across contexts can be maladaptive. For example, Tamir, Mitchell, and Gross (2008) found that people induced into a happy mood performed worse on competitive computer games than people in an angry mood. In line with this work, research also indicates that individuals who experienced positive feelings in inappropriate situations (e.g., watching sad films or listening to a distressed partner) were at greater risk for developing mania

(Gruber, Johnson, Oveis, & Keltner, 2008). Together, these findings indicate that positive emotion is not suited for every situation and can hinder a person's ability to achieve their goals successfully when experienced consistently across contexts.

Self-Regulation of Positive Emotion

The ability to regulate one's emotions adaptively has been linked to heightened well-being and social adjustment (Tamir, John, Srivastava, & Gross, 2007) and improved mental health outcomes (e.g., Folkman & Moskowitz, 2000; Tugade & Fredrickson, 2004). In contrast, difficulties flexibly regulating or controlling one's emotions are associated with psychopathology (e.g., Gratz, Rosenthal, Tull, Lejuez, & Gunderson, 2006; Menin, Heimberg, Turk, & Fresco, 2005). Less work has focused on the consequences of over- or underregulating *positive* emotional experiences or the inability to regulate these experiences flexibly. We see some examples of this type of positive emotion dysregulation in clinical science research on mood disorders. Individuals with bipolar disorder, for example, have trouble managing intense positive emotions central to episodes of mania (Gruber, 2011). The intensity of positive emotion during mania and the tendency for individuals with bipolar disorder to experience heightened positive emotion across contexts presents an opportunity to examine the consequences associated with underregulation of positive emotion. By contrast, individuals with depression have difficulty effectively increasing or up-regulating positive emotions and a decreased ability to sustain positive emotions (for a review, see Gruber et al., 2014). Focusing on individuals with depression may give insight into the costs associated with overregulating positive emotion and difficulties up-regulating positive emotion. Together, work with these two populations suggests that if positive emotions are not properly regulated, the beneficial effects commonly associated with them may be lost.

Stability of Positive Emotion across Time

A complete understanding of the correlates of positive emotion requires more than an understanding of its overall mean levels; rather, positive emotion can only be fully understood when we account for temporal dynamics. For example, two people might have identical overall mean levels of positive emotion but be quite different in their emotional variability, with one person fluctuating very little from his or her average level, while the other person fluctuates significantly. Greater fluctuations in positive affect, as measured via increased intraindividual variability in self-reported positive affect over repeated assessments in daily life, have been associated with worse psychological health, including lower well-being and life satisfaction, as well as greater depression and anxiety (Gruber, Kogan, Quoidbach, & Mauss, 2013). Thus, another way that positive emotion dysregulation may occur is through inconsistent regulation (e.g., alternating between over- and underregulation) of positive affect throughout the day.

Striving for or Pursuit of Positive Emotion

Unsurprisingly, most people prefer to feel positive emotions. Despite this, research has indicated that actively striving for positive emotion (i.e., expending efforts to attain or maximize positive emotional experiences and intensity) is associated with negative

psychological health outcomes (Ford, Mauss, & Gruber, 2015; Ford, Shallcross, Mauss, Floerke, & Gruber, 2014; Mauss, Tamir, Anderson, & Savino, 2011). In one such study, Mauss and colleagues (2011) found that participants who read an article about the benefits of feeling happy experienced lower levels of positive affect in response to watching a happy film clip than did those who read an article that did not mention happiness. Mauss and colleagues suggest that this paradoxical effect emerged because participants who were primed to value happiness became disappointed after falling short of their emotional expectation. Additional research has supported this finding, further suggesting that the pursuit of positive emotion may be associated with increased loneliness (Mauss et al., 2012), depressive symptoms (Ford et al., 2014), and manic symptoms (Ford et al., 2015). These initial findings point to the potential role of values and emotion beliefs in positive emotion dysregulation and suggest that the more people value happiness, the harder it may be for them to obtain it successfully.

In conclusion, there are numerous ways in which individuals fail to regulate or misregulate their positive emotion experiences. Since many regulatory strategies and contexts are implicated in positive emotion regulation, these guiding themes provide an overarching framework of positive emotion dysregulation. Specifically, these themes emphasize some of the ways in which previous empirical work has examined positive emotion regulation, while pointing to gaps in the current literature. These themes help to address and to integrate both the positive and negative consequences of regulating positive emotions for health and psychological well-being. For example, effective up-regulation of positive emotion can improve social connectedness (e.g., Fredrickson et al., 2008), and context-appropriate down-regulation of positive emotion can facilitate improved performance and concentration (e.g., Tamir et al., 2008).

The Role of Individual Differences and Lifespan Development

The aforementioned guiding themes—size, situation, self-regulation, stability, and striving—highlight some of the different ways that difficulties regulating positive emotions can arise. In addition to a thematic perspective, individual-difference and developmental lifespan approaches are critical to understand and identify potential sources of variation in these themes. In the following section, we briefly examine how personality traits and developmental transitions may contribute to or buffer individuals from the effects of positive emotion dysregulation. We acknowledge that these are merely discussion points and future empirical work is sorely warranted.

Individual Differences in Positive Emotion Regulation

Existing research has construed tendencies toward emotion regulation styles or strategies as a trait-like variable (Gross & John, 2003). In addition, specific personality traits may also predict positive emotion regulation. Below we suggest that two traits from the widely established five-factor model (Digman, 1990) are useful for predicting positive emotional regulation: extraversion and neuroticism, due to their relations with positive and negative emotionality, respectively.

Broadly, extraversion is associated with positive emotionality (e.g., Cloninger, 1987; Costa & McCrae, 1980; Goldberg, 1990; Tellegen, 1985). In the context of positive emotion regulation, extraverted people are more susceptible to positive mood induction

(e.g., Larsen & Ketelaar, 1991) and have increased neural reactivity to positive emotional stimuli (Lim, Woo, Bahn, & Nam, 2012). Extraversion is also negatively associated with emotional suppression (Gross & John, 2003) and positively related to relying on others rather than the self to regulate emotions (Kokkonen & Pulkkinen, 2001). From a positive emotion dysregulation framework, this research suggests that extraverted people are more likely to up-regulate positive emotions and less likely to down-regulate positive emotions. To our knowledge, no work has examined extraversion and the tendency to down-regulate negative emotions using positive emotions. However, because extraversion is associated with increased positive emotionality, positive emotions may be more readily available to extraverted people as a tool to down-regulate negative emotions.

Neuroticism is also a trait that may predict positive emotion regulation strategy use. Highly neurotic people experience higher levels of negative affect (Costa & McCrae, 1980), are more susceptible to negative mood induction compared to positive mood induction (Larsen & Ketelaar, 1989; Rusting & Larsen, 1997), and report experiencing fewer positive emotions (e.g., Shiota, Keltner, & John, 2006). In addition to being correlated with increased negative affect, higher neuroticism is associated with an increased tendency to value happiness (Ford et al., 2014). As noted earlier, the tendency to value happiness is associated with depressive symptoms (Ford et al., 2014; Mauss et al., 2011). This work suggests that neuroticism is associated with an increased motivation to experience positive emotions, but a diminished ability to successfully up-regulate emotions and attain positive affective states. Thus, neuroticism may be associated with using strategies to down-regulate positive emotions and inversely associated with using strategies to up-regulate positive emotions. We know of no work specifically linking neuroticism to using positive emotions to down-regulate negative emotions or negative emotion to down-regulate positive emotions. However, the tendency for people with high neuroticism to experience more negative emotions and lower levels of positive emotion suggests that highly neurotic people are unlikely to deploy positive emotions to successfully down-regulate negative emotions and may instead tend to use negative emotions to down-regulate positive emotions.

Positive Emotion Dysregulation across the Lifespan

Different developmental, social, and motivational contexts across the lifespan may also modulate goals of positive emotion regulation. As people develop, their ability to regulate positive emotions and the potential ways in which positive emotion dysregulation can occur may shift and change. The majority of the current literature examining positive emotion regulation has been conducted in young adults, college samples, and middle-aged adults. Thus, we highlight how variation in adolescence and older adulthood, both of which are characterized by shifts in positive emotional experience and regulation, may be exemplars of how positive emotion regulation might go awry or differ across the lifespan.

The developmental period of adolescence is characterized by more extreme positive emotional states and stronger biases toward positive emotional stimuli when compared to both childhood and adulthood (Larson & Lampman-Petratis, 1989; Larson, Moneta, Richards, & Wilson, 2002; Larson & Richards, 1994). Similarly, adolescents exhibit increased physiological and neurobiological reactivity in response to positive emotional stimuli and reward (Ernst et al., 2005; Quevedo, Benning, Gunnar, & Dahl, 2009) due

to earlier development of these positive and motivational regions of the brain and slower development in regulatory regions of the brain (Ernst, Pine, & Hardin, 2006; Luna, Paulsen, Padmanabhan, & Geier, 2013). This mismatch of development leads to difficulties down-regulating positive emotions, particularly in the context of rewards. Difficulty with positive emotion down-regulation has been associated with maladaptive outcomes in adolescence, including increased sensation-seeking and risk-taking behaviors (e.g., substance abuse, unsafe driving, sexual promiscuity; Dahl, 2004; Steinberg, 2008) that may be magnified in the presence of peers (Gardner & Steinberg, 2005; Steinberg, 2010).

Adolescence is also characterized by other forms of positive emotion dysregulation, including maladaptive attempts to blunt positive emotional experiences. This work has largely focused on one specific form of maladaptive positive emotion regulation, referred to as *dampening of positive emotion*, that is associated with increased risk for mood symptom severity. Specifically, attempts to blunt positive emotion via use of maladaptive cognitions (i.e., endorsing items including, “think about things that could go wrong” or “remind yourself that these feelings won’t last”) are associated with the onset of depressive symptoms and self-harming behaviors in youth (Bijttebier, Raes, Vasey, & Feldman, 2012; Burke et al., 2015; Forbes & Dahl, 2012). Moreover, adolescents’ difficulties up-regulating positive emotion in a productive and context-specific way predict elevated depressive symptoms (Fussner, Luebke, & Bell, 2014). In summary, adolescence appears to be an especially vulnerable time in life because it is characterized by extremes: Adolescence is characterized by difficulty down-regulating positive emotion when needed, as well as less productive attempts to manage the positive emotions that predict exacerbation of clinically relevant symptoms.

In contrast with adolescents, older adults experience more stable positive emotionality (Carstensen et al., 2011; Gross et al., 1997) and more effectively maintain positive emotionality during unpleasant situations (Voelkle, Ebner, Lindenberger, & Riediger, 2013). They are also more capable and more motivated to regulate emotions (Carstensen, 2006), particularly to maintain positive emotions and down-regulate negative emotions (Riediger, Schmiedek, Wagner, & Lindenberger, 2009). Older adults also use a wider array of effective emotion regulation strategies (Blanchard-Fields, Stein, & Watson, 2004; Watson & Blanchard-Fields, 1998). For instance, older adults often attempt to place themselves in pleasant, predictable environments (Carstensen, Gross, & Fung, 1997). Older adults also exhibit attentional and memory biases toward positive emotional material (Mather & Carstensen, 2005) and adeptly use cognitive reappraisal to down-regulate negative emotions (Opitz, Rauch, Terry, & Urry, 2012; Shiota & Levenson, 2009). Over years of practice, older adults appear to be skilled at up-regulating positive emotion and using positive emotions to down-regulate negative emotions.

Individual differences in personality and developmental changes across the lifespan influence positive emotion regulation, as well as dysregulation. These individual differences and lifespan considerations may inform future work on multiple forms of positive emotion dysregulation.

THE FUTURE OF POSITIVE EMOTION DYSREGULATION

Broadly, we have identified the emergence, components, related traits, and developmental trajectory of positive emotion dysregulation known to the field. In this section, we first

highlight some ways to expand the knowledge of positive emotion dysregulation. A first next step is to *identify mechanisms of action* within each of the components in the working framework provided. In this chapter we have provided an initial descriptive account of positive emotion dysregulation, pointing to the numerous ways in which failures to regulate positive emotion can occur. Next, researchers must begin to identify processes that may help explain *why* unsuccessful regulation of positive emotion occurs among so many individuals. In adopting this mechanistic approach, it is critical to focus on neural models (e.g., Ochsner & Gross, 2005) in the hope of identifying systems that give rise to successful cognitive control of emotion or influence emotion intensity. Furthermore, much of emotion regulation is thought to occur outside of conscious awareness (Williams, Bargh, Nocera, & Gray, 2009). Thus, assessing physiological systems and non-verbal behaviors linked to emotional regulation may offer a more precise, high-fidelity measurement of emotional regulation than that afforded by self-report measures (e.g., Blascovich & Mendes, 2010; Mehl, Robbins, & Deters, 2012).

Second, because current lines of research have yielded many insights about specific emotion regulation strategies, less is known about *polyregulation*, or the simultaneous or sequential occurrence of multiple emotion regulation strategies within a single emotion experience. Understanding the co-occurrence of multiple regulation strategies provides essential information about where in the regulatory process positive emotion dysregulation occurs and what the consequences of over- and underregulating positive emotions may be. For example, Gruber, Harvey, & Gross (2012) suggest that individuals with bipolar disorder self-report using *more* regulatory strategies than healthy controls may indicate that they are using multiple strategies that have conflicting goals (i.e., suppressing to down-regulate positive emotion, while savoring to up-regulate positive emotion at the same time) or that they are switching between strategies too quickly to alter their emotion experience effectively. Future research should adopt a “polyregulation” approach to help unravel the role of concurrent or sequential regulatory strategies (and their interactions) in perpetuating positive emotion dysregulation.

Third, it is increasingly important to consider the social context in which emotion regulation typically occurs. Indeed, positive emotion dysregulation has numerous consequences for social relationships. Thus, future research should investigate positive emotion regulation beyond the individual. *Emotion contagion*, or the tendency to unconsciously “converge emotionally” with others by mimicking facial expressions, vocalizations, and movements (Hatfield, Cacioppo, & Rapson, 1992), provides one opportunity for researchers to examine positive emotion dysregulation in dyadic or group contexts. Specifically, researchers should focus on the extent to which distinct positive emotions (e.g., self-focused positive emotions such as pride and joy, or other-focused positive emotions such as compassion and gratitude; Shiota et al., 2006) influence emotion contagion and coregulation.

Fourth, the field of psychological interventions has become increasingly devoted to alleviating emotional difficulties, hastening the need for *development of targeted interventions*. Indeed, a host of empirically supported treatments have been explicitly developed to target difficulties with emotion regulation, including dialectical behavior therapy, which includes building emotion regulatory skills (e.g., Linehan, 1993), emotion-focused therapy (e.g., Greenberg, 2002), specific emotion-regulation interventions developed for the management of anxiety and mood disorders (e.g., Fresco, Mennin, Heimberg, & Ritter, 2013), and mindfulness-based interventions focused on acceptance of current

emotional states (e.g., Segal, Williams, & Teasdale, 2002). As research begins to focus on the specific emotional processes that are implicated in positive emotion dysregulation, a critical next step will be to create and adapt interventions to target these processes and identify the individuals who will benefit the most. This will include building and expanding on existing interventions, such as small-scale exercises of listing sources of gratitude (Watkins, Woodward, Stone, & Kolts, 2003), and larger-scale interventions, such as loving-kindness meditation (e.g., Fredrickson et al., 2008; Seligman, Rashid, & Parks, 2006; Weytens, Luminet, Verhofstadt, & Mikolajczak, 2014). Although the focus of interventions is typically augmenting positive emotion experiences, positive emotion intervention research should strive to train the individual both to up-regulate *and* down-regulate positive emotions adaptively, based on the individual's goals and context. This approach would emphasize the instrumental nature of emotions and allow individuals to fully capitalize on the benefits that high and low levels of positive emotions afford. Furthermore, by recognizing that positive emotions are not adaptive across all contexts, therapists can avoid potentially harmful practices that teach their clients to overvalue positive emotions (e.g., Mauss et al., 2012).

Understanding the regulation of positive emotions is a critical next step in the quickly growing field of emotional regulation. We have outlined some of the numerous processes, outcomes, and predictors of positive emotion dysregulation. There are unexplored mechanisms, contexts that may modulate positive emotion regulation, concurrent strategy usage that may influence how positive emotion dysregulation is treated, and interventions that draw on existing and future research to target positive emotion dysregulation effectively. By highlighting the importance of positive emotion dysregulation, we hope that we can encourage researchers to continue unveiling additional processes and facets of positive emotion dysregulation that have not yet been uncovered through empirical work. Altogether, this current framework of positive emotion dysregulation emphasizes the ways in which failure to regulate positive emotions can occur and points to future directions that will improve the field's understanding and ability to target and improve the consequences of positive emotion dysregulation.

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CHAPTER 21

Grit

Sustained Self-Regulation in the Service of Superordinate Goals

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In 2013, an unknown mathematician named Yitang Zhang proved a conjecture in analytic number theory that had befuddled experts for over a century (Wilkinson, 2015). His proof, published in the *Annals of Mathematics*, earned him world renown and a MacArthur Fellowship. Asked what could explain this out-of-the-blue landmark achievement, a colleague commented: “[With Zhang] nothing is rushed. If it takes him . . . ten years, that’s fine with him” (p. 28). Working on proofs in pure mathematics, it turns out, mostly involves being stuck. Zhang’s genius was his “willingness to be stuck much longer” (p. 28).

What inclines individuals like Zhang to sustain focus on a single pursuit over months, years, and even decades? One self-regulatory construct that is relevant to this question is *grit*, defined as passion and perseverance for long-term goals despite setbacks, failures, and competing pursuits. In this chapter, we compare grit to another prominent self-regulatory construct, self-control. We identify conceptual distinctions between these constructs that account for their differential predictive validity and use a hierarchical goal framework to throw both their similarities and differences into sharper relief. After identifying the defining features of grit, we consider how psychological interventions might target these features to cultivate grit and, finally, suggest especially promising avenues for future research.

A PRÉCIS ON GRIT

Grit has a short history but a long past. Even the earliest scientific inquiries into the determinants of success recognized the importance of sustained goal pursuit. In 1869, Galton

(1869/2006) reviewed the biographies of eminent individuals and concluded that success resulted from intellect combined with “zeal” and the “capacity for hard labour” (p. 38). Half a century later, Cox (1926) surveyed the life histories of 301 geniuses and observed that “youths who achieve eminence are characterized not only by high intellectual traits, but also by persistence of motive and effort” (p. 218). If anything, Cox proposed, persistence was more important: “High but not the highest intelligence combined with the greatest degree of persistence will achieve greater eminence than the highest degree of intelligence with somewhat less persistence” (p. 187).

The years following Galton and Cox were dominated by attempts to study persistence in more typical populations, using performance tasks in controlled settings (Hartshorne, May, & Maller, 1929; Ryans, 1938a, 1938b; for a review, see Feather, 1962). These tasks afforded psychologists the opportunity to examine individual differences in behavior in identically challenging circumstances. However, it is not at all clear that struggling with a difficult puzzle in a single sitting or holding one’s leg aloft for minutes on end gets at the same psychological phenomena as documented by Galton and Cox. The modern study of grit continues in the initial tradition of examining single-minded perseverance over the very long haul. In this section, we review how grit is measured, the outcomes it predicts, as well as motivational, cognitive, and behavioral correlates of grit.

Measurement

Grit has typically been assessed using self-report questionnaires. The Grit Scale (Duckworth, Peterson, Matthews, & Kelly, 2007) has 12 items, and its short form, the Grit-S, contains a subset of eight items (Duckworth & Quinn, 2009). The Grit-S, which is often preferred due to time constraints, demonstrates internal consistency ($\alpha > .73$ across six studies), test–retest stability ($r = .68$ over 1 year), and convergent and discriminant validity (Duckworth & Quinn, 2009; for comparable statistics on the Grit Scale, see Duckworth et al., 2007). An informant-report version of the Grit-S has similar psychometric properties ($\alpha > .83$ for family and friend ratings) and converges with the self-report version ($r > .45$; Duckworth & Quinn, 2009, Study 3).

Passion and perseverance for long-term goals map directly onto the two-factor structure of the Grit Scale. “Passion” aligns with the first factor, *consistency of interests*, the tendency to invest effort in the same goal over time (e.g., “New ideas and projects sometimes distract me from previous ones”; reverse scored). Notably, questionnaire items that load on this factor do not measure intensity of commitment to a goal. Rather, these items assess the tendency to pursue a single objective rather than varying ones, over long stretches of time. “Perseverance” aligns with the second factor, *consistency of effort*, the tendency to sustain effort toward goals (e.g., “Setbacks don’t discourage me”). The two factors of the Grit Scale point to related but separable characteristics of the gritty individual: the inclination to focus on the same goal over time and to persist in the face of adversity. Combined, these factors are typically more predictive of performance in challenging settings (e.g., in the Scripps National Spelling Bee, at West Point) than is either factor alone (Duckworth & Quinn, 2009).

Recent efforts have focused on developing alternative measures of grit. One method entails using biographical evidence of long-term commitment as a proxy for grit (Matteucci et al., 2016; Robertson-Kraft & Duckworth, 2014). This approach builds on

foundational research by Willingham (1985), who found that *follow-through*—multiyear participation in extracurricular activities and evidence of advancement therein—during high school outpredicted both Scholastic Aptitude Test (SAT) scores and high school grade point average (GPA) for a range of nonacademic college success outcomes. In a more recent study of high school seniors, resumes scored using an adaptation of Willingham's procedure—which quantified follow-through in sports, paid work, and other serious pursuits outside the classroom—correlated with both self-report and teacher-report questionnaire measures of grit (Matteucci et al., 2016).

Outcomes¹

In cross-sectional research, grit is associated with achievement and well-being. For example, gritty adults tend to make fewer career changes (odds ratio [OR] = .65; Duckworth et al., 2007), grittier individuals progress farther in their formal education ($r = .22$), and at one elite college, grittier undergraduates earn higher GPAs ($r = .34$; Duckworth et al., 2007). Grit is also associated with happiness: Grittier adults report higher life satisfaction ($r = .40$), higher positive affect ($r = .47$), and lower negative affect ($r = -.34$; Young, Lin, & Duckworth, 2015). Interestingly, older individuals generally report higher levels of grit, which suggests that grit may develop with life experience ($r = .17$; Duckworth et al., 2007). However, because available data are cross-sectional, this finding may also indicate a cohort effect: Cultural influences may have more strongly encouraged grit in the past.

Stronger evidence that grit contributes to achievement comes from prospective longitudinal research. For example, among cadets at West Point military academy, grit predicts which cadets persist through their first summer training, colloquially termed “Beast Barracks” due to the mental and physical demands it makes of new recruits (OR = 1.62; Duckworth et al., 2007). The Consistency of Effort subscale continues to predict retention at West Point 4 years later (OR = 1.20; Kelly, Matthew & Bartone, 2014). In contrast, the Whole Candidate Score—a weighted average of SAT score, high school rank, ratings of leadership potential, and performance on physical aptitude tests—fails to predict retention, either through Beast Barracks or at graduation 4 years later (for replication studies, see Duckworth et al., 2007; Duckworth & Quinn, 2009).

Grit is prospectively associated with performance in a range of other challenging settings as well. For example, grit predicts graduation from the Chicago Public Schools (OR = 1.48; Eskreis-Winkler, Duckworth, Shulman, & Beal, 2014), and, among exceptionally high-achieving students, rank in the Scripps National Spelling Bee (OR = 1.86; Duckworth et al., 2007). In professional settings, grittier soldiers are more likely to complete Green Beret training (OR = 1.28), and grittier sales representatives are less likely to quit their jobs over a 6-month period (OR = 1.38; Eskreis-Winkler et al., 2014). Grittier teachers are more likely to produce superior academic learning gains in their students over the course of the following academic year (OR = 1.31; Duckworth, Quinn, & Seligman, 2009). Likewise, teachers who, during their college years, demonstrated follow-through in a small number of extracurricular pursuits are more likely to stay in teaching through the end of the school year (OR = 2.34) and to help their student achieve at least a full year of academic learning during that time (OR = 1.60; Robertson-Kraft & Duckworth, 2014).

Motivational, Cognitive, and Behavioral Correlates

A nascent literature is beginning to explore the motivational, cognitive, and behavioral correlates of grit. For example, grit is differentially related to three distinct motivational approaches to pursuing happiness: pleasure, engagement, and meaning. Individuals who are motivated by pleasure seek positive hedonic experiences, individuals who are motivated by engagement seek attention-absorbing activities, and individuals motivated by meaning seek activities that serve a greater altruistic purpose (Peterson, Park, & Seligman, 2005). In two large samples, grittier adults reported being motivated by engagement (betas = .34 and .32) and meaning (betas = .15 and .19), but not pleasure (betas = -.10 and -.24) (Von Culin, Tsukayama, & Duckworth, 2014). Relatedly, Hill, Burrow and Bronk (2016) found that gritty undergraduates reported higher levels of meaning in life ($r = .44$), and that grit predicted prospective increases in meaning over a 3-month period (beta = .21). Similarly, in a longitudinal study of undergraduates, grit combined with gratitude conferred resilience against suicidal ideations ($r = -.28$), an effect that was mediated by higher levels of self-reported meaning ($r = .38$; Kleiman, Adams, Kashdan, & Riskind, 2013).

Gritty individuals also tend to be optimistic (Duckworth et al., 2009). *Optimistic explanatory style*—interpreting the causes of adverse events to be specific and changeable, rather than global and permanent—leads to resilience in the face of adversity (Peterson, 2000; Peterson & Park, 1998). It is therefore unsurprising that among novice teachers, optimistic explanatory style has been associated with grit ($r = .32$), and that grit statistically mediates the association between optimistic explanatory style and teaching performance. Relatedly, across two samples of high school seniors, gritty individuals were more likely to hold a *growth mindset*, the implicit belief that intelligence can improve with effort, and to have an *internal locus of control*, the belief that life consequences primarily result from intentional actions (Galla et al., 2014).

Gritty individuals may also avoid grass-is-greener thinking. In one study, new cadets were asked to imagine what they might be doing if they had not come to West Point (Kwok, Buchl, & Duckworth, 2013). Cadets who imagined something worse or could not imagine an alternative at all had higher grit scores than those who could imagine an alternative that was the same or better. Should this finding replicate in other samples, it may suggest that grittier individuals generate lower estimates of the opportunity cost of their current pursuits; that is, they do not place a high value on the best foregone alternative.

One reason gritty individuals outperform their peers is because they invest more high-quality effort in their work. Grit, for example, leads individuals to engage in more deliberate practice—a difficult yet effective form of practice that is performed repetitively with feedback and designed to improve specific aspects of performance (Ericsson, Krampe, & Tesch-Römer, 1993). In one study of National Spelling Bee finalists (Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2011), deliberate practice was operationalized as studying vocabulary words and word origins in solitude and distinguished from other common practice activities, such as being quizzed by another person, reading, or playing word games. Though deliberate practice was generally experienced as the hardest, least enjoyable form of practice, gritty contestants consistently did more of it ($r = .30$). Hours invested in deliberate practice fully mediated the prospective association between grit and rank in final competition. Relatedly, gritty undergraduates engage in self-regulated learning: They proactively adapt their cognitions and behaviors to facilitate

learning and achievement (Wolters & Hussain, 2015). In one study, self-regulated learning mediated the effect of grit on improvements in self-reported GPA. Notably, these findings were only supported for the perseverance of effort factor of the Grit Scale.

Taken together, these findings suggest that gritty individuals are motivated more by meaning and engagement than by pleasure, are disposed to think about what they can change in their lives as opposed to what they cannot change, focus on current pursuits as opposed to being preoccupied with alternatives, and are inclined to put in more hours of arduous effort toward their goals. What grit has *not* been reliably associated with is talent. In most studies, grit has been shown to be either orthogonal to talent or, in one case, weakly inversely correlated (Duckworth et al., 2007).

RELATING GRIT TO SELF-CONTROL

Much of human behavior is goal-directed (Locke & Latham, 2013). A number of self-regulatory constructs refer to the ability to regulate thoughts, feelings, and behaviors in the service of valued goals. In this section, we compare and contrast grit with self-control, another prominent self-regulatory construct. We situate grit and self-control within a hierarchical goal framework to sharpen similarities and differences between these constructs.

Grit and Self-Control

Self-control can be defined as the self-initiated regulation of conflicting impulses in the service of valued goals (Baumeister, Heatherton, & Tice, 1994). Freud (1930) believed that self-control—the ability to inhibit undesirable impulses—was the bedrock of civilized life. Like grit, self-control predicts achievement-related outcomes, including school performance, income, and employment (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012; Duckworth & Carlson, 2013; Moffitt et al., 2011). Empirically, self-control and grit are highly correlated (r 's > .63; Duckworth et al., 2007).

While related both conceptually and empirically, these constructs demonstrate distinct patterns of association with achievement outcomes: Grit tends to be relevant in challenging situations in which dropout is common, whereas self-control is more relevant in everyday situations in which temptations or distractions abound. For example, grit predicts rank in the National Spelling Bee and retention at West Point over and above self-control (Duckworth et al., 2007; Duckworth & Quinn, 2009). In contrast, self-control predicts course grades, even at West Point, and healthy weight better than grit (Duckworth, 2014; Duckworth et al., 2007). These discrepancies were anticipated by Galton (1869/2006) over a century ago when he distinguished the inclination to pursue especially long-term aims in the face of obstacles, a hallmark of high achievers, from self-denial in the face of “hourly temptations” (p. 40).

A Hierarchical Goal Framework

Considering how goals are hierarchically organized clarifies key similarities and distinctions between grit and self-control (Duckworth & Gross, 2014). It is now widely accepted that goals exist at higher and lower levels (Carver & Scheier, 1998; Kruglanski et al.,

2002; Shah & Kruglanski, 2000) (see Figure 21.1). Higher-order goals are fewer, more abstract, and more valued, whereas lower-order goals are more numerous, less abstract, and more interchangeable. The uppermost goals in an individual's hierarchy reflect deeply held ideals and values (Carver & Scheier, 1998). These higher-order goals generate lower-order goals to reduce the discrepancy between the higher-order goals' uncompleted state and completion. Higher-order goals also influence lower-level goals via *transfer*—which occurs when “a means . . . associated with a goal . . . [evokes] feelings and attitudes associated with that goal” (Kruglanski et al., 2002, p. 345). In other words, commitment to higher-order goals can transfer to their means by association.

We propose that grit entails working assiduously toward one superordinate, challenging goal over extremely long stretches of time. Consider Hall of Fame baseball pitcher Tom Seaver, whose superordinate goal was to “[pitch] the best I possibly can day after day, year after year” (Dorfman & Kuehl, 1989, p. 46). Seaver coordinated nearly all his lower-level goals and actions in the service of this superordinate objective:

Pitching . . . determines what I eat, when I go to bed, what I do when I'm awake. It determines how I spend my life when I'm not pitching. If it means I have to come to Florida and can't get tanned because I might get a burn that would keep me from throwing for a few days, then I never go shirtless in the sun. . . . If it means I have to remind myself to pet dogs with my left hand, then I do that, too. If it means in the winter I eat cottage cheese instead of chocolate chip cookies in order to keep my weight down, then I eat cottage cheese. (p. 46)

Seaver is a good example of the principle of transfer. Here, the passion for excellence in pitching (a superordinate goal) increased motivation for specific goals and actions at lower levels.

The characteristic way gritty individuals respond to setbacks also has direct ramifications for their hierarchical goal structures. Individuals who persist over obstacles

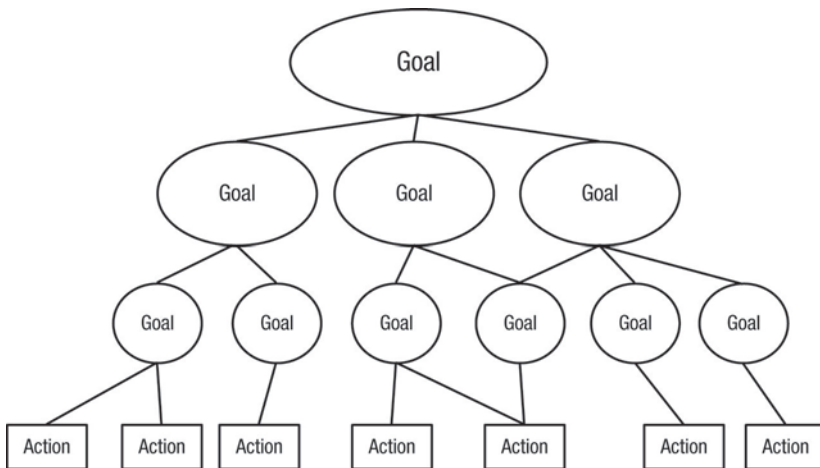


FIGURE 21.1. Hierarchical goal framework. According to this framework, goals are organized hierarchically with fewer high-level goals, and more numerous low-level goals facilitating these higher-order objectives. From Duckworth and Gross (2014). Copyright 2014 by the Association for Psychological Science. Reprinted by permission.

generate larger *equifinality sets*—substitutable sets of lower-level means for each higher-order goal in the pyramid (Kruglanski et al., 2002). Larger equifinality sets enhance goal commitment (Kruglanski et al., 2002) by increasing expectancy (the more ways one has to achieve a goal, the greater the perceived likelihood of goal attainment), increasing value (via the availability heuristic, more paths leading to a given goal enhance perceived value), and dulling the sting of failure (a larger set of means renders the individual less dependent on any given pathway, which makes failure on any one path less discouraging; Kruglanski, Pierro, & Sheveland, 2011).

Grit and self-control describe similar responses to a similar dilemma: When movement toward a higher-level goal is impeded, what does one do? Gritty individuals and self-controlled individuals both successfully self-regulate in favor of the higher-level goal of greater enduring value. Grit and self-control have both been studied in the achievement context. As summarized earlier, both reliably predict success.

Yet these constructs also differ in important ways. Self-control, as understood in a hierarchical goal framework, constitutes acting in ways that concord with *relatively* higher-order goals but not necessarily a single, highest-level goal. The difference is subtle but important. For example, a self-controlled individual may decide to put money into a retirement fund because he or she finds it relatively more valuable to be financially secure later in life than to enjoy dinner out tonight. This is adaptive and admirable, but it is not an example of grit unless the goal of financial security is, or leads to, a challenging, superordinate goal of unparalleled significance. In a hierarchical framework, self-controlled individuals will have truncated goal structures: small triangles, half triangles, maybe sometimes trapezoids, but no peaked pyramids of the sort exemplified by Seaver's dedication to pitching. Thus, in contrast to the gritty individual, for whom nearly all daily actions and lower-order objectives converge toward an ultimate concern, the lower-level actions and goals of self-controlled individuals are not unified toward a single peak. Individuals without superordinate objectives can also be expected to approach their goals with less passion because no highly valued, overarching objective transfers motivation to them.

At lower levels of the goal hierarchy, grit and self-control are also distinguished by the modal "enemies" they address. Whereas for the self-controlled individual, the modal enemy is temptation—a lower-level competing goal in the face of a more valued alternative—the modal enemies for the gritty individual are obstacles and rival pursuits. Whereas a failure of self-control entails choosing to satisfy a relatively lower-level temptation over a relatively higher-order goal, a failure of grit more commonly entails giving up on a superordinate goal in the face of obstacles or pursuing a series of superordinate goals in quick succession. As documented in the empirical findings reviewed earlier, self-control is more robustly associated with everyday success, whereas grit is more strongly correlated with exceptional achievements that can take years—or even decades—to accomplish.

BUILDING GRIT

It is the presence of a dominant superordinate goal that distinguishes grit from other self-regulatory constructs. In this section, we highlight two qualitatively different intervention approaches that aim to build grit by highlighting this superordinate goal—one is

based in the logic of consequence and the other, in the logic of appropriateness. According to March (1994), these logics represent two distinct approaches to understanding and motivating human behavior. Action based on the logic of consequence is determined by expectancies, anticipated costs, and anticipated benefits. When applying the logic of consequence, the individual asks him- or herself the following operational questions: What is the likelihood that I will achieve the desired outcome? What benefits will I accrue? What costs—including opportunity costs—will I incur?

In contrast, actions determined by the logic of appropriateness are informed by considerations of identity. Identity comprises the individual's core life roles and values (Neisser, 2006). When an individual's action is based on the logic of appropriateness, he or she asks what set of behaviors would be appropriate, given his or her identity, in the present situation: Who am I? What is this situation? What does someone like me do in this situation? Key to understanding the distinction between these two logics is recognizing that action based in the logic of identity is not informed by anticipated benefits or costs. Identity-congruent thoughts and behaviors are heuristically enacted, irrespective of associated costs or benefits. Whereas interventions informed by the logic of consequence motivate action toward a superordinate goal by highlighting benefits and downplaying costs, interventions informed by the logic of appropriateness motivate action by cueing an identity associated with the superordinate goal that, in turn, motivates goal-relevant behavior.

The Logic of Consequence

Expectancy–value theory (EVT), a dominant psychological theory of achievement, encapsulates the logic of consequence. EVT posits that people are motivated by expectancies and values. *Expectancy* is the extent to which people believe they can achieve their desired goals. *Value*, which indexes the subjective value the individual attaches to his goal, varies positively with perceived benefits (e.g., attainment value, intrinsic value, utility value) and inversely with perceived costs (e.g., the opportunity cost, emotional cost, and/or required effort). Higher levels of expectancy and value promote goal commitment, and, in turn, effort expenditure and achievement (Eccles, 1983, 1987; Eccles, Midgley, & Adler, 1984).

Expectancy–value interventions typically aim to increase either expectancies or values (Hulleman, Barron, Kosovich, & Lazowski, in press). For example, growth mindset and attributional retraining interventions, which focus on altering expectancies, encourage students to replace uncontrollable attributions for success (e.g., “I’m not smart enough to get A’s”) with controllable ones (e.g., “If I try harder, I will get good grades”). These interventions can have positive, lasting effects on achievement in grade school (for a review, see Yeager & Dweck, 2012) and college (for reviews, see Haynes, Perry, Stupnisky, & Daniels, 2009; Perry, Hechter, Menec, & Weinberg, 1993; Wilson, Damiani, & Shelton, 2002). Interventions that increase the value of academic achievement demonstrate similar benefits (Hulleman et al., in press; Yeager et al., 2014). One of the most commonly used value-focused interventions, also designed for the school context, asks students to articulate connections between their desired futures (which they intrinsically value) and the material they are learning in class, thus increasing their valuation of school (Harackiewicz, Rozek, Hulleman, & Hyde, 2012; Hulleman & Harackiewicz, 2009).

In our own work (Eskreis-Winkler, Shulman, Young, Tsukayama, & Dickworth, 2015), we have developed brief interventions that teach students the tenets of deliberate

practice (e.g., to focus on their weaknesses, set specific goals) and target associated expectancies and values in an attempt to motivate it. For example, in addressing expectancy, students learn: “Many people think talent is all that matters. . . . Actually scientific evidence suggests that deliberate practice is incredibly important to improvement and success.” The intervention goes on to explain that it is common to misattribute achievement to talent because the hours of hard practice individuals invest are often “hidden” (e.g., carried out in private). Students are also encouraged to reappraise phenomenological costs related to practice as typical, and even essential, to learning: “If you are frustrated or confused while practicing . . . it can mean you are working on your weaknesses. . . . When you practice and everything goes perfectly, it may feel good, but it’s probably a sign that you’re not challenging yourself.”

We tested this intervention in four random-assignment, longitudinal field studies (combined $N = 988$). In our first study, we randomly assigned middle school students to receive this intervention or a control activity. One week later, students were given a series of challenging math problems. Among lower-achievers, students randomized to the treatment condition demonstrated higher mastery than those assigned to the control condition. In a second study, we delivered the intervention to undergraduates several weeks before final exams. The intervention improved end-of-semester grades, especially for lower-performing students. In two final studies, we delivered the intervention to middle school students and assessed its effect on subjective appraisals of expectancies, benefits, and costs, in addition to its effects on objectively measured behavior and achievement. Compared to students in the control condition, students in the treatment condition were more likely to endorse the expectancy that deliberate practice promotes success, and to reappraise one salient cost associated with deliberate practice—frustration during learning—as a positive sign of growth. The intervention improved deliberate practice behavior for up to 1 month and raised end-of-quarter grades, particularly for lower achievers; however, effects were no longer detectable at 4 months, suggesting that the benefits of the intervention were transient rather than permanent.

The Logic of Appropriateness

The logic of consequence remains the dominant approach to achievement motivation (Hulleman et al., in press; March, 1994). But social scientists are slowly coming to realize its limitations. For example, the discipline of economics has recently recognized that beyond traditionally recognized monetary incentives, individuals pursue actions that feel identity-congruent (Akerlof & Kranton, 2010). In contrast to actions motivated by incentives, identity-congruent actions are undertaken irrespective of anticipated costs and benefits. In this section, we review identity-based interventions informed by the logic of appropriateness and speculate how this approach might be used to build grit.

Because people prefer to think and act in identity-congruent ways, cueing an identity can set in motion a cascade of associated cognitive and behavioral tendencies (Oyserman, 2007). These cognitions and behaviors are not enacted in a deliberative way; rather, when an identity is cued, they ensue, script-like. For example, priming Asians to think about the fact that they are Asian improves their math performance, presumably because they have associated their ethnic identity with the stereotype of working hard and excelling in math (Shih, Pittinsky, & Ambady, 1999). Role playing leads to similar effects. For example, participants prompted to step into the identity of a nurse by donning a nurse’s

uniform administer fewer shocks to innocent victims than participants who do not wear a uniform (Johnson & Downing, 1979). College students told to pretend to be lawyers interviewing at a prestigious firm perform better on follow-up reading comprehension tasks than controls who are not given this cover story (Strain & D'Mello, 2011). Although we are unaware of published studies in which individuals have been asked to step into an identity associated with grit, role playing has been shown to encourage self-control. In one experiment, children given a red cape and told to “pretend to be Superman” performed better on the delay of gratification task than their peers (Karniol et al., 2011).

In our own work, we are developing novel role-playing interventions that motivate effort, at least in the short term (Eskreis-Winkler, Shulman, et al., 2015). Across three separate samples, middle school students prompted to step into the identity of a hard-working person (treatment) as opposed to someone whose name begins with the letter A (control) expended more effort on a challenging series of math problems—both immediately following the intervention and at 2-week follow-up. In a sample of adults on Mechanical Turk (Mturk), this same manipulation improved performance on 10 logic problems taken from an official Law School Admission Test (LSAT) exam. Finally, in a related manipulation (adapted from Adam & Galinsky, 2012), middle school students were given white coats to wear and were told that these were either the coats of industrious doctors (treatment) or the smocks of creative painters (control). “Industrious doctors” demonstrated heightened focus on a challenging series of math problems compared to “creative painters.”

DIRECTIONS FOR FUTURE RESEARCH

Grit is the tendency to pursue a singular, challenging goal over extremely long stretches of time, doing so despite inevitable obstacles, setbacks, and long plateaus during which progress may not be obvious. The timescale over which grit is expressed and the nature of the goal pursued distinguish grit from other forms of self-regulation. Accordingly, grit is especially predictive of achievement in contexts where progress is difficult and dropout is common. The motivational, cognitive, and behavioral correlates of grit include a stronger desire for engagement and meaning than for pleasure, an inclination to see what can be improved with effort rather than what cannot be changed, a focus on the task at hand rather than potentially more attractive alternatives, and a propensity to log hours and hours of highly effortful deliberate practice. Similarities and differences between grit and related but distinct constructs, such as self-control, are illuminated by a hierarchical goal framework: Grit entails adhering to a singular superordinate goal and its corresponding lower-level goals and actions, whereas self-control refers to adhering to any goal over any relatively less valued alternative. We speculate that interventions aimed at building grit may succeed if they target the expected value of goal-congruent actions (i.e., highlighting the benefits or minimizing the costs of effort) or, alternatively, activate goal-congruent identities (i.e., prompting individuals to appraise persistence as “the sort of thing that someone like me does in a situation like this”).

We see several especially profitable directions for future research on grit. For example, little is known about how individuals develop superordinate goals of the sort that guide mathematicians like Yitang Zhang or athletes like Tom Seaver. It has been suggested that individuals are more likely to develop superordinate goals if they are more

mindful (Sheldon, 2004) or proactive (Bateman & Crant, 1993), and when they are in environments that support autonomy (Damon, 2009; Sheldon & Watson, 2011). For some individuals, surviving a traumatic life experience may play a pivotal role. Specifically, individuals who overcome extreme hardship can develop a survivor mission—a long-term, higher-order goal to redress the hardship that was personally experienced (e.g., an individual who has been victimized by violence and becomes a homicide detective) (Eskreis-Winkler et al., 2014; Herman, 1997). Prospective longitudinal research is needed to understand fully how individuals develop superordinate goals that inspire allegiance across a lifetime.

Future research might also examine the darker side of grit. Too much grit might be a bad thing. Although we have found that grit is linearly related to objective measures of achievement and subjective measures of well-being, it is possible that larger samples would reveal a nonmonotonic relationship. Indeed, many positive traits sour beyond an inflection point (Grant & Schwartz, 2011). Still, in our experience, individuals who are *too* dedicated to valued goals or *too* willing to persist in the face of failure are rare. We suspect that the dark side of grit more commonly surfaces when grit exists in the absence of other balancing virtues (Kesebir & Diener, 2014). Grit without judgment or empathy, for example, leads the overworked executive to stay at a job he or she hates, even though the job is destroying his or her life and family. Grit without temperance can lead to burn-out. Relatedly, Vallerand (2008; Vallerand et al., 2003) distinguished between *obsessive passion*—an overpowering urge to engage in an activity of interest—and *harmonious passion*—engaging in activities of interest due to the intrinsic pleasure one derives—and found that obsessively passionate people experience more domain-related injuries (Akehurst & Oliver, 2014). Finally, grit can be applied to maladaptive, destructive goals. In one sample of undergraduates, gritty individuals with a tendency toward nonsuicidal self-injury were more likely than their peers to actually attempt suicide (Anestis & Selby, 2015).

In contrast to the substantive work on mechanisms that link grit to achievement, relatively little is known about what moderates the effect of grit on outcomes. For instance, the association between grit and achievement may vary with talent. Maybe grit matters most for the most talented, who have the most to gain by sticking with things over time. Or maybe it holds the greatest benefits for the least talented, who can compensate for lack of alacrity with steadfast effort. Grit may also differentially relate to success over time. Not only may grit be more important (and more easily cultivated) during certain developmental periods, it may also differentially relate to success at different stages of goal pursuit. One could imagine grit mattering most at the beginning of an endeavor, before reinforcing habits and commitments have formed. Alternatively, grit may matter most as the honeymoon phase ends, or when a goal is nearly complete and the individual needs to muster a final effort to cross the finish line.

The predictive power of grit may also vary depending on the nature of the pursuit itself. Pursuits that lead to observable—even tangible—progress (e.g., carpentry) may require less grit than pursuits in which progress is not observable (e.g., teaching). As one teacher put it, “A carpenter at the end of the day can actually see what he has built, a doctor can observe a patient responding to treatment, but a teacher oftentimes has to go along for months with relatively few noticeable results” (Thompson, 1991, p. 104). Yitang Zhang was an extreme outlier on this spectrum—laboring in obscurity on an abstract mathematical problem for years, without any obvious interim sign of praise or progress.

CONCLUDING COMMENTS

Research on self-regulation has illuminated the importance of aligning actions with intentions in order to achieve one's objectives. Research on grit adds an appreciation for the extreme stamina with which singular objectives are pursued over time. It likewise adds an appreciation for the steadfast effort that enables extraordinary accomplishment. To quote Fields Medal recipient Terrence Tao (2007):

The popular image of the lone (and possibly slightly mad) genius—who ignores the literature and other conventional wisdom and manages by some inexplicable inspiration . . . to come up with a breathtakingly original solution to a problem . . . is a charming and romantic image, but also a wildly inaccurate one. . . . Actually, I find the reality . . . in which progress is obtained naturally and cumulatively as a consequence of hard work . . . to be far more satisfying than the romantic image that I had as a student. (<https://owl.english.purdue.edu/owl/resource/560/03>)

In addition to being more satisfying, we find the second image more awe-inspiring. We live in a talent-crazed culture—a culture that often assumes effortless genius when it finds remarkable accomplishment. But which is more admirable? The ability to solve mathematical problems through “inexplicable inspiration” or the ability to doggedly pursue a singular goal over years, overcoming obstacles, setbacks, failures, and all else that stands in the way? As more is learned about the Herculean efforts that precede accomplishment, we expect a demystification of high achievement that, rather than diminishing our opinion of human accomplishment, will magnify our respect thereof.

ACKNOWLEDGMENTS

This research was made possible by the National Institute on Aging (Grant Nos. K01-AG033182-02 and R24-AG048081-01), the Character Lab, the Gates Foundation, the Robert Wood Johnson Foundation, the Spencer Foundation, and the Templeton Foundation. The content is solely the responsibility of the authors and does not necessarily represent the official views of the funding agencies. We are grateful to Evan Nesterak for his help preparing the manuscript. The first author extends special thanks to Ari Lustig.

NOTE

1. Unless otherwise noted, the studies reported in this section used the Grit Scale or the Grit-S. For all dichotomous outcomes (e.g., retention) we report ORs. Because measures of grit were standardized prior to analyses, ORs represent the change in odds associated with a one standard deviation increase in grit.

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CHAPTER 22

Varieties of Self-Control and Their Personality Correlates

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Although the ability to exercise self-control does not guarantee good health, fulfilling relationships, and professional success, achieving these desiderata is virtually impossible without it. For some people, self-control seems to come naturally; they readily recognize threats to desired behavior and outcomes, and strategically avoid or manage them. For others, self-control is often difficult to muster and, as a result, behavior and outcomes are unduly and frequently adversely influenced by counterproductive urges and insufficient motivation or attention. This variability across people in the ability to exert self-control when needed and its covariation with personality is the focus of this chapter.

There is no widely accepted, well-articulated model of trait self-control; however, insight into the principal features of the construct can be gleaned from the different instruments routinely used to measure it. As such, we preface our review of research on self-control and personality with a brief review of prominent measures of self-control, including our own recently developed measure. This measure is unique in its basis in a multidimensional model of self-control, which it captures explicitly. We then review research on the association between self-control and personality, beginning with broad domains of personality, then turning to narrower personality traits. We cover research on traits that are conceptually similar to (and sometimes confused with) self-control, capturing individual differences in specific features or consequences of it, as well as traits that, like self-control, reflect components of and approaches to self-regulation.

MEASURES AND DEFINITIONS OF TRAIT SELF-CONTROL

Measures of self-control are of two general types. One, to which we devote relatively little attention in this chapter, includes performance and other behavioral indicators of self-control. Examples are the stop-signal task (e.g., Tabibnia et al., 2011), the go/no-go

task (e.g., Somerville, Hare, & Casey, 2011), delay discounting tasks (e.g., Waegeman, Declerck, Boone, Van Hecke, & Parizel, 2014), and the marshmallow test (Mischel, Shoda, & Peake, 1988). The other, on which we draw for the sketch of the construct and its measurement in this section of the chapter, includes self-report and informant measures. A meta-analysis focused on the convergent validity of measures of self-control from both categories identified more than 100 self-report and informant measures (Duckworth & Kern, 2011). Nearly all of those measures were developed for specific research studies and therefore have not been widely disseminated or used. Many reflect specific variants or correlates of self-control but do not capture the full breadth of the construct.

Two self-report measures of trait self-control have been used in studies of a wide range of self-control processes and behaviors. We briefly describe those measures, focusing primarily on the conceptualization of trait self-control they imply or purport to measure. We then describe a new conceptual model of the construct and a measure that captures individual differences in the different capacities for self-control it specifies. These descriptions provide a conceptual context for interpreting associations with personality, especially when they vary in magnitude as a function of how self-control is measured.

Low Self-Control Scale

The oldest widely used measure of self-control is the Low Self-Control Scale, developed by Grasmick, Tittle, Bursik, and Arneklev (1993) for the purpose of evaluating key tenets of the general theory of crime (Gottfredson & Hirschi, 1990). According to the theory, a primary cause of crime is the combination of poor self-control and opportunities to commit crime (for a review, see Rocque, Posick, & Piquero, Chapter 28, this volume). The prominent position of a trait in the theory was motivated by the observations that the propensity to engage in criminal behavior is a stable individual difference and that individuals prone to such behavior often engage in different types of crime. The theory views self-control as “the differential tendency of people to avoid criminal acts whatever the circumstances in which they find themselves” (Gottfredson & Hirschi, 1990, p. 87). The focus of the theory is poor or underdeveloped self-control, evidenced in poorly socialized individuals who are “unusually sensitive to immediate pleasure and insensitive to long-term consequences” (pp. 1–2). Despite the potential application of this definition to a broad range of behavior, the theory focuses exclusively on self-control in the context of criminal behavior, characterizing self-control as the trait that accounts for “variation in the likelihood of engaging in such acts” (Gottfredson & Hirschi, 1990, p. 2; see also Akers, 1991).

Given the exclusive focus of the conceptual model on criminal behavior, it is not surprising that the measure inspired by the theory focuses primarily on proximal causes of those behaviors. Specifically, the Low Self-Control Scale assesses impulsivity, preference for simple versus complex tasks, risk seeking, preference for physical rather than mental activities, self-centeredness, and a volatile temper (Grasmick et al., 1993). Although scores corresponding to these components of the construct can be derived from the measure (Williams, Fletcher, & Ronan, 2007), typically a single score presumed to reflect underdeveloped self-control is derived (Piquero, MacIntosh, & Hickman, 2000). Whether these scores reflect self-control proper or an amalgamation of related constructs is a concern (Piquero & Bouffard, 2007). For example, impulsivity and self-centeredness are sometimes cast as aspects of (low) self-control, but as we argue with specific reference

to impulsivity later in the chapter, they do not reflect all, or even most, of the breadth of the construct. Risk taking, volatile temper, and the preference for simple tasks and physical activities are better viewed as consequences of self-control and other factors rather than components of the construct (cf. Hirschi & Gottfredson, 1993). These concerns about the validity of the measure coupled with the criminality-focused conceptualization should be taken into account when interpreting correlations with personality.

Self-Control Scale

In psychological research on self-control and self-regulation, the most widely used measure of trait self-control is the Self-Control Scale (Tangney, Baumeister, & Boone, 2004). Noting that measures of self-control available at the time their research was conducted did not reflect the latest conceptual models and empirical findings relevant to the construct, Tangney and colleagues (2004) developed a new measure for research on the range of outcomes associated with individual differences in the capacity for self-control. They defined self-control as “the ability to override or change one’s inner responses, as well as to interrupt undesired behavioral tendencies and refrain from acting on them” (p. 275). They described this basic capacity as “powerfully adaptive,” providing an array of benefits that should result in a happier, healthier, and more productive life.

The basis for the measure and the definition it implies were results of a comprehensive review of published research on self-control, with a particular focus on self-control failures (Baumeister, Heatherton, & Tice, 1994). That review organized self-control failures in five categories, suggesting that, for a measure to fully capture the construct, it would need to touch on aspects of self-control relevant for every category of failure. Specifically, the review identified self-control failures that reflect insufficient capacity to control thoughts, emotions, and impulses; to regulate performance; and to overcome maladaptive habits. Analyses of candidate items written to reflect these capacities resulted in the Self-Control Scale, of which a subset of items constitutes the Brief Self-Control Scale (Tangney et al., 2004). The scale is nearly always used to generate a single score, which is assumed to reflect the general capacity to exert self-control when it is required. Although the items were not written with the intent of assessing different forms of self-control, such as those outlined in the next section, conceptual (de Ridder, de Boer, Lugtig, Bakker, & van Hooft, 2011) and empirical (Maloney, Grawitch, & Barber, 2012) sorting of the items hint at two forms of self-control. On balance, these analyses suggest that scores on the brief form of the Self-Control Scale primarily reflect control over impulses, with an underdeveloped secondary capacity to initiate desired behaviors.

Capacity for Self-Control Scale

The Low Self-Control Scale and the (Brief) Self-Control Scale, and the conceptual models they represent, have contributed to significant advances in the understanding of the correlates and consequences of individual differences in the capacity for self-control; however, neither captures the full breadth of the construct without reference to specific behaviors or outcomes. As a more general and complete complement to these measures and the conceptual models they represent, we have developed a new model of individual differences in self-control capacity and a corresponding measure.

Our model posits two binary dimensions along which instances of self-control vary—type and duration. Crossing these dimensions yields four forms of self-control. An assumption of the model, reflected in our multifactor Capacity for Self-Control Scale, is that there is predictive and explanatory benefit to be gained from measuring capacity for each form of self-control. Although we would expect capacity for one form of self-control to covary with capacity for the other forms, we do not assume that they represent a single, undifferentiated capacity. For that reason, we expect capacity for the different forms of self-control to be differentially associated with certain aspects of personality, particularly narrowly defined traits.

The most basic distinction between forms of self-control is type. Formalizing the distinction highlighted in item-level analyses of the Brief Self-Control Scale (de Ridder et al., 2011), we posit two types of self-control: self-control by inhibition and self-control by initiation. These are formally defined with reference to a general definition of *self-control*: a conscious decision by the individual to move, or to continue moving, in a direction that differs from that dictated by opposing forces in the person (e.g., impulses, habits, desires) or situation (e.g., norms, requests/demands by others). Building on this basic definition, *self-control by inhibition* is required when those forces pull for thoughts, feelings, or behaviors that are inconsistent with one or more active goals—consciously overriding a pull toward goal-inconsistent behavior. *Self-control by initiation* is required when those forces pull for inaction when pursuit of an active goal requires action—consciously producing goal-consistent action despite a pull toward inaction.

Whether the type of self-control required for productive goal pursuit is inhibition or initiation, its duration might be short-lived or sustained over a period of time. Typical treatments of the construct focus almost exclusively on single, short-lived acts of self-control; for example, making a healthy meal choice at a restaurant or restraining an emotional display when cut off in traffic. These treatments may not adequately account for instances of self-control that require ongoing inhibition or initiation (Vohs & Schmeichel, 2003). For example, inhibiting the desire to check e-mail while at work on a computer requires self-control by inhibition throughout the course of a workday. Completing an exercise routine begun through an act of self-control by initiation requires staying the course when heart rate quickens and muscles ache. In our model, these are acts of *self-control by continuation*, consciously deciding to persist at inhibition or to continue following initiation despite the pull to stop when a self-control challenge is ongoing.

Our initial attempt at capturing these distinctions followed the example of extant measures by focusing on single, short-lived acts of self-control. Drawing on narrative accounts of self-control successes and failures by adults of all ages, we developed self-report items to capture individual differences in the capacity for self-control by inhibition or initiation. Because our measure is new and to facilitate interpretation of correlations we report later in the chapter, we have included the items in Table 22.1. Consistent with our definition, the self-control by inhibition items focus on inhibiting the desire to act on temptations, cravings, impulses, wants, and bad habits. In contrast, the self-control by initiation items focus on initiating behavior rather than delaying or wasting time when motivation or desire for the behavior is low. In several adult samples, the correlation between the two types of self-control ranges from .50 to .60. This magnitude is strong enough to suggest that we have captured two types of the same capacity but not so strong as to suggest conceptual redundancy.

TABLE 22.1. Items from the Capacity for Self-Control Scale Arrayed by Form of Self-Control

Self-control by inhibition

- 1. I am able to resist temptations.*
- 3. I have trouble resisting my cravings. (R)
- 6. I can deny myself something I want but don't need.
- 9. My bad habits cause problems for me. (R)
- 12. When I want something that is bad for me, I go after it anyway. (R)
- 15. I am able to control how I react to impulses.*
- 18. If I want to do something I know I shouldn't, I won't do it.*

Self-control by initiation

- 2. I waste a lot of time before getting down to work. (R)*
- 4. I delay as long as possible before starting something I expect to be unpleasant. (R)
- 7. I waste time on things that don't really matter, rather than working on things that do. (R)*
- 10. I just can't seem to get going, even when I have much to do. (R)
- 13. Even when the list of things to do is long, it is easy for me to get started.
- 16. I get started on new projects right away.*
- 19. I do nothing despite having plenty to do. (R)

Self-control by continuation

- 5. I am able to keep doing what I think I should do, even when other people would stop.
- 8. When I commit to doing something difficult, I see it through to the end.*
- 11. Not much can stop me from honoring a commitment to better myself.
- 14. I find it hard to continue doing something I don't want to do. (R)*
- 17. After I have started a challenging task, I find it easy to stick with it.*
- 20. I find it easy to keep with good behavior.

Note. Numbers correspond to recommended order of items when the scale is administered. Items followed by (R) are reverse-scored. Responses are indicated on 5-point scales anchored by *hardly ever* and *nearly always*. Subscale scores are computed as a mean of scores on individual items. Asterisks indicate items that form an abbreviated measure.

We next turned to the development of items to capture the capacity for continuing inhibition and initiation when self-control challenges require it. Again, we drew on narrative accounts provided by adults asked to describe situations in which they had succeeded or failed at sustaining self-control by inhibition or initiation. Those accounts made clear that the continuation of self-control that begins with initiation is a common demand and distinct from simply initiating behavior when motivation or desire are lacking. For example, getting to the gym for a cardio workout requires initiation (often preceded by inhibition), but staying with a challenging workout that feels as if it is taking longer than it should requires continuation (Vohs & Schmeichel, 2003). Surprisingly the distinction between individual acts of self-control by inhibition and the continuation of self-control when the relevant temptation or urge is not transitory was not as clear. In circumstances involving prolonged exposure to a temptation or experience of an urge, individuals reported engaging in repeated discrete acts of inhibition rather than sustaining inhibition over time. For instance, the temptation to visit social media sites while working on a computer is not sustained over time in the same way as the urge to stop a challenging activity as motivation wanes or difficulty increases. Rather, the temptation

waxes and wanes in concert with attention to work. We nonetheless wrote items corresponding to the continuation of each type of self-control. Factor analyses confirmed the pattern evident in the narrative accounts, with items reflecting the capacity for individual acts of inhibition and those reflecting ongoing inhibition clustering on a single factor.

As a result, and as evident in Table 22.1, the final version of our Capacity for Self-Control Scale comprises subscales corresponding to the capacity for individual acts of self-control by inhibition and initiation, and the capacity for sustaining self-control that begins with initiation. As would be expected, the correlation between initiation and continuation is strong—around .70 in young adult samples. Despite the substantial empirical overlap, as we report later in the chapter, there is separation between the two in terms of association with personality traits. Somewhat unexpected is the correlation of about .60 between inhibition and continuation following initiation, which are conceptually distinct. Findings not covered in our review suggest that this relation can be attributed in part to the necessity of inhibiting the urge to quit in order to sustain self-control involving initiation. In fact, our findings to date suggest that all acts of initiation involve some degree of inhibition; that is to say, inhibition is necessary but not sufficient to account for acts of self-control by initiation (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012).

Summary: Measures and Definitions

The empirical literature on trait self-control has relied heavily on two self-report measures, each reflecting a discipline-specific view of the construct. The Low Self-Control Scale derives from the general theory of crime, in which self-control is posited to result from socialization within the family and to manifest as the propensity toward criminal behavior when afforded an opportunity. More abstractly, the theory proposes that opportunistic crime is an instance of behavior driven by immediate benefits, without consideration for potential long-term consequences of the behavior (see Hirschi, 2004). The measure used to operationally define key features of this conceptualization focuses on the implications and consequences of self-control defined in this way and, as such, conflates the propensity toward criminal behavior with poor self-control. The widely used Self-Control Scale derives from an extensive review of failures of self-control (of which opportunistic crime is but one), resulting in a more general measure and characterization of the construct. Despite its basis in a relatively nonselective review of self-control challenges, the measure does not capture the full range of self-control behaviors. With but a few exceptions, the items tap self-control by inhibition. To these measures, we have added the Capacity for Self-Control Scale, which reflects a two-dimensional model of the construct. One binary dimension distinguishes type of self-control—inhibition or initiation. The other distinguishes duration of self-control—short-lived or sustained over time. The accompanying measure produces three scores, two corresponding to short-lived inhibition and initiation, and a third to continuation following initiation. Acts of inhibition, even when they are in response to an ongoing temptation or persistent urge, are always short-lived. As a result, there is no need for a separate score for sustained inhibition.

Having sketched prominent perspectives on trait self-control and approaches to its measurement, we now turn to a review of research on self-control and personality. We

begin with a focus on higher-order dimensions of personality, then move to specific personality traits that contribute to or share features with trait self-control.

SELF-CONTROL AND BROAD DOMAINS OF PERSONALITY

Personality can be profitably studied at different levels of generality and abstractness. Our focus in this section of the chapter is on the relations between self-control and a small number of personality domains that, collectively, are posited to account for nearly all of the covariation between personality traits. The most prominent of these higher-order models posit five general sources of commonality that, together, constitute the Big Five (John, 1990) and the parallel five-factor model (Costa & McCrae, 1992; cf. John & Robins, 1993). Although the bases of these models differ, resulting in minor differences in the content of the domains, those differences are generally inconsequential for understanding the associations between self-control and broad domains of personality. We generically refer to the set of five domains as the Big Five in the remainder of this section.

Conceptual integration of the Big Five and general models of self-regulation suggest that themes relevant to self-control should be evident in each of the domains. Cybernetic Big Five theory offers the most detailed integration, casting personality as a cybernetic system that guides the pursuit of goals using specific cognitive and behavioral strategies in response to interpretations of current states given memories of past states and expectations regarding future states (DeYoung, 2015). Although self-control might be evident at any phase of the cybernetic cycle, it is most clearly evident in cognitive and behavioral activity aimed at reducing perceived discrepancies between the current states and desired states as reflected in goals (Van Egeren, 2009). For example, individuals high in Extraversion would be expected to characteristically employ approach strategies (e.g., self-control by initiation) and find motivation in positive affect stemming from goal pursuit. Individuals high in Conscientiousness should excel at inhibiting distractions during goal pursuit (e.g., self-control by inhibition). These and other points of integration between broad domains of personality and cybernetic models of self-regulation suggest that variability in the capacity for self-control should be reflected in scores on measures of the Big Five domains.

Another, related, conceptual analysis of the Big Five provides additional reasons to expect associations between broad domains of personality and self-control. Returning to the origins of the Big Five in factor analysis, this analysis finds evidence for two independent meta-traits that account for the covariation between the Big Five domains (DeYoung, 2006, 2010). Specifically, the covariation between (low) Neuroticism, Agreeableness, and Conscientiousness is attributed to a factor labeled *stability*, and the covariation between Extraversion and Openness is attributed to a factor labeled *plasticity*. Consistent with cybernetic Big Five theory, these meta-traits are cast in self-regulatory terms. Stability reflects a tendency toward resisting temptations that would disrupt progress toward currently active goals. Plasticity reflects a tendency toward the pursuit of new goals and a willingness to entertain new perspectives on currently active goals and strategies for pursuing. Given the conceptual similarity of stability with self-control by inhibition and plasticity with self-control by initiation, we would expect stronger correlations of inhibition with Neuroticism, Agreeableness, and Conscientiousness and stronger correlations of initiation with Extraversion and Openness.

Domains That Reflect Stability

Neuroticism reflects individual differences in the tendency to experience emotional instability, anxiety, moodiness, irritability, and sadness. Although some evidence suggests an association between Neuroticism and a tendency to procrastinate, which would correspond to low self-control by initiation (Steel, 2007), in general and consistent with the meta-trait of stability, we would expect moderate negative correlations with self-control by inhibition. Here we rely exclusively on our own data given the lack of published research that includes measures of self-control and measures of Neuroticism. At the domain level, we find robust negative correlations between Neuroticism and both types of self-control, with a particularly strong association with self-control by inhibition (r s about $-.60$). The five-factor model specifies facets, lower-order manifestations of the Big Five. We find that for each facet the correlation is stronger for self-control by inhibition. This is particularly true for the angry hostility and impulsiveness facets, for which the correlations for inhibition fall between $-.50$ and $-.60$ and the correlations for initiation fall between $-.20$ and $-.30$. Returning to the domain level, the associations between Neuroticism and self-control as assessed by the Low Self-Control Scale and the Self-Control Scale fall between those for inhibition and initiation (de Vries & van Gelder, 2013; Tangney et al., 2004). The propensity to experience unstable and often negative emotions appears to be especially problematic for the capacity for self-control by inhibition.

Agreeableness concerns individual differences in preferences and tendencies related to social life. Higher scores correspond to a preference for compassionate versus tough-minded interpersonal relations. Although there is no reason to predict strong associations with self-control, the maintenance of positive interactions often requires inhibition and, when difficult interactions are anticipated, initiation. In the lone published study that includes the Low Self-Control Scale and a measure of the Big Five, self-control is moderately correlated with Agreeableness and more strongly so than self-control as assessed by the Self-Control Scale (de Vries & van Gelder, 2013). In fact, when the latter correlation is estimated controlling for social desirability, it approaches zero (Tangney et al., 2004). In our analyses of both domain- and facet-level data, we find at the domain level a small correlation with self-control by inhibition but no correlation with self-control by initiation. Moving to the facet level, we find modest correlations between inhibition and the straightforwardness and compliance facets, and a modest correlation between initiation and modesty. Consistent with the cybernetic models of personality and the meta-trait conceptualization, Agreeableness is correlated with self-control in a manner that reflects self-regulation in the service of stability.

Conscientiousness, with its focus on the tendency toward responsibility, orderliness, and dependability, is the personality domain with the most explicit connections to self-control. In our own work mapping the connections between Conscientiousness and self-control, we have been particularly interested in differences between self-control by inhibition and self-control by initiation in their associations with Conscientiousness. The meta-traits conceptualization of personality suggests that we should find the strongest associations with self-control by inhibition. Strong correlations between scores on the Self-Control Scale, which disproportionately taps inhibition, and Conscientiousness are consistent with this expectation (r of about $.50$ reported by Tangney et al., 2004; see also de Vries & van Gelder, 2013). Correlations between Conscientiousness and

Low Self-Control Scale scores are surprisingly weak, perhaps owing to the focus of that measure on multiply determined consequences of low self-control (O’Gorman & Baxter, 2002). Our work with the Capacity for Self-Control Scale and facet-level measurement of personality offers a more nuanced picture of the association between self-control and Conscientiousness. The correlations of the two types of self-control with the order facet (personal organization) are modest and equivalent. The correlations with the self-discipline facet are high. Given the emphasis on starting tasks despite boredom and distractions, it is not surprising that the correlation between this facet and our self-control by initiation subscale is high (r s of about .75) and significantly higher than the correlation with self-control by inhibition (r s closer to .60). Otherwise, the correlations are moderate in magnitude and vary for the two types of self-control capacity. Inhibition is more strongly correlated with the competence and deliberation facets, whereas, in addition to self-discipline, initiation is more strongly correlated with achievement striving. This pattern partially corresponds to the stability–plasticity distinction offered by the meta-traits conceptualization, which positions Conscientiousness as an indicator of stability, although some facets of Conscientiousness appear to be more reflective of plasticity than stability.

The moderate-to-strong correlations between measures of self-control and measures of Conscientiousness and its facets raise the question of how the two constructs differ. In the absence of longitudinal data on each construct beginning during childhood, we cannot draw a distinction based on rigorous empirical evaluation. Instead we rely on theory and knowledge of the content of measures typically used to operationally define each construct. In terms of theory, we find the arguments in five-factor theory to be persuasive. Conscientiousness is the more fundamental of the two characteristics, underpinning self-control capacity and other self-regulatory processes and skills. Importantly, Conscientiousness does not alone account for individual differences in self-control capacity. Rather, it is the interaction of Conscientiousness with culture and life experiences that shapes those individual differences (McCrae & Costa, 1996). In terms of measurement, we suspect that the high correlations between certain facets of Conscientiousness and self-control can be attributed to significant overlap in item content. For instance, an item from the NEO Personality Inventory—Revised (NEO-PI-R) measure of the self-discipline facet of Conscientiousness that reads “I have trouble making myself do what I should” is conceptually similar to the Capacity for Self-Control Scale item that reads “I just can’t seem to get going, even when I have much to do.” Although self-control is associated with other personality domains, there is substantial and understandable overlap with Conscientiousness and its facets.

Domains that Reflect Plasticity

Extraversion, with its emphasis on sociability and approach orientation, should be associated with self-control by initiation; selected facets might also be associated with self-control by inhibition. Estimates of association involving the Low Self-Control Scale and the Self-Control Scale are positive but weak, peaking at $r = .16$ for the Self-Control Scale (de Vries & van Gelder, 2013). The domain-level correlations for our measure are consistent with those involving the other self-control measures but, as might be expected given the prominent role of approach, are stronger for self-control by initiation. Moving to the facet level, we find moderate correlations of self-control by initiation and the

assertiveness and activity facets. The only nonzero correlation involving self-control by inhibition is for activity; that correlation is significantly weaker than the corresponding correlation for initiation. In summary, certain features of Extraversion are associated with self-control; the magnitude of those associations is modest and, consistent with the meta-traits conceptualization, primarily involve self-control by initiation.

Estimates of the association between self-control and the Openness domain are sparse. The meta-traits conceptualization suggests that, primarily, any relation between the two should be attributable to self-control by initiation. In a study that gathered data on both the Low Self-Control Scale and the Self-Control Scale along with the Big Five, scores on neither measure correlated with Openness. In our scale development work, we assessed self-control by inhibition, self-control by initiation, and Openness at the domain and facet levels. None of the domain-level correlations was significant. Among the 12 facet-level correlations, two attained significance at a magnitude of about .30. Self-control by initiation was correlated with actions, Openness to new experiences on a practical level, and fantasy, receptivity to the inner world of imagination. As suggested by the meta-traits conceptualization of personality, only self-control by initiation is associated with Openness to experience, and the association is modest and specific to two of six facets.

Summary: Self-Control and Domain-Level Personality

Our review highlighted findings from a small corpus of research in which broad domains of personality were assessed along with one or more measures of self-control. To these findings, we added results from our own work focused at both the domain and facet levels of personality, and distinguishing between self-control by inhibition and self-control by initiation. Collectively, these findings are consistent with the stability–plasticity distinction in the meta-traits conceptualization of personality (DeYoung, 2006, 2010). Neuroticism, Agreeableness, and Conscientiousness, which primarily reflect the tendency toward resisting temptations that would disrupt progress toward currently active goals, were primarily correlated with self-control by inhibition. Extraversion and Openness, which primarily reflect a tendency toward the pursuit of new goals, and a willingness to entertain new perspectives on currently active goals and strategies for pursuing them, were primarily correlated with Extraversion and Openness (though only weakly and for selected facets of Openness). This pattern of associations validates the meta-traits conceptualization as well as our inhibition–initiation distinction, about which we offer further insight in the next section.

SELF-CONTROL AND NARROW PERSONALITY TRAITS

Findings from research on the relations between domain-level personality and self-control are informative because they reveal connections between self-control and personality across the full range of personality content. Yet, as our review of that research revealed, moving the focus to the facet level sometimes provided a clearer, more detailed account of those connections. In this section, we further narrow the focus, considering traits that, like self-control, are more proximal to behavior than domains, or even facets, of personality. Unlike facets, which can be grouped neatly under domains, most of these

traits crosscut personality domains and facets as a result of their origins in models of specific personality processes as opposed to comprehensive models of personality structure. Although a consideration of the association between self-control and almost any trait might prove informative, we limit our review to traits that help or hinder self-control or influence how self-control is enacted.

Impulsivity

As with self-control, impulsivity as a trait has been characterized in the research literature by many different—often inconsistent—definitions (DeYoung, 2011). Despite these inconsistencies, most operationalizations of impulsivity reflect the tendency to act without thought or planning (Eysenck & Eysenck, 1977; Patton, Stanford, & Barratt, 1995; Whiteside & Lynam, 2001). This feature of impulsivity is prominent in the most widely used measures of the trait (e.g., Eysenck, Pearson, Easting, & Allsopp's [1985] 16 Impulsiveness Scale Narrow Impulsiveness subscale; Urgency, Premeditation, Perseverance, Sensation Seeking [UPPS] Lack of Premeditation; Barratt Impulsiveness Scale, Version 11 [BIS-11] Nonplanning Impulsiveness). Yet, research on strategies routinely used by individuals high in self-control suggests that the conceptualization of impulsivity as acting without thought is problematic for understanding the impulsivity–self-control link. A meta-analysis of research on self-control and behavior revealed that the strongest relations involved automatic behaviors (i.e., addictive and habitual behaviors; de Ridder et al., 2012). A set of studies focused specifically on self-control and habitual behavior showed that the relation between self-control and multiple beneficial behaviors (e.g., academic engagement, effective meditation) was mediated by automatic behavior reflecting relevant habits (Galla & Duckworth, 2015). Nonetheless, we find acting without thought or planning as assessed by common measures of impulsivity to be moderately negatively correlated with self-control by inhibition scores and scores on the Self-Control Scale (cf. Friese & Hofmann, 2009). This core feature of impulsivity is only modestly associated with the capacity for self-control by initiation and the continuation of self-control over time.

Also common to these conceptualizations is the multidimensional nature of impulsivity, with some facets tapping deficits in inhibitory or impulse control (as described earlier) and others reflecting features of suboptimal Conscientiousness (e.g., the UPPS model's lack of perseverance facet; Whiteside & Lynam, 2001). Facets of impulsivity reflecting a lack of Conscientiousness, not surprisingly, are robustly associated with self-control by initiation and self-control by continuation. Common to the capacities to initiate and sustain behaviors when motivation or desire is low and to low Conscientiousness aspects of impulsivity is an ability to restrain impulses that may interfere with the pursuit of active goals from start to finish. Thus, it is not surprising that we also observe an association between those aspects of impulsivity and the capacity for self-control by inhibition.

Approach–Avoidance

We noted in our review of the association between Extraversion and self-control that one explanation for that association—and a reason to expect a stronger association for self-control by initiation than self-control by inhibition—is that Extraversion reflects, in part, an approach tendency (Quilty, DeYoung, Oakman, & Bagby, 2014). With our focus

now on narrower, more specific personality traits, we can examine more closely the relation between traits that reflect a general tendency toward approach, as well as those that reflect a general tendency toward avoidance. The most basic of these are behavioral inhibition and behavioral approach as outlined in Gray's (1987) neuropsychological model of personality and emotion. Although all normally functioning individuals are motivated by both the behavioral inhibition (BIS) and behavioral approach (BAS) systems, they vary in the sensitivity of those systems (Carver & White, 1994). The more sensitive the BIS, the more prone the individual is to anxiety and avoidance. The more sensitive the BAS, the more prone the individual is to impulsivity and novelty seeking, and the more responsive he or she is to reward. One of our datasets includes a measure of individual differences in these sensitivities, the BIS/BAS Scales, as well as the Self-Control Scale and our Capacity for Self-Control Scale. Scores on the measure of behavioral inhibition are modestly correlated with scores on both measures, equivalently for self-control by inhibition and initiation. Surprisingly, we observe only weak correlations of selected self-control measures with behavioral activation; specifically, self-control by initiation is correlated with reward responsiveness and self-control by inhibition and self-control, as measured by the Self-Control Scale, are correlated with fun seeking. The capacity for self-control is only weakly associated with individual differences in the sensitivity of the behavioral inhibition and activation systems.

Two additional traits assumed to involve approach and avoidance are sensation seeking and harm avoidance. *Sensation seeking* reflects individual differences in preferences for and a willingness to seek out (i.e., approach) novel and intense stimuli despite risks that might be associated with doing so (Zuckerman, 1994). We would expect a negative correlation with self-control by initiation and, at most, a weak negative correlation with self-control by inhibition. Our data generally confirm these expectations, showing a small but significant negative correlation between sensation seeking and initiation and no correlation between sensation seeking and inhibition. *Harm avoidance*, as typically measured, reflects concern that bad things will happen, tension in unfamiliar situations, and difficulty adapting to change (Cloninger, 1987). Because we have not included a measure of harm avoidance in our studies of the Capacity for Self-Control Scale, we cannot evaluate our expectation of a moderate negative correlation with self-control by inhibition and little or no correlation with self-control by initiation. Evidence consistent with this expectation is provided in a study showing a moderate correlation of harm avoidance with poor self-control (a composite of impulsiveness, poor anger control, and impatience) but no correlation with good self-control (a composite of dependability, attentional control, and behavioral coping) (Wills, Sandy, & Shinar, 1999). Across several relevant traits, we find a robust correlation between avoidance and self-control by inhibition but a negligible relation between approach and self-control by initiation.

Delay of Gratification

Though conceptually similar to self-control and related traits, delay of gratification diverges from self-control and many of its personality correlates with respect to its measurement. Delay of gratification is commonly assessed using a behavioral paradigm developed by Mischel, Ebbsen, and Zeiss (1972), in which participants, typically children, are presented with two items or sets of objects of varying appeal. In the classic version of this task, the "marshmallow test" (Mischel et al., 1972), children can elect to receive one

marshmallow immediately, or two marshmallows upon waiting; other versions involve two toys (Funder, Block, & Block, 1983) or foods varying in appeal (Duckworth, Tsukayama, & Kirby, 2013). The focus on children, for whom self-report is not a viable approach to measurement, necessitates the use of performance measures. That focus also implies that the ability to delay gratification is one of the earliest forms of self-control capacity to emerge, serving as a foundation for the development of the more elaborate and adaptive capacities required later in life. Early delay ability predicts an array of outcomes indicative of good self-control later in life, including better social competence in adolescence (Mischel et al., 1988), higher SAT scores (Shoda, Mischel, & Peake, 1990), fewer instances of substance use (Romer, Duckworth, Sznitman, & Park, 2010), and lower rates of obesity in both adolescence and adulthood (Schlam, Wilson, Shoda, Mischel, & Ayduk, 2013; Seeyave et al., 2009).

The ability to delay gratification, though required for many forms of self-control (Duckworth et al., 2013), is most clearly relevant for resisting the temptation of an immediate reward when it would work against currently active goals. As such, we would expect a moderate-to-strong correlation between scores reflecting the ability to delay gratification and self-control by inhibition and moderate correlations with self-control by initiation and continuation, each of which might require deferring a current desire in order to begin and/or continue goal pursuit. Indeed, we find strong associations between self-reported delay of gratification (Hoerger, Quirk, & Weed, 2011) and all forms of self-control capacity, but a significantly stronger correlation between the ability to delay gratification and the capacity for self-control by inhibition.

Grit

Despite its relatively recent appearance in the literature (Duckworth, Peterson, Matthews, & Kelly, 2007), grit has joined well-worn traits such as impulsivity and delay of gratification in discussions of individual differences relevant to goal pursuit. *Grit* captures individual differences in the ability to pursue challenging long-term goals and maintain commitment and progress toward them, even in the face of failure or adversity. Grit predicts academic success and achievement outcomes such as performance in the Scripps National Spelling Bee, retention rates of cadets at West Point, and superior college grade point averages (Duckworth et al., 2007). Although grit assumes self-control, it is a broader trait than self-control capacity and captures the need to exercise self-control and other self-regulatory strategies many times over the course of months or years (Duckworth & Gross, 2014; Eskreis-Winkler, Gross, & Duckworth, Chapter 21, this volume). We have included a measure of grit in multiple studies that also included the Self-Control Scale and the Capacity for Self-Control Scale. Correlations are moderate to high, bounded on the lower end at around $r = .60$, with the Self-Control Scale and our Self-Control by Inhibition subscale and on the upper end at about $r = .75$, with Self-Control by Initiation and self-control by continuation. These forms of self-control are strong contributors to grit.

CHARACTERISTIC APPROACHES TO SELF-REGULATION

Self-control is a self-regulatory strategy. As such, we might expect associations between self-control capacity and traits related to self-regulation more generally. An influential general model of self-regulation posits three primary phases of that psychological

process—self-monitoring, self-evaluation, and self-reinforcement (Kanfer, 1970). During the self-monitoring phase, the individual takes stock of a target behavior. The status of that behavior is then compared to an internalized standard for the behavior through self-evaluation. That comparison results in self-reinforcement, which may take the form of reward or punishment. Successful execution of each phase of this iterative process is vital for successful self-regulation. We have collected data on skill at executing each of these phases of self-regulation (Mezo, 2009) and self-control capacity, allowing us to examine how self-control might contribute to self-regulation. For both the Self-Control Scale and our Capacity for Self-Control Scale, we find a similar pattern of correlations in two large samples. Self-control is strongly correlated with self-monitoring and self-evaluation (r s between .50 and .65) but only weakly correlated with self-reinforcement. When we consider separately the three forms of self-control captured by our measure, we find slightly higher correlations for self-control by continuation than for self-control by initiation, for which the correlations are slightly higher than for self-control by inhibition. Self-control, especially the capacity to continue exerting self-control over time, is implicated at every phase of self-regulation, especially the self-monitoring and self-evaluation phases.

Although the basic processes outlined earlier are implicated in all acts of self-regulation, how they are initiated and unfold may vary between people and for the same person as a function of situational constraints and affordances (Hoyle & Gallagher, 2015). Three traits have received sufficient attention to warrant consideration from the perspective of self-control capacity. Regulatory focus theory proposes two general approaches to self-regulation—promotion and prevention. Although every individual is capable of either approach, and circumstances may favor one or the other, individuals vary in their typical or preferred approach to self-regulation. Those who favor *promotion* are more oriented toward obtaining positive outcomes, whereas those who favor *prevention* are more oriented toward avoiding negative outcomes (Higgins, 1997). Either approach can result in successful regulation of goal pursuit (Scholer & Higgins, 2010) and both require self-control. Our data suggest that the capacity for self-control by inhibition and initiation are moderately and equivalently associated with promotion orientation. Self-control by inhibition is also moderately correlated with prevention orientation, but self-control by initiation is only weakly associated with this orientation. Regulatory mode distinguishes between two fundamental aspects of self-regulation: assessment and locomotion (Kruglanski et al., 2000). *Assessment* concerns processes associated with comparison in self-regulation; *locomotion* refers to processes in self-regulation that involve moving from the current state toward another state. We have assessed locomotion in one study, predicting and finding that it correlates with both inhibition and initiation, but more strongly with initiation. One final distinction in how self-regulation is characteristically approached and for which self-control likely is relevant is that between action and state orientation (Kuhl, 1994). *Action orientation* is characterized by initiative and decisiveness, whereas *state orientation* is characterized by preservation of the current state. Although we have yet to examine the relations between these action control constructs and self-control, we would expect a moderate-to-strong correlation between action orientation and self-control by initiation, and the capacity to sustain that self-control as required. Consistent with this expectation, individuals high on action orientation show no evidence of a decline in self-control capacity following an initial self-control demand (Gröpel, Baumeister, & Beckmann, 2014). These relations among regulatory focus, regulatory mode, and action control highlight the importance of distinguishing among forms of self-control when considering the role of self-control in self-regulatory preferences.

Summary: Self-Control and Narrow Personality Traits

Self-control is associated in predicted ways with a host of narrow personality traits relevant to the self-regulation of behavior. A subset of the traits we considered are sometimes treated as variants of self-control (Duckworth & Kern, 2011). Our review highlights not only the empirical associations between self-control and traits such as impulsivity, grit, and sensation seeking but also their conceptual distinctiveness. The remainder of the traits we reviewed refer to processes and preferences related to self-regulation. In terms of processes, we highlighted the broad relevance of self-control, particularly the capacity to sustain self-control over time, for self-regulatory processes. With respect to preferences, we find differential associations between capacity for the different types of self-control and particular approaches to self-regulation. These findings establish self-control as distinct from but related to an array of narrow personality traits implicated in self-regulation and related processes.

CONCLUSIONS

Individual differences in the capacity for self-control are implicated in a wide range of personality models and traits, ranging from comprehensive models focused on broad personality domains to narrow traits that capture individual differences in specific preferences, propensities, and orientations related to the general activity of self-regulating behavior. In the absence of a widely accepted, well-articulated model of individual differences in the capacity for self-control, research on self-control and personality makes use of different measures and conceptual models that emphasize different forms and features of the construct. Our two-dimensional model offers a comprehensive account of self-control capacity, distinguishing between self-control by inhibition and self-control by initiation and, within those types, one-off versus sustained forms of self-control. For some personality domains and traits, the correlations with individual differences in the different self-control capacities are equivalent, suggesting a common set of personality assets and liabilities for all self-control capacities. For other domains and traits, the correlations differ, sometimes substantially, suggesting unique or varied contributions of personality to the different self-control capacities. Given the informative results from these studies focused primarily on personality and self-control structure, a profitable direction for future research is the dynamic interplay of online personality and self-control processes.

ACKNOWLEDGMENT

The preparation of this chapter was supported in part by Grant No. P30DA023026 from the National Institute on Drug Abuse.

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PART V

DEVELOPMENT AND SELF-REGULATION

CHAPTER 23

The Development of Executive Functions and Self-Regulation

A Bidirectional Psychobiological Model

CLANCY BLAIR

Executive functions are cognitive abilities that are important for organizing information, for planning and problem solving, and for orchestrating thought and action in goal-directed behavior. As such, they are aspects of psychological ability that assist the individual in self-regulation and self-control. As aspects of cognition important for rational thinking and behavior, however, executive functions are not synonymous with self-regulation and self-control; that is, people do not always think rationally or purposefully when regulating behavior, and they may think rationally and with deliberation when experiencing a failure of self-regulation and a loss of self-control (Stanovich, 2009). Executive thinking skills can and often do facilitate self-regulation and self-control, but the relation of higher-order, more effortful or deliberative aspects of self-regulation (e.g., executive functions) to lower-order, more automatic aspects of self-regulation (e.g., the regulation of emotion, attention, and stress response physiology) is a two-way street. Executive functions can serve a critical higher-level or top-down role in behavior regulation and act as a primary mechanism of effortful self-regulation but are to some extent as much a consequence as a cause of regulation in lower-order more automatic emotion, attention, and stress response systems. Accordingly, this chapter describes a bidirectional developmental model in which brain areas that underlie executive functions reciprocally interact with brain areas associated with the control of attention, emotion, and stress physiology. Because relations among executive functions, emotion, attention, and stress physiology are bidirectional and cybernetic (Luu & Tucker, 2004), which means that they interact in an adaptive feedback loop in response to environmental cues, the development of executive functions and self-regulation is highly influenced by experience. In this, self-regulation development is understood as a process through which experience directs or canalizes development in ways that maximize the individual's potential to act

advantageously in specific contexts and circumstances (Blair & Raver, 2012; Ellis & Del Giudice, 2014).

DEFINING AND MEASURING EXECUTIVE FUNCTIONS

Stated simply, *executive functions* refer to aspects of cognition that are called on in situations when brain and behavior cannot run on automatic. More specifically, executive functions describe interrelated cognitive abilities that are required when one must intentionally or deliberately hold information in mind, manage and integrate information, and resolve conflict or competition between stimulus representations and response options. In this process of integration and control, it is generally agreed that executive functions include *working memory*, defined as the active maintenance or updating of information over a relatively short time period; *inhibitory control*, defined as the activation of specific information and inhibition of automatic but nonoptimal or incorrect responses; and *cognitive flexibility* or *attentional set shifting ability*, defined as the ability to shift the focus of attention or cognitive set flexibly and to adjust behavior accordingly. In general, these aspects of cognition are important for planning, future-directed thinking, and monitoring of behavior, all of which are aspects of cognitive experience encompassed by definitions of executive functions.

Given the presence of distinct working memory, inhibitory control, and attentional set shifting components of executive function, researchers have been interested in the extent to which executive functions are really a single integrated, unitary construct or whether executive functioning is better represented by its distinct component processes. Results from a number of experiments including behavioral (Friedman et al., 2006; Miyake et al., 2000), neural imaging (Wager, Jonides, & Reading, 2004), and clinical neuropsychological research (Stuss et al., 2002) indicate that the components of executive function can be clearly differentiated. For example, the analysis of young adults completing simple tasks thought to capture the tripartite division of executive functions into attention shifting, inhibitory control, and working memory components has indicated the presence of distinct yet correlated latent factors for each of the aspects of executive function (Miyake et al., 2000).

In children, factor analyses of executive function test batteries designed to assess distinct components of executive function have tended to indicate that executive functions are best described by a single underlying factor rather than two or three distinct components (Wiebe, Espy, & Charak, 2008; Willoughby, Blair, Wirth, Greenberg, & the FLP Investigators, 2010). It is important to note that in all latent factor modeling of executive functions, with very few exceptions, in adults as well as children, models providing often excellent global model fit to the data are accounting for a relatively small (e.g., .05–.30) amount of the observed variation in any given task. This situation places an upward limit on the reliability of executive function measures and indicates the need for task batteries composed of at least three executive function measures to achieve adequate reliability (Willoughby, Pek, Blair, & the FLP Investigators, 2013). This aspect of executive function measurement also raises several questions about the nature of executive cognitive abilities and perhaps inherent limits on the measurement of executive function abilities due to their close neurobiological relation with emotional and motivational processes, described below.

EXECUTIVE FUNCTIONS AND HUMAN DEVELOPMENT

Generally speaking, the relation of executive functions to self-regulation is seen in the idea that executive function abilities work as an integrated whole to organize complex information and regulate thought and action in goal-directed ways (Fuster, 2002). Such a role for executive functions is seen in the types of problems individuals have in regulating emotion and behavior in the instance of damage to prefrontal cortex (PFC) and related networks, and also in pathologies affecting the chemical and neural functions of PFC and related brain systems (Mayberg, 2002; Robbins & Arnsten, 2009). Deficits in executive functions are a primary aspect of cognitive impairment in a number of disorders and psychopathologies (Pennington & Ozonoff, 1996; Zelazo & Müller, 2002), and performance on executive function tasks is positively associated with various aspects of cognitive and social competence throughout the lifespan (Blair & Razza, 2007; Hughes & Ensor, 2007; West, 1996; Zelazo, Craik, & Booth, 2004).

Influential theories of PFC function and cognitive control emphasize the ways in which executive functions represent the integration and selective maintenance and coordination of information and actions (Mesulam, 2002; Miller & Cohen, 2001). For example, clinical studies indicate that individuals with PFC damage have little difficulty representing specific information but are noticeably impaired on goal-directed tasks and on tasks in which an automatic or prepotent response must be inhibited, in which ambiguity resolved and salient distracters ignored, and in which contextual cues must be used to guide correct responding (Duncan, Burgess, & Emslie, 1995; Waltz et al., 1999). This broad integrating and organizing role for executive functions in directing behavior is embodied in a number of theories addressing the neural basis for cognitive control, such as Miller and Cohen's (2001) integrative theory and Duncan's (2001) adaptive coding model. In both of these theories, PFC is understood to maintain goal representations and to orchestrate activity in multiple neural systems, particularly when well-established or habitual responding must be overridden in order to achieve the goal. In their broad forms, however, research and theory on executive functions raise fundamental questions concerning the source of control and regulation of cognitive processes and the origin of intentionality or goal directedness. In the PFC's organizing role, there would seem to be a need to postulate an intentional agent or homunculus that prioritizes information and directs cognitive control processes. The question, however, is really one of determining how the brain selectively attends to and prioritizes information among multiple diverse sources of potentially conflicting information. To address this question, a developmental psychobiological approach is needed.

EXECUTIVE FUNCTIONS AND SELF-REGULATION: A BIDIRECTIONAL THEORY

From the foregoing discussion, it is evident that research and theory support the idea that executive functions are aspects of cognition that can be key contributors to the self-regulation of behavior. When examining executive function abilities, however, it is valuable from both an individual-differences and a developmental standpoint to consider behavioral and neurobiological evidence indicating that deliberate, intentional, and goal-directed executive functions are highly interrelated with and dependent on automatic and

nonvolitional aspects of emotion, attention, and stress response systems. Accordingly, in this chapter I define *self-regulation* as the primarily, but not necessarily, volitional management of attention and arousal (including stress physiology and emotional arousal) for the purposes of goal-directed action. Within this definition, executive functions play a primary a top-down role in directing attention and organizing cognitive resources (Miller & Cohen, 2001) and in regulating emotion (Ochsner & Gross, 2005). From a bottom-up perspective, however, executive functions, in their organizing and directing role, are dependent on activity in attention, emotion, and stress response systems (Blair & Dennis, 2009; Gray, 2004; Luu & Tucker, 2004). In contexts that lead to particularly high or low levels of attentional focus and emotion and stress arousal, executive functions are impaired (Alexander, Hillier, Smith, Tivarus, & Beversdorf, 2007; Arnsten & Goldman-Rakic, 1998). In contexts in which automatic aspects of attentional, emotional, and physiological responses to stimulation are in what can be considered a moderate range, executive functions are facilitated (Arnsten, 2009; Lupien, Gillin & Hauger, 1999; Ramos & Arnsten, 2007). Therefore, although executive functions can be considered primary mechanisms of self-regulation in a top-down framework, they are themselves dependent on the regulation of attention and emotion through bottom-up, nonexecutive processes. In other words, the relation between executive functions and the control of attention and emotion is bidirectional and operates in an interactive feedback loop.

Very generally speaking, the neural systems that underlie the bottom-up aspects of self-regulation are primarily located in limbic and brainstem structures that rapidly register experience and nonconsciously or automatically activate stress-response physiology and motoric, emotional, and attentional responses to deal with contingencies in the environment. These response systems are understood to vary between individuals in their resting level of activity and in the arousal threshold at which they are activated. It is well established that a high level of emotional arousal reduces the ability to control attention flexibly and impairs executive functions (Arnsten & Goldman-Rakic, 1998; Dennis & Chen, 2007; Lupien et al., 1999). This relation, however, is only one instance of a general relation between emotion and cognition (Blair & Dennis, 2009). Just as emotional processes can disrupt executive functions when at very high levels, emotion facilitates attention and executive functions when at moderate levels. In this, the relation between emotion and cognition follows an inverted U-shape first described by Yerkes and Dodson (1908). The Yerkes–Dodson principle states that performance on a given cognitive task increases with arousal up to a given threshold but then decreases as arousal rises beyond the threshold level. This principle, however, applies specifically to complex aspects of cognition, such as executive functions. In their original and subsequent experiments, Yerkes and Dodson demonstrated that the inverted U-shape relation between arousal and performance is specific to complex learning tasks, such as those involving executive functions. For relatively simple and reactive forms of cognition and behavior, such as the fear conditioning, attention narrowing, and traumatic or emotional memory formation, the relation between arousal and performance is linear and positive (Diamond, Campbell, Park, Halonen, & Zoladz, 2007).

The specific relation of the inverted-U to complex cognition is seen in the neurobiology of emotion–cognition interactions that underlie executive functions. Experiments conducted with animal models demonstrate that activity in areas of PFC that serve as part of the neural substrate for executive functions is dependent to some extent on relative levels of stress hormones and related neuromodulators that originate in limbic and

brainstem areas. For example, at very low level of arousal, levels of neuromodulators—including norepinephrine, dopamine, and the glucocorticoid hormone cortisol—are low, and activity in PFC is correspondingly low. As levels of these neurochemicals rise, however, activity in the neural substrate for PFC increases as specific neural receptors become occupied (Arnsten & Li, 2005; Robbins & Arnsten, 2009). With increases beyond a moderate level, receptors become saturated and neural activity in PFC begins to decrease. Conversely, as levels of neuromodulators continue to rise and activity in PFC decreases, activity in posterior brain is associated with reactive responses to stimulation and long-term memory formation of emotionally arousing events increases (Arnsten, 2000; Diamond, Campbell, Park, Halonen, & Zoladz, 2007). In this way the inverted U-shaped relation between arousal and performance at the behavioral level is mirrored in neural activity at the biological level.

The bidirectional nature of self-regulation, of cognition–emotion interaction, can be seen in terms of attention. The brain has three primary attention systems: alerting, orienting, and what is known as executive attention (Petersen & Posner, 2012; Posner & Rothbart, 2007). All three are activated automatically in response to environmental contingencies. Alerting and orienting responses are seen in the way in which attention is captured in emotionally arousing contexts and in the narrowing and focusing of attention that occurs in response to highly arousing stimuli. Alerting and orienting away from an emotional stimulus are, of course, also important for regulating emotion. In highly emotionally arousing situations, however, it is very difficult to redirect attention (Öhman, Flykt, & Esteves, 2001), and any redirection of attention for the purpose of self-regulation in these contexts is primarily *exogenous*, which means that it is prompted by persons or events external to the individual rather than self-directed. In infancy and early childhood this is seen in the fact that distraction and reorienting are primary ways in which caregivers attempt to regulate emotion in infants and young children (Harman, Rothbart, & Posner, 1997; Stifter & Braungart, 1995).

Similar to alerting and orienting aspects of attention, executive attention can be engaged automatically by contingencies in the environment, namely, conflicting information and error. Like the first two aspects of attention, it can be directed intentionally to regulate emotion and behavior in response to conflicting information, primarily by calling on and engaging executive functions (Botvinick, Cohen, & Carter, 2004; Carter & van Veen, 2007). As such, executive attention ability is an important precursor for the development of executive functions and can first be measured effectively in the preschool period using tasks that induce cognitive conflict between stimuli and on which errors are more likely, such as flanker or Simon tasks. For example, in a flanker task, the participant is asked to indicate the direction in which a central stimulus, an arrow, or for children, a smiling fish, is pointing. On certain of the trials for the task this central stimulus is congruent (facing the same direction) with the flanking stimuli, that is, those on either side of it, and on other trials the direction of the central stimulus is incongruent (facing the opposite direction) with the flanking stimuli. In a Simon-type task, stimulus and response locations are either congruent or incongruent, and responding on incongruent trials is slowed relative to responding on congruent trials; as with the Stroop color–word task, responding on flanker and Simon tasks is delayed and less accurate on incongruent versus congruent trials.

Brain imaging research has indicated that the registration of conflict associated with flanker and Simon tasks is associated with increased activity in the anterior segment

of an area of the brain known as cingulate cortex (Bush, Luu, & Posner, 2000; Ridderinkhoff, Ullsperger, Crone, & Nieuwenhuis, 2004). Furthermore, neural imaging has indicated that having registered conflict, the anterior cingulate signals the PFC to activate executive functions (Kerns et al., 2004; MacDonald, Cohen, Stenger, & Carter, 2000). These relations between brain and behavior are of particular interest because anterior cingulate cortex (ACC) links limbic areas of emotion processing with areas of PFC important for executive functions (Allman, Hakeem, Erwin, Nimchinsky, & Hof, 2001). The neuroanatomical association of executive attention with the ACC is consistent with the understanding of the role of attention in self-regulation. With the recognition of conflict, the ACC signals the PFC to initiate activity in dorsolateral and ventrolateral regions associated with executive functions. As such, the ACC and related regions of PFC form what is considered to be the primary neural substrate for executive functions (Miller & Cohen, 2001). When cognitive conflict cannot be resolved, however, or when the information to be managed overwhelms the ability and resources of the individual, PFC activity is reduced (Callicott et al., 1999; Rypma, Prabhakaran, Desmond, Glover, & Gabrieli, 1999), and activity in regions of ACC and limbic structures can trigger a stress response and increase neuroendocrine hormone activity (Critchley, 2005), leading to increased emotional and stress arousal and to difficulty controlling attention and using executive functions.

Relations among PFC, ACC, limbic structures, and stress physiology in the interaction of top-down and bottom-up processes of regulation form the basis for the bidirectional model of executive functions. Of particular interest in this model is the distinction between executive attention and executive functions. Although these are overlapping constructs, the bidirectional model considers *executive attention*, as with orienting and alerting aspects of attention, to be a relatively fast psychophysical phenomenon and *executive functions* to be somewhat slower and more consciously effortful or deliberate. That is, executive attention is the attentional component of executive functions, and as such is important for directing cognitive resources in situations that require the engagement of PFC in order to resolve conflict by holding information in working memory, inhibiting automatic responses, and shifting perspective or cognitive set as needed.

As cognitive abilities important for resolving conflicting information and maintaining task focus and goal-directedness, executive attention provides the mechanism whereby the individual's cognitive and motivational resources are directed to new and potentially confusing and disruptive information, and behavior is directed in ways that allow for purposeful engagement with the environment. Goal directedness is a hallmark of theoretical models of executive functions, and in this respect, executive functions are a central aspect of a volitional, freewill-based definition of self-regulation and self-control: the autonomous individual directing thinking, feeling, and will as a purposeful agent in the world. Executive functions interact with the knowledge base and prior experience to guide behavior. Here executive functions are important contributors to reasoning ability and to the aspect of intelligence associated with reasoning ability, referred to as *fluid* as opposed to *crystallized* or *knowledge-based* intelligence (Blair, 2006). A number of studies have demonstrated that the working memory, inhibitory control, and attentional set shifting factors that comprise executive function are uniquely related to measures of general intelligence (Friedman et al., 2006) and indicate that executive functions, working memory in particular, may serve as the basis for individual differences in intelligence (Carpenter, Just, & Shell, 1990; Gustafsson, 1984).

EXECUTIVE FUNCTIONS AND SELF-REGULATION: DEVELOPMENT AND INTERRELATION

In contrast to a focus on volition and free will in top-down models of self-regulation, the psychobiological model of self-regulation also focuses on automatic and non-volitional aspects of self-regulation (Bargh, Schwader, Hailey, Dyer, & Boothby, 2012) and as such has implications for the development of executive functions and self-regulation more generally. A valuable example of a developmental approach that incorporates conscious and nonconscious aspects of self-regulation, without describing how they are related developmentally, is found in the framework of temperament proposed by Rothbart and coworkers (Derryberry & Rothbart, 1997; Rothbart & Ahadi, 1994; see Rothbart, Ellis, Rueda, & Posner, 2003). In this theory, temperament is defined by early emerging, biologically based tendencies or predispositions to a given level of emotionality in infancy, both positive and negative, followed by development in infancy of alerting and orienting aspects of attention, and somewhat later during the toddler period of the ability to control attention volitionally (executive attention) through what is referred to as *effortful control*. Temperament as an individual-differences construct is delineated by the combination or interaction of positive and negative emotionality and the regulation of emotionality through effortful control (e.g., behavioral approach and withdrawal tendencies) and the volitional and nonvolitional control of attention. Relations between emotionality and developing control of emotionality have been shown in a number of studies with young children (Gerardi-Caulton, 2000; Rothbart et al., 2003). A child characterized by a high level of positive emotionality and approach behavior and relatively low levels of effortful control is considered to have a temperament characterized by extraversion and surgency. In contrast, a child with a high level of fear emotionality and low approach and poor effortful control is said to have a temperament type characterized by high negative affectivity.

An important distinction in research on self-regulation in children is that between effortful control in research on temperament and executive functions in research on cognitive development. The constructs overlap, particularly in terms of a focus on the ability to inhibit automatic and highly learned responses and to sustain and shift attention, but they also differ in important ways (Liew, 2012; Sulik, Daneri, Pintar, & Blair, in press; Zhou, Chen & Main, 2012). For one, assessments of effortful control tend to be questionnaire-based and to describe general behavioral tendencies in children across a variety of situations and conditions. Measures of executive functions, in contrast, are almost exclusively direct assessment and are designed to assess the cognitive skill of working memory, as well as attentional flexibility and inhibitory control, in isolation, distinct from emotional or motivational influences. As such, effortful control is best understood in relation to emotionality, whereas executive functions are best considered as distinct from yet liable to the influence of emotion. This is seen in the distinction between executive functions and executive attention, the key component of effortful control, described earlier. Effortful control would seem more of a dispositional characteristic associated with the tendency to activate executive attention. Whether or not the activation of executive attention results in increases in executive function abilities relies on whether activation of executive attention leads to the reflective capacity that is a hallmark of executive function. For example, a child successfully delaying gratification might be said to have a high level of effortful control. Whether the child uses executive function strategies to successfully delay gratification, however, may vary. Some children may find an executive

function strategy beneficial, but others may not use not executive function and instead find more automatic emotion regulation strategies, such as distraction, beneficial.

While the development of temperament is presumed to come about as the interplay of emotionality and the regulation of emotionality, theories of executive function development have focused primarily on the emergence of more or less volitional cognitive abilities that provide the foundation for more elaborated and complex cognition and reflection on experience. Adele Diamond, for example, has focused primarily on the inhibitory control aspect of executive function. She suggests that a first step in executive function development is the ability to inhibit responding in order to overcome what is termed *attentional inertia* (Kirkham, Cruess, & Diamond, 2003). In Diamond's theoretical approach, an inhibitory deficit is indicated in infancy in the A-not-B task, in which infants fail to inhibit the search for a toy at a prior location despite seemingly "knowing" that the toy is present at a new location (Diamond, 1990). This apparent failure of inhibition is seen at approximately 3 years of age, when children fail to shift cognitive set in a prototypical measure of executive function for children, the dimensional change card sort task (DCCS; Zelazo, 2006). In the DCCS, children are presented with cards containing pictures of a shape, for example, either a rabbit or a boat, and the rabbits and boats can be either red or blue. Children are instructed to attend to one of the dimensions and to sort the cards by that dimension ("We are going to play the shape game. In the shape game, rabbits go here and boats go here"). After correctly sorting by this dimension, children are then asked to switch and to sort the cards by the second dimension ("Now we are going to play the color game. In the color game, blue ones go here and red ones go here") Support for Diamond's inhibitory account of the failure to shift cognitive set in the task is found in data indicating that when the inhibitory demand of the task is reduced, as in versions of the task in which color and shape dimensions on the cards to be sorted are separated rather than integrated, the average age at which children are able to switch dimensions is reduced (Diamond, Carlson, & Beck, 2005; Kirkham et al., 2003; Kloo & Perner, 2005).

Distinct from Diamond's approach, Zelazo proposes that the primary cause of age-related change in executive functions both early and late in the lifespan is the development and decline of the ability to reason or reflect on rules, and to generate and apply higher-order knowledge of conditional relations among sets of rules (Zelazo et al., 2004). As outlined in the revised version of the cognitive complexity and control theory (CCC-R), Zelazo, Müller, Frye, and Marcovitch (2003) emphasize an integrative approach that identifies a shift in the individual's ability to maintain a representation and to guide behavior based on that representation as essential to the emergence of executive functions. Young children lack the ability to reflect on lower-order rules such as simple if-then statements, and this prevents them from embedding lower-order rules in higher-order rules that would specify which lower-order rule to follow in a given context. The CCC-R suggests that reflection and higher-order rule formation enable processes of inhibition and redirection of attention; that is, once the child has a schema of higher-order rules, he or she is then able to inhibit responding and redirect attention to the context-appropriate rule. Conversely, in older age, as basic cognitive abilities that support hierarchical representation or rules and reflection on rule pairs declines, deficits in executive functions are increasingly apparent (Zelazo et al., 2004).

In further distinction to both Diamond's and Zelazo's approaches, Buss and Spencer (2014) have proposed a model based in dynamic systems theory, a dynamic neural field

(DNF) model that identifies what might be considered the attention-shifting component of executive functions as the central feature of development. In the DNF model, a computational model of changes in neural population dynamics in response to experience, it is an increase in the signal or bias to the previously unattended dimension in the DCCS, an increase in what Buss and Spencer refer to as *dimensional attention*, that leads to improved performance on the task with age. Although detailed description of the DNF model is beyond the scope of this chapter, the model does provide a theoretical explanation of age-related change in executive function that is grounded in neurophysiology.

In contrast to the focus on age-related (nomothetic) change in executive functions in the foregoing models, the psychobiological model outlined in earlier sections provides an explanation for individual differences in the course of executive function development as a function of activity in lower-level processes of self-regulation. Specifically, activity in attention and emotion systems and in stress response physiology occurring in response to stimulation are seen as the primary influences on executive function development. Given the inverted-U-shape relation between hormones activated by the stress response and activity in the neural systems that support executive function abilities, the psychobiological model addresses the idea that the influence of experience on stress response physiology, with cascading influences on emotionality and attentional processes, determines the timing of the emergence of executive function abilities. The timing of executive function development then has cascading influences on aspects of development for which executive function abilities are central, such as school readiness (Blair & Raver, 2015) and normative expectations for the regulation of behavior in early childhood (Hughes & Esnor, 2007). In its focus on the experiential shaping of the development of executive functions through specific physiological mechanisms and its emphasis on the timing of development, the psychobiological developmental model of executive function is a typical or characteristic psychobiological model (Gottlieb, 1991; West-Eberhard, 2003) in which a primary theoretical proposition is that experience shapes development in ways that are maximally beneficial for the context in which development is occurring.

The physiological response to stress is central to the psychobiological model because it is hypothesized to be a primary conduit through which the environment shapes self-regulation. This experiential shaping occurs through both the autonomic sympathetic-adrenal-medullary system, which rapidly mobilizes visceral functions such as heart rate, respiration, digestion, and so forth, in response to acute stress, and also the limbic hypothalamic-pituitary-adrenal (HPA) axis component of the stress response, which is important for longer-term, chronic reactivity to threat or uncertainty (Gunnar & Quevedo, 2007). Both of these systems directly influence activity in emotion, attention, and executive neural systems through the production of hormones that modulate neural activity and thereby influence cognitive processes (McGaugh, 2004). These include epinephrine and norepinephrine (NE) in the sympathetic system and the glucocorticoid steroid hormone cortisol, associated with the HPA axis. As described earlier, the action of NE and cortisol affect activity in the neural systems that underlie executive functions in an inverted-U-shape fashion. As such, two points are relevant to the developmental psychobiological model of self-regulation. The first is that the activity of the stress response is influenced by experience, particularly early in life. It is reasonably well established that stressful early life experience, such as that occurring in conditions of extreme disadvantage and maltreatment (Miller, Chen, & Zhou, 2007) and even in more typical types of experience such as that occurring in poverty (Evans, 2003; Hostinar, Sullivan, &

Gunnar, 2014; Kim et al., 2013) influence the development and activity of stress response systems. The second, related to the first, is that development in these systems in response to experience influences the development of executive functions (Evans & Schamberg, 2009; Hostinar et al., 2014), likely through an influence of experience-dependent neural activity on the structure and function of neurons in the PFC and related brain areas (Liston et al., 2006; Radley et al., 2005). Given that PFC matures very slowly, throughout childhood into the young adult years (Toga, Thompson, & Sowell, 2006), there is likely considerable plasticity and malleability in the influence of experience on self-regulation.

Available evidence indicates that adverse rearing environments, such as those over-represented in poverty, detrimentally affect cognitive development through processes involving attention, emotion, and stress physiology. My colleagues and I are conducting a longitudinal study with children and families ($N = 1,292$) living in predominantly low-income and nonurban communities in two geographically distinct regions of the United States. We demonstrated that the conditions of poverty, including low income and low maternal education, and most importantly, low levels of sensitive responsive maternal caregiving behavior are associated with elevated stress physiology in infancy, as indicated by the stress hormone cortisol at 7, 15, and 24 months of age (Blair et al., 2008, 2011). Furthermore, we found that environmental effects of poverty on stress physiology, as measured by cortisol levels, represented a mediating path through which the environment affected executive function ability at age 3 years (Blair et al., 2011). We also examined the relation of emotion and emotion regulation in infancy to later-developing executive functions. Here we found that children demonstrating not only high emotional reactivity in response to a structured emotion challenge (presentation of scary masks) but also high emotional regulation (avoidance, self-soothing) in response to the emotion challenge tasks at 15 months of age exhibited highest levels of executive function in the preschool period (Ursache, Blair, Stifter, Voegtline, & the Family Life Project Investigators, 2013). In addition, in this analysis, consistent with the psychobiological model, we predicted that children characterized by the combination of high levels of both reactivity and regulation would be living in homes characterized by high levels of parental sensitivity. As expected, we found that this to be the case. Children characterized by high levels of both emotional reactivity and regulation, defined by a median split, were more likely than children in any other pairing of reactivity and regulation to be receiving high levels of sensitive maternal care.

Although among the first studies of its kind examining associations among the conditions of poverty, stress physiology, and executive functions in early childhood, our findings are consistent with prior studies examining relations between poverty and stress physiology (Evans, 2003) and poverty and executive functions (Noble, McCandliss, & Farah, 2007) in later childhood. For example, in a longitudinal sample of children seen at ages 9 years and 13 years, increased cumulative risk in the home, including physical as well as psychosocial characteristics of the home environment, were associated with elevated stress physiology. However, the association between cumulative risk and elevated stress physiology was observed only among children whose mothers were observed to have low levels of responsive involvement with children, suggesting that a close and caring relationship can buffer the effects of environmental risk on stress physiology (Evans, Kim, Ting, Teshler, & Shannis, 2007). As well, in a further follow-up of the sample at age 17 years, the working memory aspect of executive function was significantly lower for participants with a greater number of childhood years in poverty and with elevated

stress physiology. Furthermore, when covaried, stress physiology was shown to account for the relation between years in poverty and working memory (Evans & Schamberg, 2009); that is, as with the findings of my colleagues and myself relating stress physiology to executive function development in early childhood, the effect of poverty on executive function in adolescence in the study by Evans and Schamberg (2009) was found to a considerable extent to be attributable to the effect of poverty on stress physiology.

Data demonstrating relations among early experience, activity in stress response systems, and the development of executive functions are of strong interest given evidence of neurobiological mechanisms through which these relations occur. As noted earlier, activity in the neural substrate for executive functions is influenced by levels of stress hormones. Furthermore, the role of early experience in the development of stress physiology important for executive functions is consistent with a well-described model in rats demonstrating that early experience essentially programs the development of the HPA component of the stress response with consequences for learning, memory, and behavior (Meaney, 2001). In rat mothers, high levels of licking, grooming, and a style of nursing referred to as *arched-back nursing* during the first postnatal week have been shown to affect the expression of a gene that codes for the expression of the glucocorticoid receptor in the hippocampus. Rats born to mothers with high levels of licking, grooming, and arched back nursing have a greater density of glucocorticoid receptors in the hippocampus, a major structure in the regulation of glucocorticoid levels, and are therefore better able to regulate the stress response. In contrast, offspring of mothers with lower levels of licking, grooming, and arched back nursing have lower levels of glucocorticoid receptors in the hippocampus, are more reactive and less well regulated physiologically, and more anxious and fearful behaviorally (Caldji et al., 1998; Liu et al., 1997). Furthermore, offspring of low licking, grooming, and arched-back nursing mothers perform less well on cognitive tasks, such as complex learning and memory tasks (Liu, Diorio, Day, Francis, & Meaney, 2000). However, consistent with the Yerkes–Dodson principle outlined earlier, offspring of low licking, grooming, and arched-back nursing mothers are more reactive to stimulation in the environment and exhibit faster fear conditioning (Champagne et al., 2008).

In the psychobiological model, stress reactivity is understood to shape processes of self-regulation to optimize the functioning of the individual within that environment. Specifically, physiological reactivity to stress is thought to be increased both in advantaged and disadvantaged environments (Boyce & Ellis, 2005). In disadvantaged environments, primarily in the context of poverty, as described earlier, environments are more likely to be over- or understimulating (McLoyd, 1998). Environments that are excessively or unpredictably over- or understimulating are likely to lead to levels of stress hormones that are particularly high or low and not well regulated, and therefore associated with reduced neural activity in PFC and poor executive function. Furthermore, in the higher-risk environment, caregiver support for the regulation of physiological reactivity is frequently low due to stress on caregivers and general conditions of the home environment that interfere with sensitive and responsive caregiving. In contrast, in advantaged environments in which resources and support are high and predictable, increase in stress hormone levels is conducive to the development of effortful self-regulation, such as that associated with executive functions. This is because stress physiology tends to be well regulated in advantaged environments. Physiologically speaking, levels of stress hormones increase in response to stimulation provided through sensitive and responsive

caregiving to ranges that are conducive to synaptic activity in PFC associated with executive functions. As well, increases in stress hormone levels in supportive environments are sufficiently well regulated so as not to rise above a threshold range and lead to decreased activity in PFC and increased activity in posterior regions and subcortical regions associated with reactive responses to stimulation (Blair, 2010).

The foregoing association between moderate stress, presumed to be occurring in the context of relative environmental advantage, and self-regulation has been seen strong support experimentally in animal models. In both rats and monkeys, intermittent stress induced by brief periods of isolation is associated with enhanced regulation of the stress response as indicated by activity of the HPA axis, with benefits to the regulation of behavior in response to challenge, and with benefits to cognitive development, including performance on measures of working memory and inhibitory control (Parker, Buckmaster, Schatzberg, & Lyons, 2004; Tang, Akers, Reeb, Romeo, & McEwen, 2006). Moderate early life stress has for some time been theorized to inoculate or “steel” the organism by enabling more effective management of stress later in development. Primary support for such “stress inoculation” in humans has traditionally come from retrospective data indicating that individuals exhibiting better psychological adjustment following acute, high-stress events are disproportionately more likely to have experienced an acute stressor at an earlier time point (Parker & Maestriperi, 2011). Consistent with the moderate stress hypothesis, the results in our prospective longitudinal sample indicated that for children exhibiting a low-average level of salivary cortisol during early childhood (ages 7, 15, 24, and 48 months), moderate within-person variability around this low-average level predicted a higher level of executive function abilities at 60 months of age. In contrast, for children exhibiting high-average cortisol indicative of chronic stress across this period, executive function abilities were less well developed, irrespective of whether elevated levels of cortisol were chronic or varied within the child over time.

EARLY INTERVENTION AND EDUCATION

Although speculative to some extent, the psychobiological model is based on clear evidence concerning the relation of experience to the development of stress physiology and of the relation of stress physiology to emotion and cognition. It is known that the stress response is under strong social control in early childhood (Gunnar & Donzella, 2002) and that social relationships and the controllability of events are primary influences on reactivity and regulation in stress–response systems (Dickerson & Kemeny, 2004). To this end, the theoretical model linking early attention, emotion, and stress physiology as precursors of executive functions and the development of the effective self-regulation of behavior suggests a plausible mechanism of effects through which poverty “gets under the skin” to affect development at multiple levels of influence.

To this end, however, the model provides a comprehensive explanation for the efficacy of early intervention programs for children from high-risk backgrounds and can capitalize on these interventions as tests of developmental psychobiological theory. Longitudinal follow-up of several programs modeled on responsive educational caregiving for infants and children from high-risk backgrounds originally conducted in the 1970s have demonstrated sustained effects on cognitive ability and positive life outcomes. For example, several longitudinal intervention projects, providing early educational care to

high-risk samples of infants and preschoolers, such as the Abecedarian Project (Ramey & Campbell, 1991) and the Perry Preschool Project (Schweinhart et al., 2005) have produced long-term effects into adulthood on a number of outcomes associated with self-regulation and self-control, such as greater job and marital stability, and reduced rates of arrest and incarceration (Reynolds & Temple, 2008). Longer-term results from these programs may be attributable to program effects on self-regulation given that program effects on IQ, an outcome of early interest, faded shortly after the intervention phase of the programs ended in early childhood (Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001; Heckman, Malofeeva, Pinto, & Savelyev, 2010). A self-regulation hypothesis for long-term effects of early intervention is consistent with the model of self-regulation development outlined here and with current thinking about best approaches to maximizing human development potential (Heckman, 2006, 2007).

More recently, experimental evaluations of programs such as the Chicago School Readiness Project (CSRP; Raver et al., 2009, 2011) and of the Tools of the Mind program provide increasingly direct support of self-regulation as a mechanism mediating effects of high-quality programs on longer-term outcomes for children. The CSRP, for example, focused on the early prevention of behavior problems in preschool children by focusing on emotion regulation, and did so in community-based educational settings for children in poverty, namely, Head Start programs. Most notably for present purposes, it was developed within the psychobiological framework, explicitly acknowledging connections among levels of analysis and the need to intervene across levels to bring about comprehensive behavior change (Raver et al., 2009, 2011). Recent results from CSRP analyses suggest that experimentally induced benefits to self-regulation gained in the context of classroom-based intervention can be undermined by later exposure to traumatic stressors such as unsafe school settings and neighborhoods with high levels of violent crime (Raver, McCoy, Lowenstein, & Pess, 2013; Sharkey, Tirado-Strayer, Papachristos, & Raver, 2012). Following children who were initially enrolled in early interventions such as Family Check-Up or CSRP through early adulthood (using both biobehaviorally and psychologically anchored measures of self-regulation) will provide the empirical basis needed to test tenets of the psychobiological model and enable the use of developmental theory to design preventive intervention, as well as evaluation of the intervention to test developmental theory.

In a recently completed evaluation of the Tools of the Mind program in kindergarten (Blair & Raver, 2014), we found that children in schools randomly assigned to implement the program had moderately higher levels of executive function abilities, as well as mathematics and reading achievement (effect size = 0.10). The effects were particularly large (effect size = 0.30–0.80), however, in high poverty schools and extended to measures of children's ability to control attention in the face of fear-evoking stimuli in addition to reasoning and vocabulary ability. Notably, the Tools of the Mind approach is explicitly designed to provide support for child self-regulation and the development of executive functions through structured child-directed, teacher-scaffolded activities (Bodrova & Leong, 2007). Our demonstration of the effect of the Tools of the Mind program, however, followed two prior evaluations of the prekindergarten version of the curriculum, the first of which demonstrated effects of the approach on children's executive function abilities (Diamond et al., 2007), and the second of which found no effects on any aspect of children's executive functioning or academic abilities (Wilson & Farran, 2012). Certainly, additional research is needed on approaches to the promotion of self-regulation

in school-based settings. In combination, however, evaluations of CSRP and Tools of the Mind, as well as longitudinal follow-ups of the Perry Preschool (Heckman et al., 2010) and Abecedarian (Campbell et al., 2014) programs, provide clear empirical evidence of the potential to structure educational experiences for children in ways that comprehensively foster self-regulation development at multiple levels of analysis with the possibility of pronounced benefits into adulthood.

CONCLUSION AND FUTURE DIRECTIONS

In conclusion, this chapter has presented a model in which executive functions are seen to be both top-down mechanisms of self-regulation and of aspects of cognitive ability that are themselves dependent on bottom-up processes associated with the regulation of emotion, attention, and stress physiology. In applying the psychobiological developmental science approach to executive functions, I have described these cognitive abilities as emerging from early developing processes of emotionality and attention that are the primary constituents of temperament. From this model of temperament, the chapter has examined executive functions from the perspective of biological sensitivity to context. The developmental psychobiological mode of self-regulation theory is based on studies demonstrating that early experience essentially primes or programs the physiological response to stress in order to promote the expression of behaviors that are likely to be adaptive and advantageous within an expected environment. In environments that are high in social and economic resources and appropriately stimulating and supportive, attention, emotion, and stress physiology develop in ways that promote executive function ability and higher-order self-regulation. In contrast, in low resource, less predictable environments, attention, emotion, and stress physiology are more reactive and less conducive to executive function abilities. The application of the psychobiological model to executive functions is based in the neurobiology of PFC circuitry and considers how stress physiology may promote or limit the development of executive functions in the service of self-regulation in specific contexts (Blair & Raver, 2012).

Given the applicability of the psychobiological context model to self-regulation and the development of executive functions, at least three directions for future research are indicated. The first concerns the application of the model to education and the promotion of human development potential. Self-regulation, including the regulation of attention, emotion, and stress physiology, is a primary influence on educational achievement. Numerous studies with preschool and early school-age children have indicated that executive functions are robust predictors of academic achievement above and beyond measured intelligence (Blair & Razza, 2007; McClelland et al., 2007; Normandeau & Guay, 1998; Palisin, 1986) and provide support for the general theoretical model in which self-regulation is understood to be the basis for school readiness (Blair, 2002). Similarly, in older children, investigators have employed a social cognitive approach (Dweck & Leggett, 1988) to examine aspects of self-regulation relating to self-perceptions (Skinner, Zimmer-Gembeck, & Connell, 1998), self-attributions (Eccles & Wigfield, 2002), self-discipline (Duckworth & Seligman, 2005), and motivational orientations (Elliott & Dweck, 1988) that are conducive to engagement and persistence in academic learning tasks (Dweck, 1999). Future work on self-regulation and academic achievement could profitably examine bidirectional relations among executive functions and attention, and

emotion and stress physiology, and consider the extent to which particular types of experiences and educational curricula, from the perspective of the Yerkes–Dodson principle, lead to optimal levels of arousal and engagement.

In this, a second direction for future research is to consider implications of the psychobiological model to provide support for self-regulation in adults, particularly adult self-sufficiency and self-regulation in contexts such as parenting and teaching in preschool and the early elementary grades. Supporting self-regulation in adults could lead to substantial “dual generation” benefits for children. In doing so, it is important to keep the multilevel psychobiological nature of self-regulation in mind. Although it may be tempting to attribute self-regulation failures in adults to a failure of will and lack of self-control, the psychobiological model of self-regulation indicates that the ability to plan, problem-solve, and monitor goals and actions are shaped by and in some instances overridden by nonconscious (automatic) reflexive or reactive aspects of self-regulation in attention, emotion, and stress response systems. The automatic aspects of self-regulation include processes such as the biasing of attention, in which repeated prior experience and rumination cause attention to be immediately and habitually drawn to some aspect of a given stimulus or situation that triggers specific behavioral and psychological responses (Adenauer et al., 2010; Öhman et al., 2001); implicit attitudes in which individuals hold unthinking beliefs and stereotypes that shape attention, emotional responses, and behavior (Papies, Stroebe, & Aarts, 2009); and priming and motivational effects in which preferences or aversions are formed to previously presented but not consciously recalled stimuli (McCullough, Ferguson, Kawada, & Bargh, 2008). Each of these nonconscious aspects of psychological functioning can frame the way in which an individual views a specific situation or self-regulation challenge with implications for the effortful, intentional control of behavior.

A third direction for future research concerns the applicability of the bidirectional model of executive functions to research and theory on the proposition that self-regulation is a limited resource (Baumeister, Vohs, & Tice, 2007; Schmeichel & Baumeister, 2004). The limited resource model suggests that failures of self-regulation result from a depletion of as yet unspecified self-regulatory resources. As well, the limited resource model identifies executive functions as central to self-regulation ability and as being particularly vulnerable to resource depletion. Data in support of the limited resource model are consistent with the psychobiological model of self-regulation. The bidirectional model suggests that the depletion of regulatory ability is a function of the relation of stress physiology to neural activity in PFC circuits that support executive functions. With repeated regulatory challenges, the activation of attention, emotion, and stress physiology in response to those challenges will rise to levels that are not conducive to executive functions. In terms of the Yerkes–Dodson principle, self-regulation in the limited resource model is a complex cognitive ability and as such is most easily accomplished when arousal is in an optimal range. When arousal is outside this optimal range, whether at the low or high end of the inverted-U-shape curve, self-regulatory attempts are more likely to meet with failure. Although the limited resource model generally refers to self-regulatory strength and to self-regulation capacity as a muscle, it may be that an analogy to an engine in which stress hormones are more or less literally the fuel that powers the engine may be equally apt.

In contrast, however, the psychobiological model is also consistent with the idea that in the condition of “depletion” following a self-regulation challenge, attention shifts

automatically to intrinsically appealing and satisfying types of goals; something like indulging oneself after having engaged in an effortful process. Here the understanding of intentional self-regulation is not as a limited capacity system so much as a characteristic of human nature; that is, it is in our nature after completing a controlled effortful goal to shift motivation to a more rewarding, less effortful pursuit; consumption rather than acquisition, exploitation rather than exploration (Inzlicht, Schmeichel, & Macrae, 2014). Such an understanding of the give and take between automatic and effortful aspects of self-regulation is consistent with a growing number of research studies indicating that the “depletion effect” is overcome by simple actions such as changing one’s motivational framing (Muraven & Slessareva, 2003), affirming a core value (Schmeichel & Vohs, 2009), or holding the belief that willpower is controllable by effort rather than an inherent characteristic of the individual (Job, Dweck, & Walton, 2010). These studies indicate that just as intentional self-regulation can be hijacked by implicit attitudes and beliefs about the self, so can it be supported by these processes. They suggest that self-regulation can be enhanced by harnessing the automatic aspects of self-regulation to work for rather than against the intentional effortful aspects.

A fourth and final somewhat more mundane but essential direction for future research concerns ongoing advances in the measurement of executive functions. Research and theory have been increasingly clear in the definition and measurement of executive functions (Garon, Bryson, & Smith, 2008; Miyake et al., 2000; Zelazo et al., 2003) and the differentiation of executive functions from other aspects of cognitive ability, particularly general intelligence (Blair, 2006). The measures available to researchers interested in executive functions, however, have for the most part been adapted from clinical neuropsychology and originally designed to identify failures of executive functions in the instance of damage to specific brain areas. Although this tradition has been invaluable in identifying the types of tasks that elicit executive functions, the focus in neuropsychological research on the presence or absence of executive ability rather than the demarcation of a continuum of ability renders these tasks less suitable for developmental use, particularly the study of intraindividual change. Low levels of correlation both within a given aspect of executive function such as inhibitory control, cross-sectionally and longitudinally, as well as across aspects of executive function, suggest the need for further theory and data that can account for specific patterns of correlation within individuals. It is likely that the psychobiological model of self-regulation can fill this role by specifying patterns of associations that are based on the balance between more automatic and more effortful aspects of self-regulation and relying on neural and physiological as well as behavior evidence to confirm the reliability and validity of measures.

In conclusion, ongoing examination of executive function development longitudinally in relation to measures of attention, emotion, and stress physiology will help to validate the construct and begin to provide data on the normative developmental course of executive functions and their role in self-regulation development in childhood. Further research including improved measures will help to clarify the relation of developmental trajectories of executive function abilities to the self-regulation of behavior and attention, and to salient indicators of success in life (e.g., school achievement; prosocial behavior; and relative stability in friendships, jobs, and romantic relationships). Although there remains a great deal to be learned, this chapter has outlined ways in which biology and experience are intertwined in self-regulation development and how self-regulation both influences and is influenced by the environment. While top-down processes of executive

function are a mechanism of self-regulation, bottom-up processes of emotion, attention, and the stress response physiology affect executive function ability such that the relation of executive functions to self-regulation generally is best characterized as bidirectional.

ACKNOWLEDGMENTS

This work was supported by the National Institute of Child Health and Human Development (Grant Nos. R01 HD881252, R01 HD51502 P01 HD39667).

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CHAPTER 24

Self-Regulation Training

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In light of the myriad benefits conferred by self-regulation that are described elsewhere in this volume, a natural question for scientists and laypeople alike to ask is whether self-regulation can be improved with training. A good deal of research and theorizing has been done to answer this question, and the purpose of this chapter is to review the aspects of that literature that are most pertinent to self-regulation and indicative of the direction of the field as I see it. The plan is to review key theoretical models that describe how self-regulation might come to be strengthened or improved with training, then turn to the empirical literature that attempts to test those theoretical ideas. Next, I review some of the key conceptual issues that emerge when thinking about whether and how self-regulation can be improved with training, and attempt to provide a clearheaded analysis of how it would be most fruitful for researchers to think about those issues. Finally, I close by describing an emerging approach that grounds self-regulation training in neuroscientific evidence, thereby resolving some of the issues that have been problematic in previous work.

But, before all that, I must first set the scope of the chapter by defining how I'll be using the terms *self-regulation*, *training*, and *improvement*. Definitions in this area can be thorny, so my goal for the present purpose is to offer reasonable and broad ones that allow us to move forward briskly to the question at hand, without getting stuck for too long in the underbrush.

WHAT DO I MEAN BY SELF-REGULATION?

Self-regulation is defined here as the process of purposefully directing one's actions, thoughts, and feelings toward a goal (Carver & Scheier, 2011). A *goal* is a cognitive construct that specifies an intended outcome, typically one that is relatively long in duration and wide in scope compared to immediate or hedonic goals. For example, "quit smoking"

is a goal that might require self-regulation for a smoker because it would compete or conflict with the immediate goal to “smoke a cigarette.” My working definition, then, is that self-regulation is the capacity to enact psychologically distant goals in favor of psychologically proximal ones. It is noteworthy that in this definition, self-regulation includes not only overriding or inhibiting prepotent responses (typically referred to as *self-control* or *inhibitory control*, an avoidance action) but also biasing behavior toward desired responses, usually in the face of prepotent alternative responses or mere inertia (sometimes referred to as *goal striving*, an approach action).

Self-regulation under this definition is a broad construct in both content and temporal scope. It involves directing behavior toward a goal in a way that endures over time and also accommodates other, ongoing goals and the constraints of everyday life. In a laboratory, a smoker may be given a choice between smoking one or zero cigarettes; but *in vivo*, that person can smoke or engage in a substitute behavior, or distract him- or herself, or tough it out, or even smoke two cigarettes instead of one. In my definition, self-regulation is the process of guiding one’s behavior, moment to moment, day after day, in a way that generally promotes progress toward a goal or set of goals, and as such necessarily plays out in a multitude of ways depending on contextual factors and momentary constraints. Self-regulation therefore requires a range of skills, including self-control, planning, and other executive functions, but, importantly, is not limited to just those skills (Inzlicht, Berkman, & Elkins-Brown, in press). Successful self-regulation also requires the motivational capacities to want and enjoy behaviors in line with the goal, and to prioritize it above competing goals, tempting alternatives, or simply doing nothing. Above all, self-regulation toward a goal requires an overarching mechanism to enable individuals to attend to, evaluate, and enact a diverse range of goal-consistent behaviors across a variety of contexts and for an enduring period of time.

What Is the Role of Executive Function in Self-Regulation?

It is intuitive that there would be a relationship between self-regulation and *executive function*, which refers to a suite of high-level cognitive processes, including working memory, attentional control, and inhibitory control. All else being equal, it seems that people who are smart, mentally flexible, and facile with their mental resources are more likely to reach their goals. Indeed, there is some evidence that this is the case, for example, the fact that people with higher (vs. lower) levels of working memory capacity spontaneously engage in emotion regulation following negative feedback (Schmeichel & Demaree, 2010; Schmeichel, Volokhov, & Demaree, 2008). I have no doubt that better, faster, or more efficient executive functioning confers an advantage when it comes to self-regulation.

Nonetheless, executive function is not the same as self-regulation. It is neither necessary nor sufficient for goal attainment: People with poor working memory reach their goals sometimes, too, and people with exquisite inhibitory control have been known to fall short. More critically, the near-conflation between executive function and self-regulation in the literature (see, e.g., Hofmann, Friese, & Roefs, 2009) has led to an outsize view of the role of cognitive function in goal attainment relative to other pertinent factors, such as motivation. This pattern is also apparent in the literature on self-regulation training. Therefore, in the sections that follow, I am careful to draw a distinction between studies that target executive function per se and those that target self-regulation more broadly, and to focus on the latter.

WHAT DO I MEAN BY *TRAINING*?

As foreshadowed in the previous section, studies have varied quite a bit in the level of specificity of their training target. Some studies have sought to improve the quite narrow construct of proactive attentional control (a presumptive component of cognitive control), whereas others have targeted broad constructs, such as self-regulation or goal attainment. In light of the complex relationship between the narrower and broader constructs in this area, it is logical to focus this review specifically on the topic of self-regulation training. More to the point, in this chapter, I define *training* to refer to programs that, through a variety of means, aim to increase self-regulation in the broader sense of the term. Therefore, the sizable literatures on executive function training in the narrow sense (working memory, attentional control, etc.) are glossed over to the extent that they do not examine the degree to which the training causes changes in other skills besides the focal skills that promote self-regulation.

WHAT DO I MEAN BY *IMPROVEMENT*?

It seems like an odd question to ask—to improve simply means to get better, right? The issue here is to differentiate *training*, which I define as protocol that actually improves self-regulation, from learning or practice effects, which improve only the focal task. People generally get better at any task they do over and over again: This is a practice effect. But the construct self-regulation extends beyond any one task, so genuine improvement in self-regulation is reflected in performance increases in other tasks that index self-regulation but were unpracticed during the training: This is a training effect. A carryover from one (practiced) task to another (unpracticed) is also called *generalizability* or *training transfer*. Sometimes people even distinguish between near and far transfer in recognition of the fact that the distance between tasks in conceptual space varies. For example, if training in the 100 yard dash improves one's time on the 200 meter sprint, then that might be called near transfer; if the same training improved one's maximum bench press weight, then that might be called far transfer.

Most of the time when people talk about improving self-regulation, they are referring to far transfer in the sense that they expect the training to generalize beyond the task or set of tasks used in the training to other, novel tasks. Few people would be interested in self-regulation training if it only meant getting better at the Stroop task or the cold-pressor challenge. Instead, the promise of self-regulation training lies in its ability to generalize to other skills that we care about as much or more than the training task, but that are difficult to improve in other ways, such as kicking a bad habit, eating better, or exercising more. Throughout this chapter, I draw a distinction between practice effects, near transfer, and far transfer, and emphasize theories and studies that focus on far transfer. As we will see, the question of what kind of transfer constitutes successful training and how to achieve it is a topic of ongoing and vigorous debate in the training literature.

THEORETICAL MODELS OF SELF-REGULATION TRAINING

The first step in designing a program to train self-regulation is to articulate a theoretical model for how self-regulation works, and ideally one that provides a point of leverage

within that model that can be targeted for behavioral or psychosocial intervention. I do not belabor the first cause given the excellent coverage of theories of self-regulation in this volume. Instead, I briefly review a few theoretical models of self-regulation, with an emphasis on their stances on how self-regulation might be improved through training.

The Strength Model

The most prominent model of self-regulation training in the social psychology literature is the strength or resource model (Baumeister, Vohs, & Tice, 2007). According to this model, self-regulation in all domains draws on a common, limited resource. Though acts of self-regulation deplete the resource in the short run, consistent self-regulation engagement can strengthen the resource in the long run. A distinct feature of the strength model is its characterization of the resource as one that is shared across domains, in other words, that various forms of self-regulation all draw from the same well. This model therefore lends itself nicely to the possibility of domain-general improvement in self-regulation if the resource itself can be strengthened or enlarged.

A useful way to evaluate models of self-regulation training is to look at their ability to adapt to various populations and to scale to larger samples. The strength model's view of training is inherently flexible and therefore easily adaptable. Any activity that draws on the common self-regulatory resource is a potential candidate to be used for training. If someone has trouble regulating his or her emotions, then he or she might instead train on a behavioral task; if someone has problems controlling his or her substance use in a particular context, then he or she could practice regulating his or her emotions in another one. Scientists have now identified a number of ways that self-regulation tasks may be delivered en masse via computers or mobile devices. According to the strength model, even those digital forms of self-regulation may be used for practice and thereby increase self-regulatory resources in other domains.

Motivational Models

Other theoretical models of self-regulation emphasize the motivation to engage in self-regulation rather than the raw ability to do so. They focus on the *will* rather than the *way*, as it were, as their leverage point. In this category I include self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2000), self-concordance theory (Sheldon & Houser-Marko, 2001), self-affirmation and other consistency theories (Festinger, 1957; Steele, 1988), and valuation-based models of self-regulation (Berkman, Kahn, & Livingston, in press). The common theme across these models is that goals that are, or are perceived to be, closely related to one's self (meaning one's sense of identity, self-concept, core values, etc.) are more likely to be pursued robustly and ultimately achieved than are goals that are motivated from without. The specific pathways by which closeness-to-self enacts its effects on goals vary across the models and include mechanisms such as intrinsic versus extrinsic motivation, self-concordancy, subjective value, and ego consistency. Though the details vary, all of these models share the assumption that some goals are more closely linked with the self than others, and are thereby endowed with particular importance because of the fundamental need for a coherent and positive sense of self (Crocker & Major, 1989; Crocker & Wolfe, 2001).

These models are more descriptive than proscriptive and as such are largely silent on the issue of whether self-regulation can be improved by training or some other means. The models nonetheless can be used to generate predictions about how to improve

self-regulation based on how they describe the relationships among their central constructs. For example, if intrinsic goals are more likely to be achieved than extrinsic ones, then an implied intervention to improve self-regulation is to convert an extrinsic goal to an intrinsic one. Despite the intriguing possibilities that arise from the idea of motivational interventions to improve self-regulation, there are very few studies that attempt to test motivational theories of self-regulation in that way.

An interesting contrast between the strength model and motivational models is in their implied intervention targets. In the former, self-regulatory strength is conceptualized to be a property of the individual's general capacity, whereas in the latter, self-regulatory strength is cast as a property of the goal. It follows that training interventions based on the strength model would have effects on a range of goals (because the training target is the individual), whereas interventions based on motivational models would affect one particular goal (because the training target is the goal itself). Perhaps their limited scope accounts for the correspondingly limited enthusiasm for motivation-based self-regulation training interventions in the research literature. A related issue is whether it is even possible to "convert" an extrinsic goal to be intrinsic or self-concordant, or generally more self-related. If not, then a natural target for interventions based on motivational models of self-regulation would not be the goal itself, but rather the process of goal selection. Here, the hypothesis is that self-regulatory success can be increased by electing to pursue goals that are intrinsic or central to one's self in the first place.

Cognitive Models

Other theories conceptualize self-regulation training in terms of cognitive factors such as attentional processes, beliefs about oneself, and habit learning. According to these models, self-regulation success is alternatively a function of self-efficacy (Bandura, 1991), beliefs about the nature of self-regulatory resources (Molden & Dweck, 2006), or the degree of cognitive association between the goal and relevant environmental cues (Fishbach, Friedman, & Kruglanski, 2003; Gollwitzer, 1999; Mann & Ward, 2007). This class of theories is admittedly broader than the previous two, but it is useful to group cognitive models together for the present purposes because the kinds of interventions they deploy to increase self-regulation are related to each other, namely, in the sense that interventions grounded in cognitive models typically involve training based in some form of associative learning or conditioning broadly aimed at reinforcing associations between certain cognitions and behaviors.

The implied targets for intervention in these models are individual factors, in the case of self-efficacy and beliefs models, and goal-specific factors, in the case of attentional and associative models. Either way, the implied training interventions are more straightforward than those in motivational models: Beliefs can be changed through information delivery, and attention and associations can be changed through reinforcement learning. These models have also received limited empirical attention in the empirical literature on self-regulation training despite their elegant simplicity, though the issue of generalizability across goals and contexts is one that crops up in the existing studies.

Summary

The strength model, motivational models, and cognitive models are contrasting theoretical frameworks for understanding how self-regulation might be improved through

intervention. However, from a broad perspective the models all make essentially the same prediction—that self-regulation is not a fixed property of a goal or a person, but rather can be improved through behavioral means—even though they draw on a diverse range of theoretical constructs. It is from that removed distance that the models can be compared in a meaningful and productive way. Allowing each model to operate on its own terms, is there empirical evidence that self-regulation can be improved based on its predicted pathways? In this sense, the self-regulation training paradigms suggested by each of the models can be considered as empirical tests of the models themselves. In the following section, I review the empirical literature on self-regulation training, with particular emphasis on what those data can reveal about the theoretical models and on the theoretical issues that emerge across the theories.

EMPIRICAL EVIDENCE FOR AND AGAINST SELF-REGULATION TRAINING

The number of training studies in the psychological literature is relatively small compared to the overall number of studies on self-regulation, but is still sufficient to serve as the basis for a useful review and synthesis. In fact, it is my impression that the number of training studies is accelerating right now due to the high level of practical importance they could have for large-scale societal problems such as drug use, unhealthy food intake, and other risky behaviors. If that is the case, then right now is the ideal time to take stock of what works and what does not in terms of theory-informed self-regulation training programs. My purpose in this section is to review a representative, if not comprehensive, sample of training studies that have their roots in each of the theoretical models described earlier.

The Strength Model

There have been about a dozen training studies based on the strength model prediction that practice in one form of self-regulation will generalize to other forms by increasing a general self-regulatory capacity or strength. These studies are listed in Table 24.1. For the most part, these studies involve randomly assigning participants to practice a common, everyday task that involves a self-regulation or control task, then measuring their performance on another, unpracticed form of self-regulation. For example, 2 weeks of avoiding contractions and slang in everyday speech reduces the effect of stereotype suppression on anagram persistence (Gailliot, Plant, Butz, & Baumeister, 2007), and 2 weeks of foregoing sweets or practicing a handgrip exercise twice a day increases the likelihood of cigarette smoking cessation (Muraven, 2010a). Table 24.1 contains further details about the kinds of manipulations and dependent measures that were used, as well as the observed effects.

This set of studies has a number of notable features and limitations. The strengths of these studies include the variety of tasks deployed for training (ranging from journaling to squeezing a handgrip to practicing good posture and mood regulation), as well as for the outcome variables (including cognitive tasks, cold-pressor tolerance, and urges toward intimate partner violence), and a good deal of geographical diversity of the laboratories involved. Their weaknesses include the limited sample sizes (ranging from 38 to 122 participants), the uniformity of the duration (all exactly 2 weeks except for the three

studies I discuss further below), and the lack of longer-term follow-up to assess durability of the training. There is also considerable variation in the quality of the control groups used, ranging from relatively tight control of participants who exerted regular effort and even reported on their self-control attempts (Muraven, 2010a, 2010b) to waiting-list participants who engaged in no alternative treatment (Gailliot et al., 2007).

On the whole, these studies provide evidence that practicing one form of self-regulation increases performance in at least one other. A meta-analysis (Hagger, Wood, Stiff, & Chatzisarantis, 2010) of seven of the studies listed in Table 24.1 found the average

TABLE 24.1. Self-Regulation Training Studies Based on the Strength Model

Study	Self-control training	Training duration	Self-control dependent variable	Total <i>N</i>	<i>t</i> or <i>F</i>
Bertrams & Schmeichel (2014)	Journaling, attending to logical consistency	1 week	Anagrams after self-controlled typing task	49	$F = 5.05$
Bray et al. (2015)	Handgrip practice twice daily	2 weeks	Maximal exertion on a cycling exercise task	41	$F = 28.54$
Denson et al. (2011)	Nondominant hand use	2 weeks	Noise blast aggression	90	$t = 2.15$
Finkel et al. (2009)	Speech regulation	2 weeks	Intimate partner violence inclination after attentional control	40	$F = 4.65$
Gailliot et al. (2007, Study 1)	Speech regulation	2 weeks	Solving anagrams after stereotype suppression	38	$F = 7.02$
Gailliot et al. (2007, Study 2)	Speech regulation or nondominant hand use	2 weeks	Solving anagrams after stereotype suppression	98	$F = 2.08$
Hui et al. (2009)	Stroop task	2 weeks	Cold-pressor tolerance after a concentration task	55	$F = 3.11$
Muraven et al. (1999)	Posture and mood regulation	2 weeks	Handgrip persistence	69	$F = 5.57$
Muraven (2010a)	Avoiding sweets or handgrip practice	2 weeks	Self-reported cigarette smoking (in smokers trying to quit)	122	$F = 5.93$
Muraven (2010b)	Avoiding sweets or handgrip practice	2 weeks	Stop-signal task	92	$F = 5.04$
Oaten & Cheng (2006a)	Study skills program	8 weeks	Visual tracking task during distraction	45	$F = 359.98$
Oaten & Cheng (2006b)	Physical exercise (aerobic classes and weights)	8 weeks	Visual tracking task during distraction	24	$F = 23.80$
Oaten & Cheng (2007)	Financial monitoring	4 months	Visual tracking task during distraction	49	$F = 48.13$

effect size to be quite large ($d = 1.07$), and a more recent meta-analysis that statistically corrected for publication bias suggested that the average effect across all 13 studies is $d = 0.60$ (Inzlicht & Berkman, 2015). This evidence provides reason to be optimistic that self-regulation training might work, and that it potentially works quite well.

However, even without conducting a formal meta-analysis, there appears to be a good deal of heterogeneity in the effects. (And, indeed, the Hagger et al. [2010] meta-analysis of seven of the studies found statistical evidence of heterogeneity among the effects). The effect sizes range from a modest 0.1 to an astounding 8.59! Three of the largest effect sizes, which are up to an order of magnitude larger than most of the others, come from a series of studies by Oaten and Cheng (2006a, 2006b, 2007), all of which involved training for 2 months. Several features of these studies lead me to believe that they do not actually test self-regulation training. First, the main dependent measure is a visual tracking task that does not appear elsewhere in the literature, is not validated, and does not appear to require self-regulation. Second, the training protocols involved study skills training (2006a), gym attendance (2006b), and self-guided financial monitoring (2007), none of which require more self-regulation than many people exert on a daily basis. Indeed, the descriptions of the protocols are insufficiently detailed to assess whether participants engaged self-regulation at all. For example, the only detail about the physical activity training is that “exercise programmes were tailored to suit the individual by gym staff, and included aerobic classes, free-weights, and resistance training” (2006b, p. 719). Third, the estimates of the size of the ego depletion effect (which were provided along with the estimates for the training effects) are also outliers relative to other, more reliable estimates of the effect size, such as those derived from meta-analyses, suggesting that the measures used in these three studies may not have tapped the same construct as the one assessed by other studies in the strength model literature.

When these three studies are eliminated from the sample, the bias-corrected effect size of self-regulation training shrinks to $d = 0.17$, confidence interval = $-0.07, 0.41$ (Inzlicht & Berkman, 2015). This number is small but still positive, and more in keeping with the size of an effect that one might expect to be caused by 14 days of regular but nonetheless moderate self-regulation exertion. It simply does not stand to reason that watching one’s language or using one’s nondominant hand for a few weeks would increase self-regulatory ability across domains by a full standard deviation. If that were the case, then anyone who went on an extended vacation with the in-laws or had to wear a sling after a sports injury would be noticeably more self-regulated as a result—dubious hypotheses, both.

Even supposing a modest but positive effect, these results bring up a number of interesting theoretical questions. First, self-regulation training studies that are grounded in the strength model are inherently ambiguous with regard to the nature of the resource that is being trained because the dependent variable is, by design, qualitatively different from the variable targeted by the training task. What exactly is the “resource” that hand-grip strength and Stroop performance both require? Second, what do the participants think they are doing during training and during the dependent measure assessments? The answer is not provided in most of the studies, but the question is quite relevant in light of the facts that self-regulation (and self-control and willpower) are socially and personally desirable, and, as reviewed below, that beliefs about one’s own capacities in a domain can influence performance in that domain. And, third, is a set of questions about the real-world implications of these results: Do the effects endure across time? Do they scale with increasing intervention dosage? Are their effects even more powerful during critical

developmental periods such as early childhood? These are important questions, and I return to them in the sections that follow.

Motivational Models

A number of theoretical models suggest that self-regulation could be improved by increasing goal-directed motivation. At present, psychologists face a dearth of tools to easily boost motivation, but there is some evidence in support of the motivation idea. This section briefly reviews the relevant literature on “motivation training,” such as it is, with particular emphasis on studies testing its effect on self-regulation.

Several studies provide support for the idea from self-determination theory that autonomy or choice increases motivation to engage in self-regulation, mostly in the health domain. For example, a brief, physician-delivered physical activity intervention designed to increase autonomy about choices related to physical activity and relatedness with the physician about the decisions (two key constructs in self-determination theory) led to increases in physical activity for up to 13 weeks following the intervention (Fortier, Sweet, O’Sullivan, & Williams, 2007). Similarly, a cigarette smoking cessation intervention that focused on building autonomy about the choice to quit smoking, delivered in person by a health counselor, increased autonomous motivation and thereby reduced smoking at 1- and 6-month follow-up points relative to a treatment-as-usual control (Williams et al., 2006). Like many randomized controlled trials, these studies have impressive and enduring effects but use a multipronged “shotgun” intervention approach similar to motivational interviewing (Markland, Ryan, Tobin, & Rollnick, 2005) that makes the precise mechanisms difficult to pinpoint.

There is also some promising work based in self-affirmation theory that indicates affirming one’s core values can increase self-regulation or related constructs. This work is grounded in the complementary ideas that engaging in self-regulation is often psychologically threatening because it implies that one’s current and past behavior is wrong or bad, and that affirming other, valued domains protects the self against that threat, thereby enabling self-regulation in the original domain to occur. This general pattern plays out when, for example, self-affirmation eliminates the ego depletion effect (Schmeichel & Vohs, 2009) or facilitates engagement with health-related messages that otherwise would be threatening or scary (Harris & Epton, 2009; Reed & Aspinwall, 1998). Self-affirmation is not often used as an intervention on self-regulation per se, but its positive effect on several relevant constructs is fairly well established (Cohen & Sherman, 2014). For instance, writing about one’s own core values (as opposed to the values of another person) appears to have lasting effects on educational outcomes among disadvantaged samples (Cohen, Garcia, Purdie-Vaughns, Apfel, & Brzustoski, 2009), on alcohol intake in heavy drinkers (Armitage, Harris, & Arden, 2011), and on medication compliance among people who start out with low rates (Ogedegbe et al., 2012). Though promising, it is important to qualify this summary by noting that evidence for the effects of self-affirmation on self-regulation and behavior change has been mixed in terms of their direction (Vohs, Park, & Schmeichel, 2013) and their durability (Harris & Epton, 2010).

I would be remiss to overlook a final class of “motivation training” interventions that adopts the perspective from economics that all behavior, including self-regulation, is motivated by subjective utility, which is, of course, interchangeable with money. Addiction researchers capitalized on this insight when they developed contingency management

treatment, wherein people are paid for abstaining from an addictive substance (Bigelow & Silverman, 1999). A meta-analysis found contingency management to have an effect size of $d = 0.42$ on treatment for alcohol, tobacco, and illicit drugs, which was larger than that for therapy ($d = 0.25$) and outpatient treatment ($d = 0.37$), and comparable in strength to methadone treatment for opiate use (Prendergast, Podus, Finney, Greenwell, & Roll, 2006). Similarly, “precommitting” to buying more healthy foods at the risk of losing financial incentives is more effective than having the incentives alone (Schwartz et al., 2014), though part of the efficacy of this manipulation may be related to loss aversion and not monetary incentives per se. Another line of work relating utility to self-regulation has found that monetary incentives increase persistence at exercise (Cabanac, 1986), endurance on a cold-pressor task (Baker & Kirsch, 1991), and performance on a difficult cognitive task (Boksem, Meijman, & Lorist, 2006). Notably, monetary incentives appear to endure only as long as the payment is available (Volpp et al., 2008). Still, as long as the money is there, a blunt but effective way to improve self-regulation is achieved by buying it.

Cognitive Models

A variety of cognitive models serves up a smorgasbord of relatively simple interventions to increase self-regulation. There are far too many to provide a thorough review in the limited space I have here, so I focus on the three families of interventions that are most prevalent or that I think offer the most promising avenue to cognitive-based self-regulation improvement. Also, note that I omit discussion of interventions aimed at “pure” executive functions, such as working memory or inhibitory control, for reasons described earlier. However, good coverage of those topics as they pertain to training-related improvement in performance can be found elsewhere (Diamond & Lee, 2011; Melby-Lervåg & Hulme, 2013; Owen et al., 2010).

By far the cognitive manipulation that has the best documented effects on self-regulation is implementation intentions (Gollwitzer, 1999). Implementation intentions are simple if-then self-statements that create an association between potential hurdles along the path toward goal progress (e.g., “If someone offers me a cigarette at the bar . . .”) and a concrete plan to overcome them (“then I will politely decline and state that I am chewing gum”). Interventions based on implementation intentions are alluringly simple, usually involving no more than a single session in which participants brainstorm potential obstacles that could impede goal progress and come up with plans to deal with each (Gollwitzer & Brandstatter, 1997; see Gollwitzer & Oettingen, Chapter 13, this volume). These kinds of interventions have lasting effects (meta-analytic $d = 0.65$) on a range of goals, including personal, academic, health, and consumer-related ones (Gollwitzer & Sheeran, 2006). The effects of implementation intentions can be strengthened further by combining them with a mental contrasting induction, in which participants mentally elaborate on the details of the gap between the present state and a desired future outcome (Adriaanse et al., 2010; see Gollwitzer & Oettingen, Chapter 13, this volume). Counterweighed against the simplicity of implementation intentions is the significant limitation that they are goal-specific, and even hurdle-specific, which means that they are not expected to (and indeed do not) increase self-regulation beyond the focal goal.

More recently, another cognitive manipulation has been suggested that does purport to increase self-regulation writ large. The manipulation targets people’s beliefs about

the nature of their own self-regulatory resources, and is based in Dweck's long-standing theory about the power of lay beliefs (e.g., Molden & Dweck, 2006). The idea is that beliefs about self-regulation, rather than self-regulatory resources per se, are what determine self-regulation performance most of the time, including the case of everyday goal pursuit. The idea is compelling, and the larger theoretical framework is quite powerful, but to date only one longitudinal study shows an effect of self-regulatory beliefs on self-regulatory performance (Job, Dweck, & Walton, 2010, Study 4). In that study, participants who believed their self-regulatory resources were limited, as compared to participants who held unlimited self-regulation beliefs, had a larger number of self-regulatory failures (e.g., more unhealthy eating and procrastinating). However, this effect held only during finals, a time of high self-regulatory demands, and is correlational because beliefs were not manipulated in that study. Also, a well-powered conceptual replication from my laboratory failed to show an effect of a longitudinal self-regulatory beliefs manipulation on everyday goal outcomes across 30 days (Miller-Ziegler & Berkman [2012], unpublished data, available from the author by request). It is likely that there is some effect of lay beliefs on self-regulation, but this line of inquiry is still nascent, and reliable measures and tools are not yet available.

A final way that cognitive manipulations can influence self-regulation is via identity. The idea is that people's self-concepts can be pushed around to some extent by cognitive factors such as framing or construal. Using this observation as a starting point, psychologists have shown that a "noun-verb" manipulation can improve self-regulation, presumably through a subtle shift in the extent to which the behavior in question is construed as identity-relevant. In one study, phrasing questions about voting intentions in identity-relevant terms (noun: *being a voter*) instead of action terms (verb: *voting*) increased voting intentions and actual turnout in statewide elections (Bryan, Walton, Rogers, & Dweck, 2011). In another, participants were less likely to cheat by claiming money to which they were not entitled if that behavior was described as a (negative) identity (noun: *being a cheater*) instead of an action (verb: *cheating*; Bryan, Adams, & Monin, 2013). Following this path is a promising direction for the future of self-regulation interventions because it is low-cost, quick to administer, and easily scalable to a broad range of populations and types of desired identities.

Summary

Psychologists have used a variety of means to intervene on self-regulation, with more or less success. At least 10 studies have tested the strength model's prediction that regular practice in one domain of self-regulation has an effect on others, and have found moderate support. Other theories predict that self-regulation can be increased through motivational means, but specific interventions that target motivation alone, and via psychological instead of monetary means, have been elusive. In contrast, a variety of cognitive manipulations are available to increase self-regulation, notably, those including implementation intentions, but most of these target one specific goal and not self-regulation in general.

A number of conceptual issues lurked beneath the surface throughout the foregoing review. In the next section, I dredge them up in an attempt to shed some daylight on what will be critical issues to consider for the next phase of research on self-regulation training.

CONCEPTUAL ISSUES IN SELF-REGULATION TRAINING

What follows is an incomplete list of the theoretical issues that face the field. These are not necessarily the ones that are the hardest to tackle or the most relevant to other areas of self-regulation, but I believe these are the most pressing ones for researchers in this area to consider as we move forward with our self-regulation training interventions.

What Gets Trained?

One of the biggest conceptual questions regards the intervening mechanisms of the effects: What is actually being trained? This is a deceptively simple question when it comes to a construct, self-regulation, that is measured behaviorally but whose underlying mechanisms are still obscured despite decades of research. The question could be rephrased: When an intervention increases self-regulatory behavior, what contributed to that behavioral improvement? The answer to the question is entirely dependent on your model of what self-regulation is. If you think self-regulation draws on an unseen resource, then the training expanded the resource; if you think self-regulation is driven by motivation, then the training must have boosted motivation. How can training studies adjudicate among these possibilities, while acknowledging that most of the possible mechanisms (e.g., motivation or a willpower resource) are unobservable?

I have three modest answers to this question. One is to eliminate the possibility of mere practice effects by mixing up the training tasks and using different training and dependent measures. This simple option is commonly adopted by studies based on the strength model, but less so in other studies and in other training literatures (e.g., working memory training; see Shipstead, Redick, & Engle, 2012). Another is to measure, or attempt to measure, potential mechanisms of the training, and to include several possible alternatives to your theoretical model. At this early stage of scientific progress in self-regulation training, most researchers are understandably focused on demonstrating effects rather than establishing their mechanisms, though there are some laudable exceptions (e.g., Muraven [2010a, 2010b] showed that his training effects were not attributable to perceptions of effort or beliefs about the training itself). My final recommendation is to use adequate control groups. A surprising number of studies used a no-contact or waiting-list control condition, though, again, the studies by Muraven are a notable and welcome exception. There is a trade-off in interventions between the tightness of the control condition, which, in the extreme, enables the scientist to pinpoint the essential ingredient in the treatment, and the likelihood of finding a difference between the two conditions. An important step that a field must take to mature scientifically is to embrace the former at the cost of the latter.

The deeper issue, in my mind, is theoretical rather than methodological. The dominant models lack specificity regarding exactly how self-regulation actually works. If, in the resource model, self-regulation is the speed of the car and the resource is the amount of gas in the tank, then what is the engine? By what means, in the lay belief model, does a mindset increase physical endurance on a handgrip task? Even newer models (e.g., Inzlicht & Schmeichel, 2012) that explicitly focus on the mechanisms of self-regulation and, by extension, how self-regulation can be improved by intervening on those underlying mechanisms, merely substitute one unobservable process for another. The next

generation of models must be more precise in naming the specific, measurable processes that give rise to self-regulated behavior, and in describing the nature of the interactions between them. For example, there is increasing focus on valuation (or subjective utility) as an underlying mechanism through which motivational factors such as reward, effort, and social influence contribute to self-regulation (Botvinick & Braver, 2015; Inzlicht, Legault, & Teper, 2014; Kable & Glimcher, 2007). Nonetheless, the fact that the field is awash in interesting and diverse theories of self-regulation, and that there is lively debate among proponents of the various models, is highly encouraging because it means that researchers are actively struggling to refine their theories to keep pace with the emerging evidence.

Practical Issues: Generalizability, Durability, and Scalability

Researchers interested in self-regulation training can learn a great deal about the challenges ahead by looking to related literatures in adjacent fields, such as working memory training, cognitive psychology, and executive function interventions from developmental psychology. Because these lines of inquiry have had more time to develop, both theoretically and empirically, they offer us a glimpse into the issues on the horizon and an opportunity to learn from the missteps of others. Three that are imminently on the horizon have to do with pragmatic questions we must answer if and when we find effective ways to increase self-regulation: generalizability, durability, and scalability.

Generalizability refers to the breadth of the effects of a training program. Probably the most appealing feature of the strength model with respect to training is that there is a single, common self-regulation resource, so strengthening it will produce general effects. Other models are almost a mirror image in terms of their potential for generalizability in that they predict focused interventions to affect behavior only in the domains they target. At the societal level, there is a case to be made for both kinds of training strategies: There is likely a large market that comprises individuals who want to increase their self-regulatory resources across the board; but there is also a market of individuals who can identify one or two problem areas that could benefit from precise intervention. These might be called *training to improve* and *training to remediate* populations, respectively. A natural direction for the training literature is to consider the breadth of generalizability that is expected and that is possible given a particular model, and to sample from the population of people who are likely to be interested in and benefit from training of that reach.

Durability refers to the length of time that the training effects will persist. This is entirely unexplored territory for self-regulation training, so I do not have much to say here besides the obvious: Durability is critical. Self-regulation training is likely to become little more than a historical curiosity unless we can find a way to use it to produce enduring change. A couple of the motivational theories explicitly describe the process by which changes in self-regulation can become long-lasting (e.g., Cohen & Sherman [2014] discuss how targeted self-affirmation can trigger an “adaptive cycle,” and Deci & Ryan [2000] describe a process by which internalized motives become integrated), but most are silent on that issue. I note that, unlike many interventions, some of the training protocols described earlier involve a “light touch” manipulation and might therefore be easily adapted into follow-up or “booster” sessions that could even be delivered remotely

(as described in the following paragraph). A self-regulation training protocol does not need to be one-shot to be enduring; it just needs to identify a mechanism to perpetuate its effects.

Scalability refers to ease of dissemination. The highest level of self-actualization that a theory can achieve is for its predictions to be put into practice at a population level. Many, if not all, researchers want not only to test our theories but also to use those theories to change people's lives for the better. Some theories, and, in particular, some experimental manipulations, scale-up better than others. For instance, motivational interviewing is relatively effective at increasing intrinsic motivation toward a goal, thereby increasing self-regulation, but it is highly labor intensive and impractical to deliver on a large scale. In contrast, interventions involving implementation intentions plus mental contrasting have been simplified to a one-page handout and can be self-administered by schoolchildren in a matter of minutes (Oettingen, Kappes, Guttenberg, & Gollwitzer, 2015; see Gollwitzer & Oettingen, Chapter 13, this volume). Along these same lines, some of the interventions and training protocols described here could be easily ported into digital forms for electronic delivery via computers, tablets, or smartphones, enabling them to reach rural and other populations that are difficult to contact (Berkman, Dickenson, Falk, & Lieberman, 2011). I advocate that evaluation of theories be based on not only their ability to prescribe an effective means to improve self-regulation but also on the ability of interventions based on those theories to actually reach people.

Beware the Placebo! Long Live the Placebo!

Do training effects amount to nothing more than placebo? Until we start using adequate control conditions, as noted earlier, we may never know. But here is another question that is also worth considering: Does it matter? What if merely convincing your participants that an intervention improves self-regulation is all that it takes to make an intervention effective? Placebo treatments have well-documented effects on a number of physical processes, and there is strong evidence that placebos could have equal or even greater effects on psychological ones (Shiv, Carmon, & Ariely, 2005). Indeed, several of the self-regulation interventions described here, such as lay beliefs and noun-verb framing, have placebo-like properties insofar as their effects depend on participants' perceptions instead of their capacities. A placebo-based intervention could potentially be made to be generalizable, durable, and scalable. It would be welcome news for public health if self-regulation intervention amounts, essentially, to persuasion.

This is not to say that placebos are panaceas. They are not. They certainly would not liberate us from the obligation of specifying the mechanisms of effects. Claiming that an intervention works because of a placebo effect is much closer to a redescription of the results than to an actual mechanistic explanation. But establishing a placebo effect on self-regulation would substantially advance theory (e.g., by contrasting with a capacity explanation) and would be highly appealing from a pragmatic perspective. The greatest challenge would probably be in figuring out a method to separate placebo effects from those attributable to other kinds of beliefs.

Still, all of this is predicated on the existence of some compelling data that, to date, do not exist. The next section provides a blueprint for theory-guided research in this area.

NEXT STEPS FOR SELF-REGULATION TRAINING THEORY AND RESEARCH

The idea that self-regulation can be improved with training is as intuitive as it is optimistic. It should be so, and all of us wish that it were so. In this chapter, I have reviewed theoretical models that explain why and how such training might work, described some of the empirical evidence for and against those models, and discussed sundry conceptual issues that have emerged, or soon will emerge, as the field moves forward. Throughout, I tried to foresee and discuss the directions that self-regulation training will be going in the coming years. Among these are increased focus on mechanisms, greater theoretical clarity about which mental processes contribute to self-regulation, and more attention to practical issues related to implementation.

Relevant to all of these is an understanding of the neural systems that contribute to self-regulation. This knowledge has implications for training because the rapidly accumulating wisdom about basic brain function can be leveraged to inform interventions to improve self-regulation (Berkman, Graham, & Fisher, 2012). For example, recent research from my laboratory has shown that cognitive control training causes a shift in key neural regions from later, more reactive activity to earlier, more proactive activity (Berkman, Kahn, & Merchant, 2014). This result prompted researchers to attend to aspects of the cognitive control training that turn out to be important but might have gone unnoticed if not for the neural data. As a result, several studies are now under way that test new interventions that were refined based on this information. As this sequence of events illustrates, theory-based interventions often proceed in an iterative manner, with basic science informing intervention work, which in turn prompts further basic research.

There is disparate yet tantalizing evidence that self-regulation can be improved with training. I hope that this review will serve future researchers as a framework to organize the extant evidence and to guide future training interventions based on the lessons we are now beginning to learn.

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CHAPTER 25

Effortful Control

Relations with Emotion Regulation, Adjustment, and Socialization in Childhood

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Our purpose in this chapter is to discuss the construct of effortful control and review literature relevant to its importance, development, and significance for optimal development in childhood. First, we review basic definitional and conceptual issues. Then we review literature on the emergence of effortful control in childhood. Next we consider the issue of its role in children's emotionality, moral development, empathy, adjustment, and social competence. Finally, we consider what is known about the socialization of effortful control, especially in the family.

THE DEFINITION OF EFFORTFUL CONTROL

Temperamental self-regulatory capacities are often called *effortful control*, defined as “the efficiency of executive attention—including the ability to inhibit a dominant response and/or to activate a subdominant response, to plan, and to detect errors” (Rothbart & Bates, 2006, p. 129). Effortful control pertains to the ability to willfully or voluntarily inhibit, activate, or change (modulate) attention and behavior, as well as to executive functioning tasks of planning, detecting errors, and integrating information relevant to selecting behavior. As a component of temperament, it is viewed as having some constitutional basis and as being an individual-difference variable that is relatively stable across time and contexts. Due to the role of executive attention in effortful control, effortful control is believed to come into play when resolving conflict (e.g., in regard to discrepant information), correcting errors, and planning new actions (Posner & Rothbart, 1998) and overlaps with, but is not identical to, the construct of executive functioning (see Zhou, Chen, & Main, 2012). Measures of effortful control tend to include indices of attentional regulation (e.g., the ability to voluntarily focus or shift attention as needed, called *attentional control*), behavioral regulation (e.g., the ability to effortfully inhibit

behavior as appropriate, called *inhibitory control*), and/or the ability to activate behavior when needed (even if someone does not feel like doing so, called *activation control*), for example, when it is needed to complete a task or to respond to a signal, or to persist on a task (e.g., Eisenberg, Spinrad, et al., 2004; Kochanska, Murray, & Harlan, 2000), as well as executive functioning tasks.

THE ROLE OF EFFORTFUL CONTROL IN EMOTION REGULATION AND SOCIAL FUNCTIONING: CONCEPTUAL ISSUES

Effortful control plays a central role in the self-regulation of emotion and related processes. For example, when people are experiencing (or are likely to experience) negative emotions, often they appear to use attentional processes such as distracting themselves by shifting their attention to something else or simply breaking off input from the emotion-inducing stimuli. They also may use inhibitory control, for instance, to mask the expression of negative emotion or to inhibit aggressive impulses when they are angered. Moreover, the planning capacities linked to effortful control (or executive attention) can be viewed as contributing to attempts to actively cope with stress, that is, active coping or engagement coping (Compas, Connor-Smith, & Saltzman, 2001). In situations in which people are experiencing negative emotion, they also may need to force themselves to take action to ameliorate the situation; that is, they may use activational control.

Eisenberg and colleagues (2013) have attempted to differentiate effortful or willful regulation of emotion, emotion-relevant motivation and cognitions, and related behavior—largely accomplished through effortful control—from less voluntary reactive control-related processes. Eisenberg has argued that effortful self-regulation should be differentiated from the general construct of *control*, defined in the dictionary as inhibition or restraint. Although voluntarily managed inhibition (or control) is part of effortful control (i.e., what Rothbart has labeled *inhibitory control*), inhibition often may be involuntary or so automatic that it usually is not under voluntary control. For example, behaviorally inhibited children, who are wary and overly constrained in novel or stressful contexts, seem to have difficulty modulating their inhibition. Similarly, the impulse to activate behavior and approach people or things in the environment often may be relatively nonvoluntary—for example, people may be “pulled” toward rewarding or positive situations with little ability to inhibit themselves (i.e., they are impulsive and exhibit surgent, approach behaviors). Optimal emotion-related regulation, which generally involves effortful control, is believed to be flexible and willfully modulated so a person is not overly controlled or out of control. Regulated individuals are expected to be able to respond in a spontaneous manner when in contexts in which such reactions are acceptable and also to effortfully inhibit their approach or avoidant tendencies when appropriate.

Effortful control is believed to be grounded primarily in processes in the anterior cingulate gyrus and regions of the prefrontal cortex (e.g., Posner & Rothbart, 2007; Rothbart & Bates, 2006). In contrast, Pickering and Gray (1999), among others, have argued that approach and avoidance motivational systems related to impulsive and overly inhibited behaviors, respectively, are centered in subcortical systems. Although these subcortical bases are intimately associated in complex ways with cortical functioning (see Goldsmith, Pollak, & Davidson, 2008), the neural bases of reactive systems appear to be somewhat different than those involved in effortful control.

Effortful control and reactive control are conceptually and statistically related; however, they tend to load on different latent constructs in structural equation models (e.g., Eisenberg et al., 2013; Eisenberg, Spinrad, et al., 2004; Valiente et al., 2003). In this chapter, we focus primarily on effortful control and not reactive control.

DEVELOPMENT OF EFFORTFUL CONTROL

In tracing the development of executive attention and effortful control, Rothbart and colleagues (Posner & Rothbart, 1998; Rothbart & Bates, 2006) have differentiated between attentional systems that are largely reactive and attentional systems that appear to denote self-regulatory mechanisms (i.e., effortful processes). The former system is present very early in life and is evident in behaviors such as infants' orienting responses to novelty, early attentional persistence, duration and latency of orienting, and early state control. This early attentional system is thought to be controlled by posterior orienting systems in the brain, which are involved in orienting to sensory stimuli.

Posner and Rothbart (1998) proposed that the attentional processes involved in effortful control (i.e., executive attention) develop later than the posterior attentional system. Executive attention is viewed as involved not only in the abilities to focus willfully and shift attention as needed to adapt but also in inhibitory control and activational control (i.e., the abilities to inhibit or activate behavior as needed, especially when one is not inclined to do so). As already noted, this second system is thought to be centered primarily in anterior cingulate gyrus.

Posner and Rothbart (1998) believe there is modest development in the anterior attentional system around the second half of the first year of life, although this system is thought to be quite immature in the first couple of years of life. Indeed, the capacity for effortful control is believed to increase markedly in the preschool years and may continue to develop into adulthood (Albert & Steinberg, 2011; Carlson, 2005; Dennis, Brotman, Huang, & Gouley, 2007; Leon-Carrion, García-Orza, & Pérez-Santamaría, 2004; Li-Grining, 2007; Murphy, Eisenberg, Fabes, Shepard, & Guthrie, 1999; Willoughby, Wirth, & Blair, 2012).

In fact, executive attention, which is a large part of effortful control, has been demonstrated in infancy and toddlerhood and improves throughout the toddler and preschool period. Between 9 and 18 months of age, attention becomes more voluntary (Ruff & Rothbart, 1996) as infants learn to resolve conflicts (e.g., when processing information), correct errors, and plan new actions (Posner & Rothbart, 1998). Diamond (1991), for example, showed that 12-month-olds are able to reach for a target not in their line of sight, demonstrating the ability to coordinate reach and vision, and attend to both. Moreover, infants' performance on visual sequencing tasks to assess anticipatory looking also demonstrates rudimentary executive functioning skills. Sheese, Rothbart, Posner, White, and Fraundorf (2008) found that anticipatory looking (i.e., looking at the location of a target prior to its appearance in that location) was observable in 6- and 7-month-old infants. Moreover, anticipatory looking in 24- and 30-month-old children has been related to better conflict resolution in a visual spatial-conflict task and parent report of child effortful control (Rothbart, Ellis, Rueda, & Posner, 2003).

According to Posner and Rothbart (1998), another transition in the development of executive attention (and inhibition of related behavior) can be seen around 30 months of age. Using a Stroop-like task that requires toddlers to switch attention and to inhibit

behavior accordingly, Posner and Rothbart reported that children showed significant improvement in performance by 30 months of age and performed with high accuracy by 36–38 months of age. Moreover, toddlers' ability on this sort of task, which improved from 24 to 36 months, was positively related to parent-rated attention shifting at 30 and 36 months (Gerardi-Caulton, 2000).

The ability to inhibit behavior upon command also appears to improve across the toddler and preschool years (Rothbart & Bates, 2006). Kochanska and colleagues (2000), with a battery of tasks tapping five components of effortful control (delaying, slowing down motor activity, suppressing or initiating activity to signal, lowering voice, and effortful attention), found an improvement in effortful control in toddlers between 22 and 33 months. Other researchers have shown that the ability to inhibit behavior effortfully on tasks such as "Simon Says" improves between 36 and 48 months of age (Jones, Rothbart, & Posner, 2003; Posner & Rothbart, 1998).

There is also evidence that effortful control (or components thereof) show interindividual (i.e., correlational) stability. Stability of attention span has been observed in young toddlers (Gaertner, Spinrad, & Eisenberg, 2008), and parental reports of attentional regulation have been correlated across infancy and toddlerhood (Bridgett et al., 2011; Gaertner et al., 2008; Putnam, Rothbart, & Gartstein, 2008). In terms of the broader construct of effortful control, Kochanska found that effortful control observed at 22 months substantially predicted effortful control at both 33 months (Kochanska et al., 2000) and 45 months (Kochanska & Knaack, 2003; also see Eisenberg, Spinrad, Eggum, et al., 2010; Li-Grining, 2007; Spinrad et al., 2012). Moreover, early focused attention/orienting predicts later effortful control (Bridgett et al., 2011; Gartstein, Bridgett, Young, Panksepp, & Power, 2013; Kochanska et al., 2000). In the early school years, teachers' and parents' reports of aspects of effortful control tend to be stable over 4, or sometimes 6, years (especially for attention focusing and inhibitory control, but less so for attention shifting; Eisenberg, Zhou, et al., 2005; Murphy et al., 1999; Valiente et al., 2006). Friedman, Miyake, Robinson, and Hewitt (2011) found that toddlers' self-restraint during a delay task predicted executive functioning (including measures that overlap with effortful control) 14 years later. As argued by Kochanska and colleagues (2000), the robust stability findings suggest that effortful control is trait-like and support Rothbart and Bates's (2006) view of effortful control as a temperamental construct.

RELATIONS OF EFFORTFUL CONTROL TO DEVELOPMENTAL OUTCOMES

Effortful control is believed to play an important role in the development of a wide range of socioemotional outcomes, including negative emotionality, the development of a conscience, prosocial behavior, empathy-related responding, social competence, and maladjustment. Due to space limitations, our review is illustrative, and we review only studies with children.

Relations to Emotionality

It is logical to expect children's regulatory skills to be negatively related to individual differences in their emotionality because the latter sometimes may be due to poor self-regulation (and children's negative emotions also may impair effortful control). Indeed,

effortful control generally has been associated with low levels of children's negative emotionality. One component of effortful control, attentional regulation, consistently has been negatively related to negative affect in infancy (Bridgett et al., 2009; Calkins, Dedmon, Gill, Lomax, & Johnson, 2002). Further support for this relation has been found with toddlers; Gaertner and colleagues (2008) found that toddlers' observed attention was negatively related to negative emotionality at both 18 and 30 months of age; in longitudinal analyses, early negative emotionality predicted less focused attention over time when researchers controlled for initial levels of attention, suggesting that negative affect may have a negative impact on children's capacity to learn to sustain attention.

Other measures of regulation (besides attentional control) or composite indices of effortful control also have been related to young children's emotionality (Gerardi-Caulton, 2000; Kochanska & Knaack, 2003). Putnam and colleagues (2008) found longitudinal relations between toddler negativity and lower effortful control in childhood. Hill-Soderlund and Braungart-Rieker (2008) found that increases in fear reactivity in infancy predicted low effortful control in early childhood, suggesting bidirectional relations between emotion and effortful control (but see Aksan & Kochanska, 2004). In a relatively recent study, low executive functioning skills at 48 months (a battery that included measures of inhibitory control, attention shifting, and working memory) were predicted by high emotional reactivity during a fear-inducing task at 15 months for those children with low observed regulation during the task (Ursache, Blair, Stifter, Voegtline, & Family Life Project Investigators, 2013).

Similar finding have been obtained in studies of preschoolers and school-aged children (Eisenberg et al., 1993; Eisenberg, Fabes, Nyman, Bernzweig, & Pinuelas, 1994; Hanish et al., 2004). Hanish and colleagues (2004) found that teacher-reported effortful control was inversely related to parents' and teachers' reports of children's anger and observed anger at preschool (similar relations with anxiety were not significant). Gilliom, Shaw, Beck, Schonberg, and Lukon (2002) reported that shifting attention away from sources of frustration and seeking information about situational constraints were associated with decreased anger for 3.5-year-olds. Similar patterns of inverse relations between adults' reports of school children's effortful control and their negative emotionality have been found in non-Western samples, including reported anger or negative emotional intensity in China (Eisenberg, Ma, et al., 2007; Zhou, Eisenberg, Wang, & Reiser, 2004) and in Indonesia (Eisenberg, Liew, & Pidada, 2004; Eisenberg, Pidada, & Liew, 2001). Moreover, delay of gratification in preschoolers has predicted the ability to deal with frustration in their adolescence (Mischel, Shoda, & Peake, 1988). However, positive relations between anger and persistence during challenging tasks have been found in a Chinese sample, suggesting that anger also may motivate individuals during goal blockages (He, Xu, & Degnan, 2012).

There is much less literature on the relation between children's positive emotionality and effortful control. In general, positive emotionality positively predicts children's effortful control (Komsis et al., 2006; Putnam et al., 2008); however, it is important to differentiate between high-intensity positive emotions and low-arousal positive emotions. High-arousal positive emotions (e.g., exuberance, elatedness) may be dysregulating (see Sallquist et al., 2009; Valiente, Swanson, & Eisenberg, 2012). Indeed, in one study, positive affect during mother-child interactions was positively related to children's effortful control in early childhood, whereas positive affect during joy-eliciting laboratory situations (likely a measure of high-intensity positive emotion and approach behavior) was

negatively related to children's effortful control (Kochanska, Aksan, Penney, & Doobay, 2007). Recently, Conway and colleagues (2014) showed that greater persistence (an index of effortful control) was related to lower latency to express positive emotions during positive emotion-eliciting tasks, which occurred immediately following anger-inducing tasks. These findings suggest that effortful control may facilitate children's ability to come back from stress. Consistent with these results, Taylor, Eisenberg, Spinrad, and Widaman (2013) reported that effortful control predicted subsequent ego resilience, suggesting that it may contribute to flexibility and adaptability over time.

Relations to Moral Development

Measures of effortful control or related constructs have been linked to the development of conscience, empathy-related responding, and prosocial behavior.

Conscience

Measures of children's internalized, committed compliance with adults' wishes, a precursor or correlate of early conscience (Kochanska, Coy, & Murray, 2001), have been associated with observed effortful control in the toddler and preschool years (Kochanska, Murray, & Coy, 1997; Kochanska et al., 2001; Spinrad et al., 2012). In a recent study, effortful control was positively related to children's generalized rule-compatible internalization, particularly for children with less positive relationships with their parents (Kochanska & Kim, 2014). Moreover, Kochanska and colleagues (1997) found that children's effortful control and conscience were positively related concurrently in the early years, and that effortful control at young ages predicted early school-age conscience (see Kochanska & Knaack, 2003, for a replication). Measures of conscience included ratings on items reflecting dimensions of moral self (e.g., concern about others' wrongdoing, apology, and empathy), responses to hypothetical moral dilemmas, internalization of the mother's rules, internalization of the experimenter's rules (not cheating at a game while the experimenter was not in the room), and internalization of the experimenter's rules in a peer context (not cheating on a game while the experimenter was not in the room but two other children were present). Moreover, Rothbart, Ahadi, and Hershey (1994) found that parents' reports of 6- to 7-year-olds' effortful control and tendencies to experience guilt were positively associated. Due to a dearth of research, it is not clear whether such relations hold in adolescence.

Empathy and Prosocial Behavior

Eisenberg and colleagues (e.g., Eisenberg, Fabes, Karbon, et al., 1996) hypothesized that individuals high in effortful regulation tend to experience sympathy (an other-oriented response to another's emotion or condition) rather than personal distress (a self-focused, aversive response to another's emotional state or condition) because empathic overarousal is aversive and leads to a self-focus and self-concern. Consistent with this premise, positive relations between effortful control and empathy-related responding (i.e., sympathy/empathy) have been found (Eisenberg, Fabes, Murphy, et al., 1996; Eisenberg, Fabes, et al., 1998; Guthrie et al., 1997; Murphy, Eisenberg, Fabes, Shepard, & Guthrie, 1999; Rothbart et al., 1994). For example, Eisenberg, Michalik, and colleagues (2007) found

that high levels of effortful control and growth in effortful control were often related to relatively high sympathy over 2, 4, or even 6 to 8 years. In addition, Taylor, Eisenberg, and Spinrad (2015) found that preschoolers' effortful control predicted sympathy in early childhood, even after controlling for earlier sympathy. Conversely, low effortful regulation tends to be associated with experiencing personal distress (Geangu, Benga, Stahl, & Striano, 2011; Valiente et al., 2004).

Consistent with the relations between effortful control and sympathy/empathy, well-regulated children also tend to be relatively prosocial. For example, adults' reports of self-regulation (a composite including components of effortful control) have been positively related to mothers' reports of adolescents' prosocial behaviors (Carlo, Crockett, Wolff, & Beal, 2012). In a recent study of adolescents, effortful control measured at 13 years of age predicted less of a decline in normative prosociality in adolescence (Kanacri, Pastorelli, Eisenberg, Zuffianò, & Caprara, 2013). Thus, children who can regulate their emotions and behavior are not only more likely to experience sympathy but also to act in morally desirable ways with others.

Social Competence and Adjustment

In general, measures that likely tap effortful control have been positively related to children's adjustment and social competence (see Eisenberg, Spinrad, & Eggum, 2010, for a more detailed review). In one of the most relevant longitudinal studies, children's lack of control at ages 3 and 5—seemingly a combination of effortful control, low reactive control, and negative emotionality (e.g., variables such as fleeting attention, emotional lability)—was rated, based on their behaviors when performing tasks. In addition, at age 3, children were classified into various personality types, based in part on this index of lack of control (the undercontrolled group was characterized primarily by lack of control). Early lack of control was positively associated with parents' and/or teachers' reports of externalizing problems (e.g., hyperactive behavior, inattention, antisocial behavior or conduct disorder) and internalizing problems (anxiety/fearfulness) at ages 9 and/or 11 and ages 13 and/or 15, and negatively related with the number of children's strengths (e.g., parents' and teachers' ratings of caring, mature, friendly, interested, determined, well behaved, enthusiastic, creative, confident, sense of humor, popular, cooperative, helpful, good at sports, clean, active) in adolescence (Caspi, Henry, McGee, Moffitt, & Silva, 1995). At age 18, undercontrolled individuals scored high on measures of impulsivity, danger seeking, aggression, and interpersonal alienation (Caspi & Silva, 1995). In addition, undercontrolled 3-year-olds were more antisocial at age 21 and had poorer social relations and high levels of interpersonal conflict (Newman, Caspi, Moffitt, & Silva, 1997). At 32, early regulation predicted physical health, substance dependence, personal finances, criminal offenses, and disordered gambling (in the expected directions; Moffitt et al., 2011; Slutske, Moffitt, Poulton, & Caspi, 2012).

Although the measure of undercontrol used in the aforementioned studies likely assessed impulsivity and emotionality, as well as effortful control, other investigators have obtained similar results using somewhat purer measures of effortful control. In regard to social competence, researchers have found that the abilities to shift and focus attention effortfully (Eisenberg et al., 1993, 1994; Spinrad et al., 2004), as well as composite measures of effortful control (e.g., Spinrad et al., 2007), relate to concurrent measures of toddlers' and preschoolers' social functioning (e.g., adults' ratings of social

competence, peers' reports of being liked, and/or observed socially skilled behavior at preschool). In addition, teachers' and/or mothers' reports of attentional control at this age often have predicted social functioning and prosocial/social behavior at school 2, 4, and 6 years later (Eisenberg et al., 1995; Eisenberg, Fabes, & Shepard, 1997; Murphy, Shepard, Eisenberg, & Fabes, 2004). Similar relations of children's adult-reported attentional and inhibitory effortful control and/or behavioral indices of effortful control to adults' and peers' reports of social competence have been obtained at age 5 and in elementary school, concurrently and across time (Eisenberg, Fabes, Guthrie, & Reiser, 2000; Eisenberg, Guthrie, et al., 1997; Eisenberg et al., 2003; Lengua et al., 2015; Spinrad et al., 2006) in the United States, and in Indonesia (e.g., Eisenberg, Liew, et al., 2004) and China (Zhou et al., 2004). Effortful control also has been related to less peer victimization (Iyer, Kochenderfer-Ladd, Eisenberg, & Thompson, 2010) and higher-quality friendships (Blair et al., 2014).

In regard to social competence at older ages, delay of gratification at age 4 or 5 predicted parent-reported social competence and coping with problems in adolescence (Mischel et al., 1988). In contrast, in a study of French high school students, relations between parents', teachers', and adolescents' reports of effortful control and popularity varied with the reporter, although there was an indirect positive relation between effortful control and popularity through youths' ego resiliency (Hofer, Eisenberg, & Reiser, 2010). In addition, change in effortful control in preadolescence/adolescence predicted social competence (King, Lengua, & Monahan, 2013), and teacher- and peer-reported self-control at age 8 predicted individuals' social network and the depth of their close relationships at age 27 (Pulkkinen, Lyyra, & Kokko, 2011).

Relations of effortful control with social competence have tended to be especially evident for children prone to negative emotion (Eisenberg, Guthrie, et al., 1997; also see Belsky, Friedman, & Hsieh, 2001). In addition, relations between effortful control and social functioning often have been mediated by ego resiliency (Eisenberg, Guthrie, et al., 1997; Eisenberg et al., 2000; Hofer et al., 2010; Spinrad et al., 2006).

Consistent with the findings of Caspi and colleagues (1995), low effortful control has also been rather consistently linked to problems with maladjustment, especially externalizing problems. This association is evident within and across time in regard to externalizing in the toddler and preschool years (Calkins & Dedmon, 2000; Crockenberg, Leerkes, & J6, 2008; Eiden, Colder, Edwards, & Leonard, 2009; Eisenberg, Spinrad, Eggum, et al., 2010; Kim, Nordling, Yoon, Boldt, & Kochanska, 2013; Kochanska, Barry, Aksan, & Boldt, 2008; Kochanska & Knaack, 2003; Spinrad et al., 2007), as well as in the school years (Choe, Olson, & Sameroff, 2013; Murphy, Shepard, Eisenberg, & Fabes, 2004) and adolescence (Doan, Fuller-Rowell, & Evans, 2012; Hofer et al., 2010). For example, Eisenberg and colleagues found that children with teacher- and parent-reported externalizing problems (co-occurring with internalizing problems or not) tended to be low in adult-reported attentional effortful control and inhibitory control, and at younger ages, with behavioral measures of persistence and inhibitory control (e.g., persisting on a puzzle task rather than cheating, sitting still when asked to do so; Eisenberg et al., 2001; Eisenberg, Sadovsky, et al., 2005; Eisenberg, Valiente, et al., 2009). Converging results have been obtained in numerous U.S. studies of effortful control/executive skills using a variety of measures of the constructs (Lengua, 2006; Martel et al., 2007; see Eisenberg, Spinrad, & Eggum, 2010), and the association has been found in Western Europe (Hofer et al., 2010; Muris, 2006; Oldehinkel, Hartman, Ferdinand, Verhulst, & Ormel, 2007;

Rydell, Berlin, & Bohlin, 2003), Indonesia (Eisenberg et al., 2001), and China (Eisenberg, Ma, et al., 2007; Zhou et al., 2004), as well as in the aforementioned study in New Zealand (e.g., Caspi et al., 1995).

In longitudinal studies in which stability in both externalizing problems and in effortful control were taken into account in structural equation models, investigators have found support for the assumption that change in effortful control is related to change in externalizing problems after about age 4.5 (Eisenberg, Spinrad, et al., 2004; Eisenberg, Zhou, et al., 2005; Kim & Brody, 2005; Valiente et al., 2006). In a study with a large sample (which makes it more likely to obtain significant bidirectional paths), Belsky, Fearon, and Bell (2007) found that children's attentional regulation at 54 months, grade 1, and grade 5 predicted externalizing problems at the next assessment and vice versa (although attentional control apparently was not assessed at grade 5; for evidence of bidirectional relations, also see Choe et al., 2013; Eisenberg et al., 1999). In contrast, Spinrad and colleagues (2007) did not obtain similar findings longitudinally in a study of children at 18 and 30 months of age. Lengua and colleagues (2015) found that level of executive function and delay abilities, but not change in their slopes from ages 36–40 to 63–67 months, predicted externalizing and internalizing problems combined. In contrast, King and colleagues (2013) found that an increase in effortful control during pre-adolescence predicted lower levels of externalizing problems at the last assessment (the children were studied across 3 years).

Supporting the distinction between reactive and effortful control, both constructs provide some unique prediction of early to middle elementary schoolchildren's externalizing problems (Eisenberg, Fabes, Guthrie, et al., 1996; Eisenberg, Sadovsky, et al., 2005). However, by around middle to late childhood and moving into adolescence, the relation of reactive control drops to marginal significance or nonsignificance when children's effortful control is also used to predict externalizing problems (despite significant concurrent correlations between reactive impulsivity and externalizing problems; Eisenberg, Spinrad, et al., 2004; Valiente et al., 2003). In contrast, in a larger study of high-risk adolescents, Martel and colleagues (2007) reported that both early reactive undercontrol and poor response inhibition provided unique prediction of externalizing problems.

Children's negative emotionality has been found to moderate the degree of relation between self-regulation/effortful control and children's externalizing problems. In general, effortful control/self-regulation is a better negative predictor of children's and adolescents' externalizing problems if they are prone to negative emotions, especially anger (Degnan, Calkins, Keane, & Hill-Soderlund, 2008; Diener & Kim, 2004; Eisenberg, Ma, et al., 2007; Eisenberg, Spinrad, et al., 2004; Moran, Lengua, & Zalewski, 2013; Muris, 2006; Oldehinkel et al., 2007; Valiente et al., 2003), although this interaction was not found in research with infants (Belsky et al., 2001) or 3-year-olds (Olson, Sameroff, Kerr, Lopez, & Wellman, 2005). Thus, general negative emotionality or frustration may start to moderate the relation of self-regulation to externalizing after the early years, possibly because of the emergence of more mature effortful self-regulation and/or more serious externalizing problems. However, Moran and colleagues (2013) found that fear and executive functioning/effortful control interacted to predict 3-year-olds' externalizing problems: Higher mother-reported fear and lower executive functioning predicted more externalizing, whereas higher observed fear and higher delay ability predicted fewer externalizing problems.

Findings in regard to the relation of effortful control to internalizing problems are somewhat less consistent. Attentional control might be expected to help children refocus attention away from negative and threatening stimuli and facilitate refocusing attention on neutral or positive stimuli or thoughts. In addition, activational control likely helps children with internalizing problems to approach threatening objects and situations when it is adaptive to do so. In a number of studies in which internalizing problems were assessed without taking into account the degree of co-occurring externalizing problems, effortful control has been inversely related to children's and adolescents' internalizing problems (Buckner, Mezzacappa, & Beardslee, 2009; Kim-Spoon, Cicchetti, & Rogosch, 2013; Silk, Steinberg, & Morris, 2003; Spinrad et al., 2007), even when removing overlapping or confounding items from the scales (e.g., Eisenberg, Zhou, et al., 2005; Lemery, Essex, & Snider, 2002; contrast with Lengua, West, & Sandler, 1998).

The inverse relation between self-regulation/effortful control and internalizing problems may increase with age (Dennis et al., 2007). Indeed, in the preschool years, there is some evidence that internalizing problems are *positively* related to effortful control (Murray & Kochanska, 2002). Reactive inhibition to novelty—often viewed as an early internalizing problem—may decrease the speed of approach responses early in life, which in turn facilitates the emerging capacity for effortful inhibitory control (Aksan & Kochanska, 2004).

In a few longitudinal studies, researchers have examined relations of effortful control to internalizing problems when controlling for the stability of both constructs across time in models. Spinrad and colleagues (2007) found that 18-month effortful control did not relate to 30-month internalizing when controlling for stability in internalizing. In a study including children approximately 4.5 to 7 years of age and followed up 2 years later, Eisenberg, Spinrad, and colleagues (2004) reported that effortful control predicted internalizing indirectly through low ego resiliency. In a follow-up of this sample at three time points, Valiente and colleagues (2006) found some evidence of effortful control predicting teacher-reported, but not mother-reported, internalizing problems across 2 years.

The relations between effortful control and internalizing problems may be much weaker, and may decrease with age, when one considers internalizing problems that do not co-occur with externalizing problems (Eisenberg, Cumberland, et al., 2001; Eisenberg, Sadovsky, et al., 2005; Eisenberg, Valiente, et al., 2009). However, although the relation between “pure” internalizing problems and effortful control dropped out for children in the United States who were approximately 7–9 years of age, the same relation was significant in a Chinese sample (Eisenberg, Ma, et al., 2007), suggesting that these relations may vary across cultures. Note, however, that Zhou, Lengua, and Wang (2009) did not find a difference between Chinese and U.S. children in the strength of the inverse relation when using a measure of internalizing problems that did not take into account children's externalizing problems.

Summary

There is mounting evidence that individual differences in effortful control are linked to a variety of important developmental outcomes. It seems likely that a relative lack of ability to effectively regulate their attention and behavior puts children at risk for behavior problems and low social and moral competence, perhaps sometimes due to problems in managing emotional experience and expression. However, it is also likely that socioemotional

deficits, due to their effects on the quality of social interactions, can affect the development of effortful control.

THE SOCIALIZATION OF EFFORTFUL CONTROL

According to Kopp (1989; Kopp & Neufeld, 2003), successful regulation of behavior in infants and young children can be indexed by how closely children meet familial and social conventions. Infants and young children must have external support for regulating their behavior, and the development of self-regulation involves give-and-take between the children's needs and caregivers' behaviors (Calkins, 1994; Kopp, 1989). Consistent with Kopp's theorizing, although effortful control likely has relatively strong hereditary and constitutional origins, parenting styles and behaviors play an important role in children's effortful control.

Findings from several investigators (e.g., Gaertner et al., 2008; Gilliom et al., 2002; Karreman, van Tuijl, van Aken, & Dekovic, 2008; Li-Grining, 2007) suggest that responsive, supportive parenting is positively linked with children's effortful control abilities. Associations between better attentional control and more sensitive parenting have been found in infancy (Calkins et al., 2002), as have direct links between parental responsiveness/support and high effortful control abilities in toddlerhood (Eisenberg, Spinrad, et al., 2010; Kochanska, Aksan, Prisco, & Adams, 2008; Kochanska & Knaack, 2003; Kochanska et al., 2000; Spinrad et al., 2007, 2012) and in older children (Belsky et al., 2007; Eisenberg, Zhou, et al., 2005; von Suchodoletz, Trommsdorff, & Heikamp, 2011). Additionally, Kochanska and Kim (2014) found that mutually responsive orientation between parents and toddlers predicted later effortful control (a finding that was replicated across two samples, one with low-income mothers and the other including similar relations for mothers and fathers). In this case, effortful control was higher when the dyads had a more positive relationship, which the authors suggested would provide a better context for successful socialization.

Parental discipline and parenting styles also have been related to children's effortful control (Eisenberg, Chang, Ma, & Haung, 2009; Hofer et al., 2010; Lee, Zhou, Eisenberg, & Wang, 2013). Harsh parental control or an authoritarian parenting style (characterized by low warmth and high control) is expected to result in overarousal in children, particularly for those low in regulatory abilities (Calkins, 1994). Kochanska, Aksan, and colleagues (2008) found that higher levels of observed parental (maternal and paternal) power assertion in toddlerhood were associated with lower levels of observed effortful control during children's preschool years. Similarly, Taylor and colleagues (2013) found that intrusive parenting was associated with less effortful control in early childhood. In a sample of children in late childhood, King and colleagues (2013) found that children's reports of more parental acceptance and less physical punishment were concurrently associated with more effortful control. Thus, these findings, along with those on parental warmth, suggest that supportive parenting is positively related to the development of effortful control from infancy into the school-age years and that harsh, controlling parenting may interfere with the development of effortful control.

Research on the socialization of effortful control also has included parental responses to children's emotions (Eisenberg, Cumberland, & Spinrad, 1998). Parents who appropriately respond to children's emotions may be teaching their children effective strategies

for self-regulation. Consistent with this notion, using a diverse sample of 7- to 12-year-old children, Valiente, Lemery-Chalfant, and Reiser (2007) found that parents' (mostly mothers') high levels of positive reactions to children's emotions (problem-focused, emotion-focused, and expressive encouragement reactions) and low levels of negative parental reactions to children's emotions (minimization, punitive, and distress reactions) were associated with higher levels of children's effortful control, measured from children's and parents' reports. Similar findings have been obtained with younger children (e.g., Spinrad et al., 2007). These findings support the view that parents who use more effective responses to children's emotions may provide children with strategies for effortful control of emotions.

In addition to maternal responses to children's emotions, researchers have also examined how maternal emotional expressions are related to children's effortful control across childhood and into adolescence (e.g., Eisenberg, Zhou, et al., 2005; Valiente et al., 2006). The type and intensity of emotions expressed by parents may provide children with either positive or negative models of emotional control (Eisenberg, Cumberland, et al., 1998). Moreover, Kryski and colleagues (2013) found that effortful control is a protective factor in children's stress responses, measured through cortisol, to parental expressions of emotion. When children had high levels of effortful control, they were not as reactive to parents' negative emotions. Additionally, lower levels of baseline cortisol, indicating less stress, were associated with more parental positive affect when effortful control was high. The authors concluded that the effects of parental emotions depended on the level of the children's effortful control.

Other parental characteristics, such as parents' own dispositions or psychopathology, also are likely to be important to children's self-regulation (Bandon, Calkins, Keane, & O'Brien, 2008; Gartstein et al., 2013; Yap, Allen, Leve, & Katz, 2008). Maternal factors, including their own effortful control and executive functioning, have been related to children's effortful control, although these associations are often mediated by parenting (Bridgett et al., 2011; Cuevas et al., 2014; Valiente et al., 2007; also see Bridgett, Burt, Edwards, & Deater-Deckard, 2015, for a review of the relations between parent self-regulation and child self-regulation). Interestingly, Choe and colleagues (2013) expected to find a direct effect of maternal distress to children's effortful control given past work showing that maternal depression has the potential to interfere with children's self-regulation. Instead, the relation of maternal distress to preschoolers' effortful control was mediated by parenting (both warmth and induction). Although Gartstein and colleagues (2013) found direct longitudinal prediction from higher maternal extraversion and lower parenting stress in infancy to higher levels of toddlers' effortful control, the authors speculated that these associations were related to better parent-child interactions (i.e., extraversion supports more optimal parenting behaviors, whereas parental stress is a risk factor for parenting). Although characteristics such as parents' own regulatory capacity may have direct relations to children's effortful control, these associations are often explained by higher-quality parenting behaviors that support the children's development of effortful control.

It is also interesting to note that there may be interactions between parenting and child characteristics to predict children's effortful control. In fact, using a candidate gene approach, Kochanska, Philibert, and Barry (2009) found that children's genotype (serotonin transporter gene [*5-HTTLPR*] polymorphism) and infant attachment (likely related to parental responsivity) interacted to predict the children's level of effortful control.

Children who were genetically at risk for problems with self-regulation only demonstrated lower levels of effortful control when they also experienced insecure attachments to their mothers during infancy. Maternal behaviors, in this case, developing a secure attachment with infants, may protect children who are genetically vulnerable for problems with self-regulation.

Furthermore, the relations between parental socialization and children's effortful control are likely to be bidirectional (Belsky et al., 2007; Eisenberg, Zhou, et al., 2005). Consistent with the idea that children's regulatory abilities affect parenting, Bridgett and colleagues (2009) found that steeper decreasing trajectories of regulatory capacity across infancy were associated with less maternal negative parenting at 18 months of age (also see Eisenberg, Vidmar, et al., 2010; Lengua, 2006). In a sample of Chinese school-age children, Lee and colleagues (2013) found support for longitudinal bidirectional relations: Not only did authoritarian parenting predict less effortful control 4 years later, but also less effortful control at the first assessment predicted greater subsequent authoritarian parenting. Parents of less regulated children may have increased their level of authoritarian parenting in an effort to control them.

The importance of the socialization of effortful control is highlighted by evidence that effortful control statistically mediates the association between parenting and child outcomes, especially behavior problems (e.g., Belsky et al., 2007; Choe et al., 2013; Eisenberg, Zhou, et al., 2005; Kochanska & Knaack, 2003; Spinrad et al., 2007, 2012; Taylor et al., 2013; Valiente et al., 2006). However, findings with younger children indicate that the relations among parenting, effortful control, and behavior problems may be set across the early years due to the high stability of the constructs. After controlling for stability over time, Eisenberg, Spinrad, and colleagues (2010) did not find that effortful control mediated the association of parenting to externalizing behaviors. In the same sample, Spinrad and colleagues (2012), however, found support for the mediated pathway predicting children's committed compliance as the outcome, even after accounting for stability over time. These findings may be related to children's effortful control becoming more organized and stable over time, and the outcome measure of committed compliance may have been more reflective of the developmental challenges for children of this age than for externalizing problems that may emerge later. Additionally, Kochanska and Kim (2014) found an interesting pattern of moderated mediation when examining effortful control in toddlerhood as a mediator of the relation of parent-child mutually responsive orientation (MRO) to later internalization of rules. In this case, the mediated associations were particularly relevant when MRO was low. Children's effortful control may be more important when MRO is low because children in less positive relationships may need to rely more on effortful control. Findings such as these highlight the complexity behind the socialization of effortful control.

CONCLUSIONS

In the past two decades, it has become increasingly clear that effortful control is intimately related to social, emotional, moral, and psychological development in childhood. Of course, because the research generally is correlational in design, it is very difficult to prove causal relations. Nonetheless, researchers have found that early measures of effortful control (or measures including effortful control) predict a broad range of important

outcomes in childhood and beyond. Moreover, relations between effortful control and emotionality, adjustment, and social competence are evident across childhood and at older ages. Thus, effortful control is a capacity that appears to play a major role in many aspects of development.

Findings also suggest that socialization in the home may contribute to the development of effortful control. It is possible that a number of effects of parental socialization on developmental outcomes are partly mediated through their relations to effortful control. However, experimental studies in which parents are trained to interact with their children in ways likely to foster effortful control are needed to prove a causal link. Given the critical role of effortful control in many aspects of development, it is important that developmentalists find ways to stimulate its development both within and outside of the home.

ACKNOWLEDGMENT

This research was supported by grants from the National Institute of Mental Health and the National Institute of Child Health and Development to Nancy Eisenberg and Tracy L. Spinrad and a grant to Carlos Valiente, Nancy Eisenberg, and Tracy L. Spinrad.

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CHAPTER 26

Aging and Self-Regulation

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Atrophy of the brain is a normal part of aging. Just as muscle and bone mass decline in late adulthood, so too does the brain gradually shrink in total volume and weight. The frontal and temporal lobes, in particular, often show substantial atrophy with age (Dempster, 1992; Scahill et al., 2003; West, 1996). The frontal and temporal lobes support a number of important mental processes, but for our purposes in this chapter, we focus on executive functions and emotions. Age-related atrophy of the frontal and temporal lobes can lead to changes in executive functions and emotions, with important consequences for self-regulation later in life. Our goal in this chapter is to review research that concerns the consequences of age-related losses in emotion and executive processes for self-regulation and social functioning. We turn first to a consideration of the consequences of deficits in executive control.

AGING, EXECUTIVE FUNCTIONS, AND SELF-CONTROL

Like executives in a complex organization, the mental processes known as *executive functions* are responsible for initiating, planning, and coordinating the basic cognitive processes with which we navigate our everyday lives. Executive functions include planning, task switching, and inhibition of thought and behavior. Thus, rather than being considered a unitary ability, the term *executive functions* refers to the ensemble of higher-order processes that permit contextually sensitive, flexible behavior. Because executive functions impose particular demands on frontal neural substrates, and because these structures are subject to age-related deterioration, aging has been linked to diminished executive control (Dempster, 1992; Hasher, Zacks, & May, 1999; West, 1996).

Failures at thought control lead to contamination of ongoing mental activities with unwanted information; thus, age-related deficits in inhibitory ability have been implicated in a variety of cognitive deficits (Hasher et al., 1999). Executive functions are not

only important for regulating cognitive activity but they also play a central role in social functioning. Indeed, many theorists believe that it was the demands of social living that led to the development of such large frontal lobes in humans (Dunbar & Shultz, 2007), and there is considerable evidence for social abnormalities in populations with executive impairment (Stuss & Levine, 2002). Thus, despite the fact that aging is associated with improvement in some aspects of socioemotional functioning (Blanchard-Fields, 2007; Carstensen, Gottman, & Levenson, 1995), age-related executive deficits have the potential to disrupt social behavior in a variety of domains. In the first part of this chapter we review the evidence for this possibility.

Aging, Inhibition, and Prejudice

It is common knowledge that older Americans tend to be more prejudiced than their younger counterparts. It is also widely assumed that the root cause of this age difference lies in the historical periods in which different generations were socialized. Consistent with these lay beliefs, research supports the notion that people were more prejudiced 60 years ago than they are today (Schuman, Steeh, Bobo, & Krysan, 1997). Nevertheless, this “generational” explanation for age differences in prejudice may be only part of the story.

In an influential model of prejudice, Devine (1989) proposed that because American culture is suffused with stereotypes concerning African Americans, these stereotypes become overlearned and are automatically activated upon encounters with individual African Americans. What differentiates nonprejudiced from prejudiced people is not whether prejudiced thoughts are activated, but whether people inhibit those thoughts and replace them with more egalitarian beliefs. Prejudiced people endorse the stereotypic thoughts that are automatically activated, and nonprejudiced people reject and subsequently inhibit the stereotypic thoughts. This model suggests that older adults may be more prejudiced than younger adults because they can no longer inhibit their unintentionally activated stereotypes. There are now several lines of research that support this possibility.

In a study of explicit stereotyping and prejudice, von Hippel, Silver, and Lynch (2000) found that older white adults show greater stereotyping and prejudice toward blacks than do younger white adults. This age difference emerged despite the fact that the older adults were more concerned about impression management and more motivated than the younger adults to control their prejudices. Older adults also performed more poorly than younger adults on a measure of inhibitory ability, in which they read paragraphs aloud, some of which contained distracting text that they were asked not to vocalize. Perhaps most importantly, this age difference in inhibitory ability fully mediated the age differences in stereotyping and prejudice; that is, older adults only showed greater stereotyping and prejudice to the degree that they also showed greater difficulty inhibiting their responses in general. Additionally, individual differences in inhibition were associated with individual differences in prejudice among both older and younger adults. This finding suggests that the link between inhibition and prejudice in older adults is not simply a by-product of their shared relationship with general cognitive decline or early stages of dementia. Rather, because a correlation between inhibitory ability and prejudice is also seen in younger adulthood, there appears to be something unique about inhibition that plays a critical role in the prevention of prejudice.

There are, of course, interpretive ambiguities associated with the findings of von Hippel and colleagues (2000), and subsequent research has addressed these issues in a variety of ways. First, it is possible that older adults are no more prejudiced than younger adults, but they are simply more willing to express their prejudices in the politically correct confines of the university laboratory. To test this possibility, Henry, von Hippel, and Baynes (2009) asked a close friend or family member of the participants to report on the participants' prejudice level. Participants then completed two measures of executive control—a Trail Making Test (which requires participants to trace a pathway among randomly scattered letters and numbers, alternating between letters and numbers, and thus to inhibit the natural tendency to follow alphabetic or numeric sequences) and a phonemic fluency test (which requires self-initiated retrieval of words that begin with a particular letter, thereby requiring participants to inhibit words that have previously been retrieved). Henry and colleagues found that older adults were more prejudiced than younger adults (according to their peers), and that this age difference in peer-reported prejudice was mediated by participants' own performance on these measures of executive control.

These results address some of the problems associated with political correctness and social desirability, but they do not circumvent the fact that prejudice is still measured as public expression. To address this issue, Radvansky, Copeland, and von Hippel (2010) conducted an experiment in which older and younger adults were presented with stories that contained stereotype-suggestive sentences that were not explicitly stereotypic. After these suggestive sentences, participants were occasionally interrupted to complete a lexical decision task assessing activation of a word highly related to the stereotypic inference (e.g., after the sentence, "Susan saw that Jamal didn't help," participants were tested with the word *lazy*). Participants were also presented with lexical decisions after inference-inviting sentences that were stereotype-neutral (e.g., the sentence "Jamal watched with anticipation," followed by the word *hungry*) and after sentences in which no inference was likely (which were used as control sentences). Results revealed that compared to the lexical decisions in the control sentences, younger adults were faster to identify the inference-relevant neutral words but slower to identify the inference-relevant stereotypic words. Older adults were also faster to identify the neutral words, but rather than being slower to identify the stereotypic words, in this case, they were nonsignificantly faster. These findings suggest that younger adults inhibit their stereotypic inferences as they encode new information, but older adults fail to do so.

Two different types of modeling data reveal results that are also consistent with this possibility. First, Gonsalkorale, Sherman, and Klauer (2009) used the quadruple-process model (Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005) to examine the source of age differences in implicit prejudice that emerged in a large national dataset with the Implicit Association Test (IAT; Greenwald, McGhee, & Schwarz, 1998). Their modeling results indicated that older adults are less successful than younger adults in regulating automatic bias toward African Americans but show no differences in degree of bias itself (also see Gonsalkorale, Sherman, & Klauer, 2014). Second, Stewart, von Hippel, and Radvansky (2009) conceptually replicated this result using the process dissociation procedure (Jacoby, 1991). They found that age differences in implicit prejudice toward African Americans emerged only in the control component of implicit prejudice, with older participants showing decreased control over their automatic biases. Furthermore, this age difference in prejudice control was mediated by age differences in the

reading with distraction task used by von Hippel and colleagues (2000). Finally, Stewart and colleagues also found that self-reported motivation to be nonprejudiced only translated into low prejudice responses on the IAT when participants also had good control over their automatic biases. Taken together, the results of Gonsalkorale and colleagues (2009) and Stewart and colleagues suggest that age differences in prejudice are the result of poor inhibitory control of prejudicial associations and are not just evidence of a greater willingness among older adults to express their prejudices.

Aging, Inhibition, and Social Inappropriateness

Age-related inhibitory losses have also been implicated in two types of social inappropriateness. First, older adults are more likely than younger adults to talk excessively and about topics that are irrelevant to the stream of conversation (Pushkar et al., 2000). This “off-target verbosity” is associated with diminished inhibitory ability (as indexed via the Trail Making Test, the Stroop test, and verbal fluency), which leaves older adults less capable of stopping their conversation and remaining on topic.

Inhibition also appears to be necessary to restrain oneself from verbalizing thoughts that are better left unsaid (von Hippel & Gonsalkorale, 2005); thus, inhibitory deficits can lead older adults to make socially inappropriate remarks. Consistent with this possibility, von Hippel and Dunlop (2005) found that older adults are more likely than younger adults (according to their peers) to inquire about private issues in public settings, and that this age difference in peer-reported social inappropriateness is mediated by their own inhibitory deficits (measured with a trivia test [Yoon, May, & Hasher, 2000] that includes misleading items that require respondents to inhibit their initial response; e.g., answering “black” to the question “What color are a tiger’s spots?”). Furthermore, these age differences emerged despite the fact that older and younger adults agree that it is inappropriate to inquire about such issues in public settings. Indeed, older adults in particular felt less close to those who inquired about private issues in public. These findings suggest the presence of a dissociation between knowledge of social rules and the ability to follow them that is often seen in people who have sustained frontal lobe damage.

This finding of increased social inappropriateness with age was conceptually replicated by Henry and colleagues (2009), who found that older adults were more likely than younger adults to engage in a variety of socially inappropriate behaviors (again, according to their peers). Furthermore, this peer-reported increase in social inappropriateness was again mediated by participants’ own performance on measures of executive control (the Trail Making Test and verbal fluency). Importantly, the effect of executive decline was found to be independent of the effect of general cognitive decline, suggesting that increased social inappropriateness in late life is not just an early indicator of dementia.

If these effects of executive decline are indeed distinct from the effects of incipient dementia, then it should also be the case that younger adults who have relatively poor inhibitory functioning are more likely to make socially inappropriate comments. To test this possibility, von Hippel and Gonsalkorale (2005) told young adult, white subjects that they were participating in a study on the effects of food chemicals on memory. Half of the participants were then told by a Chinese experimenter that they were going to eat her favorite food, which was also the national dish of China. The other participants were simply told by a white experimenter that they would be eating Chinese food. Independent

of this social pressure manipulation, half of the participants were then asked to remember an eight-digit number, whereas half were not given this task.

In close proximity to the participant's face, the experimenter then opened a dish containing an intact chicken foot, including the claws, cooked in a Chinese style. A hidden video camera revealed that participants were least likely to make a negative expression or comment if they were not cognitively busy, and if the Chinese experimenter had placed social pressure on them with her claims about the food's cultural and personal significance. Additionally, only in this condition did participants show a negative relationship between inhibitory ability (measured via the Stroop task) and the likelihood of making a negative expression or comment. These results indicate that younger adults also rely on their inhibitory ability to restrain socially inappropriate comments because only when they were motivated to pretend to like the chicken foot and had all of their mental faculties available did a difference in responses to the foot emerge between good and poor inhibitors. These results also suggest that increased social inappropriateness with age is not just a sign of early dementia because younger adults also appear to rely on inhibition to keep socially inappropriate thoughts in check. Thus, as with prejudice, there appears to be something unique about the role played by inhibition in the relationship between age and social inappropriateness.

Aging, Inhibition, and Depression

Poor inhibitory ability is associated not only with cognitive and social problems but is also related to depression (Hertel, 1997). Although depression might cause inhibitory deficits, age-related inhibitory deficits might also contribute to late-onset depression by impairing control of excessive rumination. Note, however, that inhibitory deficits should not lead all, or even most, older adults to excessive rumination. Rather, only those older adults who rely on inhibitory control to stop themselves from ruminating (either chronically or when confronted by negative life events) are likely to develop problems with rumination if they have poor executive control. Older adults who are disinclined to ruminate and those who ruminate but do not try to suppress their ruminative thoughts should not show a relationship between inhibition and rumination.

Deficits in executive control are particularly apparent in depression that has its initial onset in older adulthood (typically defined as at or after 60 years of age; for a review, see Alexopoulos, 2003). This suggests that inhibitory deficits may contribute to depressive symptoms because they bring decreased capacity for self-regulation in the face of negative life events. Additionally, age-related deficits in executive control may increase vulnerability to depression among older adults who have been prone to depressive patterns of thinking throughout their lives. According to these possibilities, late-onset depression is more likely than early-onset depression to be associated with deficits in executive control. As such, among depressed older adults, late onset of symptoms should be associated with poor inhibitory ability, whereas this may not be the case for early onset of symptoms (because poor inhibition is only one of many possible causal factors in early-onset depression). Moreover, the relation between inhibitory deficits and late-onset depression should be mediated by rumination.

Consistent with this reasoning, von Hippel, Vasey, Gonda, and Stern (2008) found that inhibitory deficits (measured via the Stroop task, the reading with distraction task described earlier, and a working memory task) predicted greater depression among

late-onset but not early-onset depressed older adults, and that inhibitory deficits had their impact via their role in rumination. That is, among older adults with late-onset depression, poorer inhibition predicted increased rumination, which in turn predicted increased depression. In contrast, among older adults with early-onset depression, inhibitory deficits were not associated with ruminative tendencies, suggesting that these individuals were not relying on inhibition to control their rumination and had in all likelihood developed depression for other reasons.

Aging, Inhibition, and Problem Gambling

Analogous to the case with late-onset depression, poor inhibitory ability is unlikely to lead to gambling problems in all or even most older adults. Rather, inhibitory deficits might lead to gambling problems only among those who enjoy gambling and have ready access to gambling sites. To test this possibility, von Hippel and colleagues (2009) recruited older adults from various gambling establishments, and measured their executive control and self-reported level of gambling problems. They found that older adults who gamble have greater gambling problems to the degree that they also have poor executive control (measured via the Trail Making Test). In a follow-up study, von Hippel and colleagues replicated this relationship and also found that self-reported gambling problems predicted greater depression via their impact on financial stress. Furthermore, these relationships emerged independent of general cognitive decline. These findings suggest that older adults who enjoy gambling are likely to develop greater gambling problems if they suffer losses in inhibitory control, and furthermore, that these gambling problems are important in that they appear to cause significant financial distress and consequent depression.

The problem with these studies, however, is that they rely exclusively on self-report measures of gambling problems. If deficits in inhibitory functioning cause gambling problems because they make it difficult for older adults to restrain their urge to gamble, then they should also lead to greater perseverance at gambling in the face of losses. To test this possibility, von Hippel and Hucker (2006, cited in von Hippel, 2007) conducted an experiment in which older adults recruited from gambling venues played a computerized gambling game with real winnings. Because people show reliable circadian rhythms in their inhibitory control—with most older adults showing better inhibitory control in the morning than in the afternoon (May & Hasher, 1998)—participants were randomly assigned to play the gambling game either in the morning or the afternoon. The game was programmed to appear random but initially to provide more wins than losses. After participants had accumulated some winnings, they were told that they could continue to play for as long as they liked, or until they lost all their winnings. Unbeknownst to them, at that point, the program shifted, so that the game no longer provided any wins, thereby enabling the assessment of perseverance in the absence of reward. Consistent with predictions, older adults responded more readily to the absence of reward and stopped playing more quickly in the morning than in the afternoon, and this effect was most pronounced among older adults whose circadian rhythms identified them most clearly as “morning types.” These findings implicate inhibitory deficits in gambling perseverance, but because circadian rhythms influence general cognitive functioning in addition to inhibitory control (May & Hasher, 1998), it remains for further research to establish that inhibition is the mechanism underlying this effect.

AGING, EMOTIONAL EXPERIENCE, AND SELF-CONTROL

Age-related losses in emotional recognition, experience, and expression also have the potential to lead to difficulties regulating social behavior in late adulthood. The next section of this chapter reviews evidence on how age-related changes in emotion processing can lead to self-regulation difficulties in late adulthood.

Emotion Recognition

The face is a particularly important source of nonverbal emotional information, and from a very early age, basic emotions are represented clearly on the human face. Deficits in normal facial emotion recognition are therefore a critical factor in poor communication, and are associated with interpersonal problems and the development and maintenance of psychopathology (Mogg, Millar, & Bradley, 2000; Pollak & Tolley-Schell, 2003).

Although emotion recognition relies on multiple cognitive processes that are subserved by a large array of neural structures, difficulty recognizing specific emotions has been observed in normal aging and linked to age-related brain changes (e.g., Calder et al., 2003; Sullivan & Ruffman, 2004). A meta-analytic review indicates that age differences vary across the six basic emotions (Ruffman, Henry, Livingstone, & Phillips, 2008). There are strong and clear age-related declines in the ability to label anger, fear, and sadness; much smaller (but reliable) age impairments in identifying happiness and surprise; and a trend toward age-related improvement in identifying disgust. These age-related changes appear to emerge due to the demands that the decoding of different emotions imposes on specific frontal, temporal, and limbic neural substrates (Calder et al., 2003; Sullivan & Ruffman, 2004).

Importantly, difficulties understanding emotional signals have implications for social interactions in old age. Indeed, poor emotion recognition is associated with reduced social competence and interest, poor interpersonal functioning and communication, reduced quality of life, inappropriate social behavior, and a reduced likelihood of detecting deception (Carton, Kessler, & Pape, 1999; Halberstadt, Ruffman, Murray, Taumoepeau, & Ryan, 2011; Ruffman, Murray, Halberstadt, & Taumoepeau, 2010; Ruffman, Murray, Halberstadt, & Vater, 2012; Shimokawa et al., 2001). For example, Phillips, Scott, Henry, Mowat, and Bell (2010) found a positive correlation between the ability to perceive facial expressions of emotion and self-reported quality of life in healthy older adults. Furthermore, this effect was independent of these individuals' level of cognitive functioning. These data suggest that older adults who struggle to perceive emotions also experience poorer quality of life, independent of any other cognitive losses they might have. Naturally, this sort of finding raises questions about what sort of role emotion recognition plays in everyday interpersonal functioning.

One answer to this question lies in the importance of emotional recognition for proper self-regulation in social settings. For example, Ruffman and colleagues (2010) replicated the findings of Pushkar and colleagues (2000) that older adults are more verbose than their younger counterparts, but found that the increase in verbosity among older men was fully mediated by poorer emotion recognition (rather than losses in executive control, as found by Pushkar et al.). These results suggest that older men who fail to self-regulate their verbosity in social situations do so in part because they fail to decipher appropriately the emotional cues of their social partner.

Recent evidence even suggests that age-related losses in emotion recognition can lead to changes in people's general orientation toward others. Specifically, Ruffman and colleagues (2016) found that endorsement of right-wing authoritarianism increased in late adulthood. *Right-wing authoritarianism* refers to strong beliefs in the legitimacy of hierarchy that are associated with a high degree of submissiveness to authorities, as well as aggressiveness toward those who deviate from group norms. Moreover, Ruffman and colleagues found that poorer emotion recognition predicted unique variance in older adults' authoritarianism. Ruffman and colleagues argued that poorer emotion recognition results in subtle emotional signals being less likely to be perceived, leading to more extreme responses to others. Because expression of extreme attitudes (right- or left-wing) has the potential to antagonize others, this finding suggests that failure to detect social cues accurately may make older adults less likely to regulate endorsement of right-wing attitudes in their interpersonal interactions, with potential social costs. Clearly, further research on this topic is necessary to disentangle the underlying mechanism; nonetheless, the broader collection of findings on emotion recognition provides compelling evidence for a link between age-related losses in emotion recognition and poorer regulation of social behavior.

Cognitive and Affective Empathy

Empathy can be divided into cognitive and affective components. While the cognitive component focuses on *understanding* another's internal mental state (and is often also referred to as *theory of mind* [ToM] or *perspective taking*), the affective component concerns emotional *responses* to the cognitive or affective state of another. Because empathic skills are considered an essential prerequisite for social functioning (Baron-Cohen & Wheelwright, 2004), deficits in either component are likely to incur social costs. Indeed, Bailey, Henry, and von Hippel (2008) found that age-related decline in social functioning was partially mediated by reductions in the ability to understand others' mental states. This mediational finding implies that older adults might be unintentionally driving away some social partners due to a reduced capacity for empathy.

In the literature on aging, empathy research has focused almost exclusively on assessment of the cognitive component, with age-related deficits the norm. In their meta-analytic review, Henry, Phillips, Ruffman and Bailey (2013) found that across a wide variety of ToM task, older adults performed more poorly than younger adults, with ToM losses that were moderate in magnitude. With few exceptions, age deficits for ToM tasks were larger in magnitude compared to those for matched control tasks, indicating that these ToM difficulties are not simply secondary to non-ToM-related task demands. These findings suggest that the ToM difficulties seen in late adulthood are large enough to have potential implications for social interactions in everyday life, and likely reflect a deficit that is not reducible to any one type of task demand. Nonetheless, reduced executive control seems to play an important role in age-related losses in ToM (Bailey & Henry, 2008; Phillips et al. 2011).

In contrast to the consistent evidence for age-related impairment in cognitive empathy, the smaller literature on aging and affective empathy typically points to either stasis or enhancement of this capacity, as indexed by self-report and performance-based measures (Bailey et al., 2008; Richter & Kunzmann, 2011; Ze, Thoma, & Suchan, 2014). For example, Richter and Kunzmann (2011) found that relative to their younger counterparts,

older adults generally reported and expressed greater sympathy while observing video clips in which protagonists thought aloud about emotionally engaging topics. Nevertheless, reduced executive control can disrupt the capacity for affective empathy, at least in some circumstances. For example, older adults were found to show less activity in the medial prefrontal cortex (an area involved in the experience of empathy) than younger adults when viewing stigmatized individuals (Krendl, Heatherton, & Kensinger, 2009). Additionally, Krendl and colleagues (2009) found that among older adults, activation in the medial prefrontal cortex while viewing stigmatized individuals was positively correlated with executive functioning scores. These findings suggest that older adults rely on their executive control to inhibit their prejudices, and as they become less capable of inhibition, they also experience less empathy for members of stigmatized groups. Thus, reduced capacity for self-regulation appears to have the potential to disrupt both cognitive and affective empathy in late adulthood, although evidence to date suggests that this relationship is typically stronger for the former.

Self-Conscious Emotions

Self-conscious emotions have been closely linked to self-regulation. For example, Beer, Heerey, Keltner, Scabini, and Knight (2003) found that deficient behavioral regulation following orbitofrontal damage is related to inappropriate self-conscious emotions, as well as deficits in interpreting the self-conscious emotions of others. Furthermore, simply expecting to feel the negative self-conscious emotions of shame or guilt promotes greater self-control efforts (Giner-Sorolla, 2001). These data suggest that the adaptive regulation of social behavior is dependent to some degree on self-conscious emotions and their underlying appraisal processes.

Different literatures generate different predictions about how age may be related to self-conscious emotions. On the one hand, age-related losses may be anticipated because self-conscious emotions are more cognitively complex than the basic emotions, requiring the ability to self-reflect and to be aware of how our actions might be perceived by others. Consequently, cognitive empathy plays an important role in self-conscious emotions. In conjunction with possible atrophy of the orbitofrontal area, age-related losses in cognitive empathy therefore have the potential to lead to reduced self-conscious emotional responding.

In contrast to these predictions, evidence for age-related gains in some aspects of emotion regulation predict that only the experience and expression of *negative* self-conscious emotion may be reduced; the experience of positive self-conscious emotion may be enhanced. For example, socioemotional selectivity theory suggests that older adults may be more effective than younger adults at engaging in the emotion regulation strategy of *situation selection*—planning contact with people they already know and love rather than pursuing interactions with more peripheral social contacts (Carstensen, Fung, & Charles, 2003).

The only study to date that has investigated self-conscious emotion and aging examined shame, guilt, and two forms of pride in a large sample of individuals between ages 13 and 89 (Orth, Robins, & Soto, 2010). The predominant picture to emerge from this research was that guilt and authentic pride are more likely to be experienced as people age, whereas shame and hubristic pride are less likely to be experienced. Although this study represents an important step, it was limited by the fact that the age differences

emerged in self-report measures that indexed *perceived* reactions to situations that typically elicit self-conscious emotions. Orth and colleagues' (2010) data therefore do not indicate whether there are actually age differences in the personal experience of self-conscious emotions. In addition, the measure used by Orth and colleagues focused only on relatively mild instantiations of these self-conscious emotions, but strong experiences of self-conscious emotion (particularly shame and guilt) may be more likely to shape social behavior and therefore are particularly important to assess in late adulthood.

Finally, no research to date has assessed whether the *expression* of self-conscious emotion is altered in late adulthood. As noted previously, not only the experience but also the appropriate outward display of self-conscious emotion has been linked to various social outcomes. Given the importance of appropriately experiencing and expressing self-conscious emotion for everyday social behavior, the possibility of age-related changes in these capacities represents an important area of future research.

POSITIVE VERSUS NEGATIVE SOCIAL CONSEQUENCES OF AGING

Our focus in this chapter has been on the negative social consequences that emerge from age-related atrophy of the frontal and temporal lobes. It should be noted, however, that some of these negative effects can be offset by other changes in social and cognitive functioning that emerge in late adulthood. For example, it is well known that older adults attend to positive information more than younger adults do, and older adults indeed show decreased responding in the amygdala (a brain region involved in emotional experience) to negative but not to positive events (Mather et al., 2004). This increased positivity and decreased negativity with age has a number of important social consequences, such as a more affectionate style of conflict resolution (Blanchard-Fields, 2007; Carstensen et al., 1995). Indeed, evidence suggests that this increased positivity can even reverse the typically negative consequences of diminished executive control, resulting in positively disinhibited behavior among older adults. In their examination of this possibility, Apfelbaum, Krendl, and Ambady (2010) presented younger and older adults with a videotape of an obese adolescent who complained of lack of energy and other ailments that typically emerge from obesity. Participants were asked to provide her advice about how she might solve these problems. Younger adults and older adults with strong executive control typically danced around the issue and did not mention her obesity. In contrast, older adults with poor executive functioning were much more direct and to the point, albeit in a sympathetic manner, and their advice was rated by obesity specialists as most likely to lead to desired lifestyle changes (also see Apfelbaum & Sommers, 2009).

These studies suggest that there are likely to be some circumstances in which the social behavior of older adults is facilitated by increases in wisdom, positivity, and the priority of relationship motives, and other circumstances in which social behavior is disrupted by deficits in executive control and emotion processing. Indeed, the same circumstances might involve both countervailing forces. Evidence for such a possibility can be seen in the research of von Hippel, Henry, and Matovic (2008), who found that older adults show levels of social satisfaction similar to those of younger adults, despite spending more time alone and engaging in fewer social activities. Additionally, older adults reported neither more nor fewer uplifts from the experiences that they shared with younger adults. Yet this apparent stability in social experience masked underlying

countercurrents whereby age-related losses were suppressing the effect of age-related gains on social satisfaction. On the loss side of the ledger, in addition to spending more time alone and engaging in fewer social activities, older adults also had poorer working memory than younger adults. All three of these factors played a mediating role in decreasing social satisfaction among older adults, and when they were included as mediators, a suppression effect emerged, whereby aging was now associated with residual *increases* in social satisfaction and uplifts from social experiences. Thus, at the aggregate level, the losses offset the gains, but in the case of any single individual, there is clearly the potential for age-related losses, gains, or stasis in social functioning and satisfaction.

FUTURE DIRECTIONS

The findings reviewed here on aging and self-regulatory deficits suggest a variety of directions for future research. Perhaps most notably, this review highlights the need to combine cognitive and affective approaches in the study of aging and self-regulation because changes in cognitive and affective processes have the potential to augment or attenuate each other's effects. For example, declines in executive functioning have the potential to exacerbate age-related declines in perspective taking and empathy, but enhanced emotion regulation and prioritization in late life have the potential to offset some of the social consequences of executive decline (Apfelbaum et al., 2010; von Hippel, Henry, et al., 2008). Thus, future research on aging and self-regulation would benefit from integrating cognitive and affective approaches. With this goal in mind, we briefly outline a few possible themes for future research on aging and self-regulation.

Social Functioning

Loneliness and social isolation have broad negative implications for physical health and mental well-being, with the strongest effects in late adulthood (House, Landis, & Umberson, 1988). Although there are many causes of loneliness in late life, deficits in executive functioning and increased social inappropriateness are possible sources of reduced social satisfaction (von Hippel & Dunlop, 2005; von Hippel, Henry, et al., 2008). Additionally increased difficulty taking the perspective of another (Bailey & Henry, 2008) might also contribute to poorer social functioning and subsequent loneliness (Bailey et al., 2008). Taken together, these possibilities suggest that some social problems are increased in older adulthood because of self-regulatory failures arising from executive dysfunction.

Age-related changes in emotional responding also have the potential to disrupt self-control efforts in social domains and, as noted earlier, one possible route is through the altered experience of self-conscious emotion. Self-conscious emotions, such as pride, guilt, shame, and embarrassment, are critical determinants of self-control behaviors in social contexts that motivate interpersonal etiquette and personal hygiene, and inhibit transgression of social standards. Such emotions also promote reparative actions to mend social relations following transgressions (Tracy & Robins, 2007). Furthermore, any decrease in felt arousal in response to negative outcomes should also reduce experience of self-conscious emotions that arise in relation to negative cues (e.g., guilt). Future research might profitably explore whether, when, and how altered emotional experience

interacts with diminished executive control to influence self-regulation of social behavior and consequent social outcomes.

Finances

The percentage of adults over the age of 65 who gamble has risen dramatically over the past 30 years, as have rates of problem gambling in this age group (Petry, 2005). It is unclear from these trends, however, why gambling problems are increasing among older adults. It could be that the increased accessibility of gambling, in combination with the availability of leisure time and expendable income, leads some older adults to develop gambling problems. Alternatively, as suggested earlier, it is possible that gambling problems in older adults are at least partially the result of age-related reductions in the capacity for self-regulation. Problems with executive control might be compounded by changes in emotional experience because reduced arousal in reaction to losses (but not wins) may increase the weighting placed on positive relative to negative feedback, making it more difficult to inhibit the urge to gamble. These possibilities suggest that gambling establishments might be exploiting older adults who have problems with self-control and limited opportunities to earn back their losses. At the same time, the current findings also suggest new avenues for treatment of gambling problems among older adults. For example, older adults might gamble more wisely if they adhere to their circadian rhythms and avoid gambling in the afternoon or evening. As with social functioning, future research might profitably examine the conjoint effects of executive losses and increased positivity on levels of gambling problems in older adults.

Health

Like many other demographic groups in industrialized nations, older adults are increasingly struggling with obesity (e.g., Australian Institute of Health and Welfare, 2004). These obesity trends have important health, economic, and social consequences, with a recent longitudinal study of nearly 4,000 older adults identifying a relationship between increasing body mass index and functional impairment (Lang, Llewellyn, Alexander, & Melzer, 2008). The increased prevalence of obesity in late adulthood may be partially attributable to reduced capacity for self-regulation. Excess body weight has been strongly linked to lifestyle factors, such as reduced exercise and increased food consumption. Because exercising can be onerous, maintaining a healthy routine can depend on the ability to resist the temptation to relax and to induce oneself to exercise. Furthermore, because fattening foods are readily available, maintenance of a healthy body weight also depends on the ability to resist frequent dietary temptations. Self-regulatory failures in late adulthood may therefore manifest themselves in increased body weight. Indeed, in a sample of otherwise healthy adults, those who were overweight exhibited reduced executive control relative to their normal-weight counterparts (Gunstad et al., 2007). Furthermore, any diminution of felt arousal in response to negative (but not positive) outcomes may increase the emphasis placed on the immediate positive feelings derived from eating a tempting food relative to the negative long-term consequences of weight gain. At this point there are no empirical tests of these possibilities, but changes in emotional responding and losses in executive functioning could easily be precursors of weight gain and other health problems in late adulthood.

Forewarning

Although the data reviewed in this chapter suggest a variety of self-regulation problems experienced by older adults due to deficits in executive functioning and changes in emotional experiences, older adults are likely to be able to compensate for many of these changes. For example, older adults typically manage their poorer memory for details by relying on higher-level representations that contain the primary points of the information they learned (Radvansky & Dijkstra, 2007). In a similar manner, older adults might also develop strategies that minimize their difficulties with self-regulation brought about by executive decline or emotional changes.

In support of such a possibility, evidence suggests that older adults can inhibit stereotypes just as effectively as younger adults when they know the stereotype is irrelevant at encoding (Radvansky, Lynchard, & von Hippel, 2009). In their study, Radvansky and colleagues (2009) presented younger and older adults with stories about a person with a stereotypically male or female occupation (e.g., plumber vs. babysitter). Half of the time, participants were explicitly given a gender label when first learning about the protagonist (e.g., “The babysitter was a young boy who . . .”), and half the time they were not (e.g., “The babysitter was a young teenager who . . .”). Additionally, half of the time the gender of the protagonist was occupation-stereotypic and half the time it was counterstereotypic. Later in the story, participants encountered a pronoun that communicated the gender of the protagonist, and the critical measure was whether they read the sentence containing the counterstereotypic pronoun more slowly than the sentence containing the stereotypic pronoun. Results indicated that both younger and older adults read the sentence containing the counterstereotypic pronoun more slowly when they had not initially been provided an explicit gender label, but both younger and older adults read the counterstereotypic pronoun just as quickly as the stereotypic pronoun when they had already been provided a gender label.

These findings suggest that older adults are just as capable as young adults of putting aside their stereotypes when they know at the moment they encounter the person that their stereotypes are irrelevant to the situation at hand. These findings are also consistent with informal observations from our laboratory that older adults are often just as capable as younger adults of suppressing a socially inappropriate response when they know in advance that the need to suppress a response is likely to be imminent. Older adults seem to get themselves into trouble primarily when they cannot anticipate the self-regulatory demands in advance and prepare themselves for it. This possibility suggests that interventions might be designed around the idea of forewarning older adults who are having self-regulatory difficulties. The mechanisms and boundary conditions involved in the effectiveness of forewarning, and indeed the search for and development of other compensatory strategies, would seem to be a worthwhile direction for future research.

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PART VI

SELF-REGULATION CHALLENGES

CHAPTER 27

Attention-Deficit/Hyperactivity Disorder and Self-Regulation

Taking an Evolutionary Perspective on Executive Functioning

RUSSELL A. BARKLEY

Current psychiatric taxonomy describes attention-deficit/hyperactivity disorder (ADHD) as involving developmentally inappropriate degrees of inattention and hyperactive–impulsive behavior. These two highly correlated symptom dimensions frequently arise in early childhood, are relatively pervasive or cross-situational in nature, yet can be highly variable across contexts, and may persist into adolescence and young adulthood in the majority of clinically diagnosed cases. The symptoms result in impairment in major life activities such as family functioning, developing self-sufficiency, peer relations, and educational and occupational functioning, among others (American Psychiatric Association, 2013; Barkley, 2015a; Barkley, Murphy, & Fischer, 2008). This perspective emphasizes problems in the realms of attention, impulsiveness, and activity level as being central to the disorder. But children with ADHD often demonstrate deficiencies in other motor, cognitive, and emotion regulation abilities that cannot be readily ascribed to secondary consequences of the primary symptom dimensions.

Among these, are difficulties with (1) gross and fine motor coordination and motor sequencing (Fliers et al., 2010; Harvey et al., 2007); (2) executive functioning (EF; inhibition, working memory, planning and problem-solving, fluency, etc.; Willcutt, 2015); (3) effort allocation (Douglas, 1983; Nigg & Casey, 2005); (4) developing, applying, and self-monitoring organizational strategies (Barkley, 2012a; Sullivan & Riccio, 2007); (5) the internalization of self-directed speech (Berk & Potts, 1991; Reck, Hund, & Landau, 2010) and verbalization of internal states (Rumpf, Kamp-Becker, Becker, & Kauschke, 2012); (6) rule-governed or instructionally guided behavior (Danforth, Barkley, & Stokes, 1991); (7) impaired sense of time (Houghton, Durkin, Ang, Taylor, & Brandtman, 2011); (8) steep temporal discounting of delayed rewards (Demurie, Roeyers, Baeyens, & Sonuga-Barke, 2013; Scheres, Tontsch, & Thoeny, 2012); and (9) self-regulation

of emotion (Barkley, 2010, 2015c; Martel, 2009), among other deficits. Many of these difficulties appear to be relatively specific to ADHD and do not seem to be a function of comorbid disorders, such as learning disabilities, depression, anxiety, or oppositional/conduct disorder (Barkley, 2012a; Barkley et al., 2008; Hummer et al., 2011; Nigg, 1999).

The commonality among most or all of these seemingly disparate abilities is that all have been considered to fall within the domain of “executive functions” (EFs) in the field of neuropsychology (Barkley, 2012b; Denckla, 1996) or “metacognition” in developmental psychology (Welsh, Pennington, & Grossier, 1991), or to be affected by these functions. All seem to be mediated, at least in part, by the frontal cortex, and particularly the prefrontal lobes are associated with at least three or more neural networks and implicated in the neuropsychology of ADHD (Castellanos, Sonuga-Barke, Milham, & Tanock, 2006; Fuster, 1997; Nigg & Casey, 2005; Sagvolden, Johansen, Aase, & Russell, 2005). Theorists and clinical scientists have long speculated that problems with prefrontal (executive) functioning specifically and self-regulation more generally are at the heart of this disorder and give rise to the more superficial and surface symptoms represented in clinical diagnostic criteria (Barkley, 1997a, 1997b, 2015d; Pontius, 1973). I agree and argue that ADHD is executive function deficit disorder (EFDD).

The view of ADHD as a disorder of EF remains controversial, however (Barkley, 2015c; Willcutt, 2015), given that when EF is measured using laboratory tasks, only a minority of subjects display deficits (Barkley & Fischer, 2011; Barkley & Murphy, 2011; Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005). However, when ratings of EF in natural settings involving daily life activities are collected from parents and teachers of children with ADHD or from self and other reports of adults with ADHD, the vast majority manifest serious deficits in all dimensions of EF (Barkley, 2011, 2012a; Barkley & Fischer, 2011; Barkley & Murphy, 2011). The gross disparity in findings here results in part from a lack of significant relationships between EF tasks and EF ratings purportedly measuring the same construct(s) (Toplak, West & Stanovich, 2013). The fact that EF ratings are more strongly predictive of impairments in daily life activities in which EF is likely involved than are EF tests, which often have weak or no relationships to such impairments (Barkley & Fischer, 2011; Barkley & Murphy, 2011), seriously undermines the commonplace assumption that EF tests are the “gold (or only) standard” by which EF should be assessed (Barkley, 2012b).

That EF specifically and self-regulation more generally are central deficits in ADHD is highly consistent with clinical observations of the disorder and with the high correlations seen between ratings of EF and self-regulation and ADHD (Barkley, 2011, 2012a). Yet to argue that EF and self-regulation are involved in ADHD first necessitates that (1) one operationally define these terms and (2) give a reasonable account of how normal self-regulation develops in children, and (3) explain just how ADHD acts to disrupt that normal developmental process. These necessities have led me to spend the better part of the past 15 years conceptualizing and investigating the nature of self-control in children and adults with and without ADHD (Barkley, 1997a, 2012b). Of relevance to a theory of ADHD are operational definitions for the terms *behavioral inhibition*, *self-control*, and *executive function* that have been employed frequently in the fields of developmental psychology, neuropsychology, and child psychopathology.

My stance in this chapter is that the initial and overarching purpose of self-control and EF is an inherently social one: Humans engage in reciprocal social exchanges as a means to their survival and must both track such prior exchanges with others and anticipate and

prepare for such future interactions with others. That purpose arose out of the group-living niche that humans occupy—one of social groups that comprise genetically unrelated or distantly related individuals who came to depend on forms of reciprocal exchange or self-interested altruism and the formation of cooperative coalitions for orchestrating non-zero-sum activities on which their survival depended. It is the essence of such coalitions aimed at joint non-zero-sum activities that they attain economic and other survival benefits that cannot be achieved by the individuals acting alone or purely selfishly as in zero-sum interactions (Wright, 2000). From this perspective, nonsocial organisms that live relatively independently of other members of their species (other than for mating/reproductive activities) do not need self-control or the EF systems that permit it.

DEFINING INHIBITION, SELF-CONTROL, AND EXECUTIVE FUNCTIONING

From the perspective taken here, the terms *behavioral* or *response inhibition*, *self-control* or *self-regulation*, and *executive functioning* are overlapping and interacting human abilities. Defining them carefully shows their interconnectedness.

Defining Our Terms

Response inhibition, as I use it here, refers to three overlapping yet somewhat distinct and separately measurable processes:

1. Inhibiting the initial prepotent (dominant) response to an event so as to create a delay in responding (the response is now temporarily decoupled from the stimulus that served to elicit it).
2. Interrupting an ongoing response that is proving ineffective, thereby permitting a delay in and reevaluation of the decision to continue responding (a sensitivity to error).
3. Protecting the self-directed (executive) responses that will occur within these delays, as well as the goal-directed behavior they generate from disruption by competing events and responses (interference control or resistance to distraction) (Barkley, 1997a, 1997b, 2012b; Fuster, 1997).

I employ the definition of *self-control* used in behavior analysis: Self-control is a response (or series of responses) by the individual that functions to alter the probability of his or her subsequent response to an event and in so doing thereby changes the likelihood of a *later* consequence related to that event (Kanfer & Karoly, 1972; Mischel, 1983, 2014; Mischel, Shoda, & Rodriguez, 1989; Skinner, 1953). In other words, self-control is any action by an individual directed toward him- or herself so as to change his or her behavior and therein alter future rather than merely immediate consequences. Some considered self-control to be the choice of a delayed, larger reward over a more immediate, smaller one (Ainslie, 1974; Burns & Powers, 1975; Logue, 1988; Mischel, 1983; Navarick, 1986). But this ignores the self-directed actions in which the individual must engage so as to value the delayed over the immediate reward and to pursue that delayed consequence.

What, then, is EF? I conceptualize it as comprising *the principal classes of behavior that we direct toward ourselves for purposes of self-regulation (changing our future)*. An *executive act* is any action directed toward oneself that functions to modify one's own behavior so as to strive to change one's future outcomes. Each EF represents a specific type or class of self-control. Such actions may be covert but need not be so to be classified as "executive" actions here. The term *covert* merely means that the outward, publicly observable (musculoskeletal) manifestations of such behavior have been made very difficult to detect by others over the course of human evolution (and human development), probably by inhibiting those peripheral movements. But those actions still occur centrally (in the brain), and they can still be thought of as forms of behavior, albeit behavior-to-the-self. Second, developments in the technology of neuroimaging and the fine-grained recording of shifts in muscle potential now suggest that this covert behavior-to-the-self is capable of being measured (D'Esposito et al., 1997; Livesay, Liebke, Samaras, & Stanley, 1996; Livesay & Samaras, 1998; Ryding, Bradvik, & Ingvar, 1996). In short, EF is viewed here as behavior-to-the-self and develops in such a way that by adulthood the peripheral musculoskeletal apparatus associated with such actions is being largely inhibited so as to create a private form of behavior-to-the-self.

The conceptual linkage of inhibition with self-regulation and of both of these constructs with executive functioning is now obvious. Response inhibition is a prerequisite to self-regulation because one cannot direct actions or behavior toward oneself if one is instead already responding impulsively to an immediate event. The EFs are the general forms or classes of self-directed actions that humans use in self-regulation. I have identified at least five such classes besides inhibition below (Barkley, 2012b). The EFs and the general self-regulation they create produce a net overall maximization of social consequences when considering both the immediate and delayed outcomes of certain response alternatives. As noted earlier, the hypothetical or anticipated future toward which they are directed is a social one. I proposed that there are six classes of actions that people direct toward themselves to change their own behavior so as improve the future (Barkley, 2012b).

SIX SELF-DIRECTED ACTIONS OF EF

Self-Directed Attention—Self-Awareness

The self-direction of attention comes to create self-awareness. Logic alone requires that it precede the existence of the other EF components because they all presuppose a sense of self. One cannot direct an action back on the self for self-regulation if one has no sense of self.

Sensing to the Self (Nonverbal Working Memory)

This EF is akin to Baddeley's visuospatial sketchpad in his information-processing rendition of working memory (Baddeley, 1986; Baddeley & Hitch, 1994). It originates in the privatization of sensorimotor actions; it is sensing to the self (literally, resensing to the self). The most important of the senses to humans are vision and hearing, so this EF may chiefly comprise visual imagery and covert audition—reseeing and rehearing to the self. This EF has both retrospective (sensory or resensing) and prospective (preparatory motor)

elements (Fuster, 1997; Goldman-Rakic, 1995). Here, then, arises the mental module for sensing the hypothetical future from the experienced past.

Speech to the Self (Verbal Working Memory)

This is similar to Baddeley's construct of the same name. It can be better understood, however, using Vygotsky's model of the developmental internalization of speech. Such self-speech permits self-description and reflection, self-instruction, self-questioning and problem solving, as well as the invention of rules and meta-rules to be applied to oneself (Diaz & Berk, 1992). It therefore contributes not only to a major form of self-control via language, but likely provides the basis for moral conduct (internalizing socially prescribed rules of conduct).

Self-Directed Appraisal (Emotion and Motivation to the Self)

This EF may occur initially as a mere consequence of the others (described earlier). Those EFs involve covertly re-presented forms of visual and verbal information to oneself. These mentally represented events have associated affective and motivational properties or valences, which Damasio (1994, 1995) called *somatic markers*. This EF forms the wellspring of intrinsic motivation (willpower) so necessary to support future-directed behavior, especially across large delays in schedules of reinforcement or when external consequences for such future-directed action are otherwise not available in the immediate context.

Self-Play (Reconstitution): The Origin of Planning and Problem Solving

The last EF is self-directed private (covert) play, or reconstitution. *Fluency*, *flexibility*, and *generativity* are other terms by which this EF is known in neuropsychology. This EF serves to generate a diversity of new combinations of behavioral units out of old ones and so is the source of behavioral innovation (problem solving) during goal-directed actions. This EF may be subdivided further into verbal and nonverbal components comparable to the working memory system (verbal or nonverbal) on which it acts.

Further Implications of the Theory

Each executive function is also hypothesized to contribute to the following developmental shifts in the sources of control over human behavior:

- From external events to mental representations related to those events
- From control by others to control by the self
- From immediate reinforcement to delayed gratification
- From the temporal now to the conjectured social future

With maturation, the individual progressively comes to be guided more by covert representations that permit self-control, deferred gratification, and goal-directed actions toward conjectured social futures.

THE IMPORTANCE OF VIEWING EF AS AN EXTENDED PHENOTYPE

In the most recent revision and expansion of this theory of EF, I have cast it in the form of a multilevel hierarchy (Barkley, 2012b). I did so in large part to examine how the initial, self-directed and cognitive level of the EFs extend outward like a series of concentric rings to impact important major domains (levels) of human social activity. As I noted earlier and have discussed in detail elsewhere (Barkley 2012b), the human EF system does not exist to sort cards, detect between X's and O's on computer screens (as in continuous performance tests), recite digit spans backwards, or generate multiple words for the initial letter of F, as may often tested in neuropsychological batteries purporting to measure EF. These are not the most important purposes of the EF system because they are not the crucial faculties lost in people with frontal lobe disorders, such as the classic case of Phinneas Gage (Harlow, 1848, 1868). Using the notion of an extended phenotype developed by Dawkins (1982) in understanding the evolution of various adaptations in species' phenotypes, I have attempted to show how the EF mind tools can produce effects that radiate outward like a series of concentric rings from a drop in a water basin into physical, social, and cultural space, so as to produce important evolutionary (selective) effects at a considerable distance from the individual. Such effects-at-a-distance can be considered part of the species' phenotype if they feed back to eventually impact the survival, reproductive fitness, and general welfare of the individual.

The new model is depicted in Figure 27.1. Briefly stated, the theory now includes the self-directed, internalized EFs described earlier as forming the initial *self-directed-instrumental* or "cognitive" level, so called because the EFs are not merely self-directed as an end in themselves but are a means to other ends (and so are instrumental). As they develop, they contribute to survival benefits at the next level of the extended phenotype of EF, that being the *methodical-self-reliant* level, so labeled because the EFs are used to create short-chain behaviors that accomplish near-term goals (methods) having to do with immediate survival, welfare, independence from others, and social self-defense. This level permeates or comprises daily human adaptive functioning.

Over time, a third ring or level of extended phenotypic effects emerges, having to do with social reciprocity and exchange, which forms the basis of human friendships and extended social networks. This level is entitled the *tactical-reciprocal* level, for obvious reasons. The term *tactical* here not only implies the military one of adjusting one's actions as a function of the actions of others but it also represents the nesting of methods (short-chain goal-directed behavior) into longer-chain activities that accomplish goals further distant in time.

With further development, I argue that another, higher level or extended ring of the EF phenotype emerges, in which people join together to accomplish joint goals that none could do alone and so they share in the outcomes of those joint activities. Cooperative ventures such as these require very special situational factors to cause them to come into existence and are rather fragile, deteriorating back to lower levels of self-interested reciprocal or even predatory forms of social behavior if those conditions deteriorate (see Barkley, 2012b, for these conditions). This level of the extended EF phenotype is called the *strategic-cooperative* one not only because it is the level or concentric zone in which cooperation takes place but it also incorporates the two meanings of the word *strategic*. In its obvious sense, this term refers to sets of tactics being used to accomplish a longer-term goal in the context of others and using others, which form strategies. In another

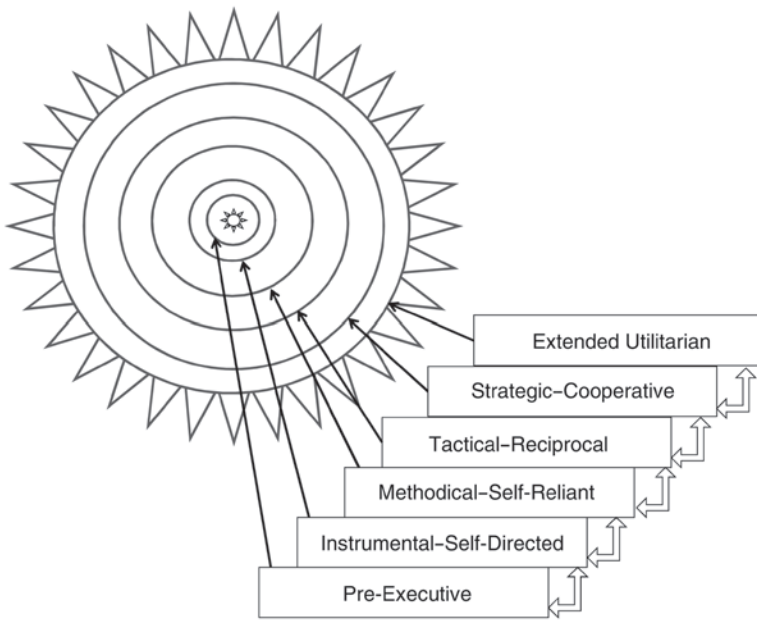


FIGURE 27.1. Two different ways of illustrating the extended EF phenotype. The concentric rings at the left indicate the outwardly radiating nature of the phenotype at this intermediate stage of development (preexecutive, instrumental–self-directed, methodical–self-reliant, tactical–reciprocal, strategic–cooperative, principled–mutualistic) as does the leftward pointing arrow. The final sunburst edging of this diagram reflects the extended consequences or utility of employing EF across these levels and one’s lifetime, known as the extended utilitarian zone. The stacked boxes at the right indicate the hierarchical arrangement of these seven phenotypic levels and the ultimate utility (effects at a distance) of using them. The bidirectional arrows to the right of each box are intended to convey the bidirectional flow of information between the levels. Information from the lower level flows upward to the higher level, while management of the lower level may be exerted downward by the next higher level. From R. A. Barkley (2012). Copyright 2012 by The Guilford Press. Reprinted by permission.

sense, the term means a nested set of tactics accomplished by each as an intermediate term goal that when strung together can accomplish far longer-term goals.

Note then not only the social and cultural aspects to these levels of concentric phenotypic rings of effects but also the nesting of instrumental cognitive, self-directed actions within methods within tactics within strategies that result in both a chaining and a nesting of short-term within midterm within longer-term goals that create highly complex forms of human activities. Within the strategic–cooperative level may even arise under special sociocultural conditions a higher level of human EF activities, known as *principled–mutualistic* activities that groups of individuals form not only to accomplish longer-term shared goals (and benefits) but in whom each individual also looks out for the welfare of others in that group, and in which much higher-level rules are used to guide social and cultural conduct (principles), such as abstract laws, norms, rules, and so forth.

At each new level of EF, consequences (advantages mostly) accrue to the individual; otherwise, the extension into that zone of effects would either not have happened or it would be a mere by-product with no selection effect in evolution and would therefore

not be considered part of the extended EF phenotype at all. Each new ring of the model is surrounded by a zone of feedback effects that are the consequences of using EF at that level. In short, extended phenotypes produce extended consequences. I refer to this outermost zone of consequences as the *extended utilitarian* zone. Should individuals have developmental or acquired disorders of the prefrontal cortex and the EF system it supports, any and all of these concentric or hierarchically arranged levels of this EF extended phenotype are put at risk of dysfunction.

IMPLICATIONS OF THE THEORY FOR ADHD

A central problem in those with ADHD is the reduced capacity for behavioral inhibition (Barkley, 1997a, 1997b; Nigg, 2001; Quay, 1987). Given the importance of such inhibition to the other EFs, as described earlier, a deficit in inhibition will result in a cascade of secondary deficits into the remaining four EFs. As extrapolated to those with ADHD, the model predicts that deficits in behavioral inhibition lead to deficiencies in nonverbal working memory and therefore (1) particular forms of forgetfulness (forgetting to do things at certain critical points in time); (2) impaired ability to organize and execute one's actions relative to time (e.g., time management); (3) reduced hindsight and forethought; (4) leading to a reduction in the creation of anticipatory action toward future events. Consequently, the capacity for the cross-temporal organization of behavior in those with ADHD is diminished, disrupting the ability to string together complex chains of actions directed, over time, to a future goal. The greater the degree to which time separates the components of the behavioral contingency (event, response, consequence), the more difficult the task will prove for those with ADHD who cannot bind the contingency together across time so as to use it to govern their own behavior as well as others are able to do.

Research demonstrates some of these deficits in those with ADHD, such as poor nonverbal working memory, timing, and forethought (Barkley, 1997a; Barkley et al., 2008; Frazier, Demareem, & Youngstrom, 2004; Hervey, Epstein, & Curry, 2004; Willcutt, 2015). Understudied is the prediction from this theory that children with ADHD will be delayed in making references to time, past, and future in their verbal interactions with others relative to when children without ADHD begin making such references in their development of sense of time, hindsight, and foresight.

For those with ADHD, the privatization of speech should be delayed, resulting in greater public speech (excessive talking), less verbal reflection before acting, less organized and rule-oriented self-speech, a diminished influence of self-directed speech in controlling one's own behavior, and difficulties following the rules and instructions given by others (Barkley, 1997a). Substantial evidence has accumulated to support this prediction of delayed internalization of speech (Berk & Potts, 1991; Winsler, 1998; Winsler, Diaz, Atencio, McCarthy, & Chabay, 2000). Given that such private self-speech is a major basis for verbal working memory (Baddeley, 1986), this domain of cognitive activity should be impaired in those with ADHD as well. Evidence suggests this is so; children with ADHD have difficulties with tasks such as digit span backwards, mental arithmetic, paced auditory serial addition, paired associated learning, and other tasks believed to reflect verbal working memory (Barkley, 1997a; Frazier et al., 2004; Hervey et al., 2004; Kuntsi, Oosterlaan, & Stevenson, 2001).

The impairment in the internalization and self-direction of emotion arising from ADHD leads to the following predictions. Those with ADHD should display: (1) greater emotional expression in their reactions to events; (2) less objectivity in the selection of a response to an event; (3) diminished social perspective taking because the child does not delay his or her initial emotional reaction long enough to take the view of others and their needs into account; and (4) diminished ability to induce drive and motivational states in themselves in the service of goal-directed behavior. Those with ADHD remain more dependent on the environmental contingencies within a situation or task to determine their motivation than do others (Barkley, 1997a). And people with ADHD do have significant problems with emotion regulation (Barkley, 2015c).

The model further predicts that ADHD will be associated with impaired reconstitution, or self-directed play, evident in a diminished use of analysis and synthesis in the formation of both verbal and nonverbal responses to events. The capacity mentally to visualize, manipulate, then generate multiple plans of action (options) in the service of goal-directed behavior and to select from among them those with the greatest likelihood of succeeding should therefore be reduced. This impairment in reconstitution will be evident in everyday verbal fluency when the person with ADHD is required by a task or situation to assemble rapidly, accurately, and efficiently the parts of speech into messages (sentences), so as to accomplish the goal or requirements of the task. It will also be evident in tasks in which visual information must be held in mind and manipulated to generate diverse scenarios to help solve problems (Willcutt, 2015). Evidence for a deficiency in verbal and nonverbal fluency, planning, problem solving, and strategy development more generally in children with ADHD is considerable and is consistent with the theory (Barkley, 1997a; Clark, Prior, & Kinsella, 2000; Frazier et al., 2004; Hervey et al., 2004).

In general, ADHD is predicted to disrupt the four transitions noted earlier in the source of control over behavior. The child with ADHD will be more under the control of external events than mental representations about time and the future, under the influence of others rather than acting to control him- or herself, pursuing immediate gratification over deferred gratification, and more under the influence of the temporal now than of the probable social futures that lie before him or her. From this vantage point, ADHD is not a disorder of attention, at least not to the moment or the external environment, but more of a disorder of intention (i.e., attention to the future and what one needs to do to prepare for its arrival). It is also a disorder of time—specifically, time management—in that the individual manifests an inability to regulate his or her behavior relative to time, as well as do others at his or her developmental level. This creates a sort of temporal myopia in which the individual with ADHD responds to or prepares for only events that are relatively imminent rather than ones that lie further ahead in time, whereas others of the same age without ADHD are preparing, so as to be ready for their eventual arrival (Barkley, 1997a, 2012b).

By implication, this view of ADHD, combined with an evolutionary perspective on EF, suggests that the disorder will interfere with the larger social purposes for which EF and self-control may have evolved—reciprocal altruism (social exchange) and vicarious learning—and the higher levels of the extended phenotype (reciprocity, cooperation). These predictions remain to be tested through research on children with ADHD. But there is sufficient evidence currently available to demonstrate significant impairments in the peer relationships of children with ADHD, perhaps for these very reasons (McQuade

& Hoza, 2015). And it is apparent that those with ADHD have a propensity for risk taking despite having been reasonably informed of the consequences for others who do so (Barkley, 2015b, 2015e). This perspective on EF, self-regulation, and ADHD also generates numerous clinical recommendations for the management of ADHD and other disorders of EF (Barkley, 2012b). Some of the principles of EF deficit management for ADHD that arise from the extended phenotype model are briefly mentioned below.

Externalize Information

If the process of regulating behavior by internally represented forms of information (working memory or the internalization of self-directed behavior) is impaired or delayed in those with EF deficits, then they will be best assisted by “externalizing” those forms of information; the provision of physical representations of that information will be needed in the setting at the point of performance. Since covert or private information is weak as a source of stimulus control, making that information overt and public may assist with strengthening control of behavior by that information. It must be made physical, outside of the individual, as it has to have been in earlier development. The internal forms of information generated by the executive system, if they have been generated at all, appear to be extraordinarily weak in their ability to control and sustain the behavior toward the future in those with EF deficits. Self-directed visual imagery, audition, covert self-speech, and the other covert resensing activities that form nonverbal working memory do not have sufficient power to control behavior in many EF disorders. That behavior remains largely under the control of the salient aspects of the immediate context.

The solution to this problem is not to nag those with EF difficulties simply to try harder or to remember what they are supposed to be working on or toward. Instead, the solution is to fill the immediate context with physical cues comparable to the internal counterparts that are proving so ineffective. In a sense, clinicians treating those with EF deficits must beat the environment at its own game. Whenever possible, minimize sources of high-appealing distracters that may subvert, distort, or disrupt task-directed mentally represented information and the behavior it is guiding. In their place should be cues, prompts, and other forms of information that are just as salient and appealing, yet directly associated with or an inherent part of the task to be accomplished. Such externalized information serves to cue the individual to do what he or she knows.

If the rules that are understood to be operative during educational or occupational activities, for instance, do not seem to be controlling the adult’s behavior, they should be externalized. They can be externalized by posting signs about the rules in the school or work environment and having the adult refer frequently to them. Having the adult verbally self-state these rules aloud before and during individual work performances may also be helpful. One can also record these reminders on a cassette tape for the adult to listen to through an earphone while working. It is not my intention in this chapter to articulate the details of the many treatments that can be designed from this model. That is done in other textbooks. All I wish to do here is simply show the principle that underlies them—to put external information around the person’s sensory fields to better guide his or her behavior in more appropriate activities. With the knowledge this model provides and a little ingenuity, many of these forms of internally represented information can be externalized for better management of the child or adult with EF deficits, as seen in ADHD, for instance.

Externally Represent or Remove Gaps in Time

The organization of the individual's behavior both within and across time is one of the ultimate disabilities rendered by injuries to the prefrontal cortex and other EF disorders. EF deficits create problems with time, timing, and timeliness of behavior, such that they are to time what nearsightedness is to spatial vision. They create a temporal myopia in which the individual's behavior is governed even more than normal by events close to or within the temporal now and the immediate context rather than by internal information that pertains to longer-term, future events. This helps us understand why adults with EF deficits make the decisions they do, shortsighted as they seem to be to others around them. If one has little regard for future events, then much of one's behavior will be aimed at maximizing the immediate rewards and escaping from immediate hardships or aversive circumstances, without concern for the delayed consequences of those actions. Those with deficient EF could be assisted by making time itself more externally represented, by reducing or eliminating gaps in time among the components of a behavioral contingency (event, response, outcome). Caregivers and others can also help to bridge such temporal gaps related to future events.

Another solution is to reduce or eliminate these problematic time-related elements of a task when feasible. The elements should be made more contiguous. Rather than tell the person that a project must be done over the next month, assist him or her with doing a step a day toward that eventual goal, so that when the deadline arrives, the work has been done, but done in small daily work periods with immediate feedback and incentives for doing so.

Externalize Motivation

The model also hypothesizes that a deficit will exist in internally generated and represented forms of motivation needed to drive goal-directed behavior. Complaining to these individuals about their lack of motivation (laziness), drive, willpower, or self-discipline will not suffice to correct the problem. Pulling back from assisting them to let the natural consequences occur, as if this will teach them a lesson that will correct their behavior, is likewise a recipe for disaster. Instead, artificial means of creating external sources of motivation must be arranged at the point of performance in the context in which the work or behavior is desired. For instance, the provision of artificial rewards, such as tokens, may be needed throughout the performance of a task or other goal-directed behavior when there are few or no immediate consequences associated with that performance. Such artificial reward programs become for the person with EF deficits what prosthetic devices are to physically disabled people, allowing them to perform more effectively in some tasks and settings in which they otherwise would have considerable difficulty. The motivational disability created by EF deficits makes such motivational prostheses essential for most children deficient in EF and they can be useful for adults with EF deficits as well.

The methods of behavior modification are particularly well suited to achieving these ends. Many techniques in this form of treatment can be applied to children and adults with EF deficits. What first needs to be recognized, as this model of EF stipulates, is that (1) internalized, self-generated forms of motivation are weak at initiating and sustaining goal-directed behavior; (2) externalized sources of motivation, often artificial, must be

arranged within the context at the point of performance; and (3) these compensatory, prosthetic forms of motivation must be sustained for long periods. If the external motivation is removed, the behavior will not be further sustained and the individual will regress to more erratic goal-directed behavior, with less ability to sustain actions toward tasks and goals.

In general, there are two reasons to do behavior management for anyone: for informational training and to sustain motivation. The former is done for individuals who have not yet acquired a skill. Once the skill is taught through behavioral or other pedagogical methods, those methods can be withdrawn and the behavior is sustained presumably by contact with the natural contingencies. But in EF disorders the issue is not ignorance or lack of knowledge of a skill; the problems are with the skill's timing and execution at key points of performance, and with the self-motivation needed to sustain the performance. Behavioral treatments can provide the motivational or behavior-sustaining assistance. Removing the external motivation after improvement in task performance will result in a loss of motivation and a return to the baseline state of limited self-motivation and an inability to sustain actions toward goals.

By equating EF with self-regulation, and by viewing the self-regulation of emotion as described by Gross (Gross & Thompson, 2007) as but a specific form of a more generalized process of self-regulation, the extended phenotype model of EF illustrates at least five vectors through which EF and self-regulation can influence goal-directed activities: situation selection, situation modification, attentional control/redirection, reappraisal, and response modification/suppression. In attempting to assist individuals with rehabilitating or at least compensating for their EF deficits, these five vectors offer opportunities in which clinicians can strive to improve such deficits. While this can be done by directly working with the patient, it is likely to be greatly assisted by advising caregivers or significant others to assist the individual with these five pathways of SR. Modifying the "point of performance" as discussed more below, readily fits into the situation modification vector of self-regulation. Various cognitive-behavioral therapies may prove useful at the reappraisal pathway. The point here is not to map out all possible ways these five vectors of self-regulation may be used to boost EF in those with EF deficits but to make clinicians cognizant that such pathways are available for doing so.

Related to this idea of motivational deficits accompanying EF disorders is the literature on self-regulatory strength and the resource pool of effort (willpower) associated with activities of self-regulation. There is an abundant literature on this topic that has been overlooked by neuropsychologists studying EF, yet it has a direct bearing on EF given that EF is viewed as self-regulation. As nicely summarized by Bauer and Baumeister (2011), research indicates that each implementation of self-regulation (and hence EF) across all types of self-regulation (working memory, inhibition, planning, reasoning, problem solving, etc.) depletes this limited resource pool temporarily, such that protracted self-regulation may greatly deplete the available pool of effort. This can result in an individual being less capable of self-regulation (EF) in subsequent situations or immediately succeeding time periods. The individual is therefore more likely to experience problems or fail outright in his or her efforts at EF and self-regulation and resistance to immediate gratification. Such temporary depletions may be further exacerbated by stress, alcohol or other drug use, illness, or even low levels of blood glucose. Research also indicates the following factors that may serve to more rapidly replenish the resource pool:

- Routine physical exercise.
- Taking 10-minute breaks periodically during strenuous self-regulation situations.
- Relaxing or meditating for at least 3 minutes after such self-regulation activities.
- Visualizing the rewards or outcomes while involved in EF and self-regulation tasks.
- Arranging for periodic small rewards throughout the tasks in demanding self-regulation settings.
- Engaging in self-affirming statements of self-efficacy prior to and during such tasks.
- Generating positive emotions.
- Consuming glucose-rich beverages during the task.

Some research further suggests that the actual capacity of the resource pool may be boosted by routine physical exercise and by routinely practicing tasks involving self-regulation daily for 2 weeks. From the extended phenotype view of EF as self-regulation, these findings from the psychological literature on self-regulation are directly pertinent to EF and its disorders.

Intervene at the Point of Performance in Natural Settings

Given the previously listed considerations, clinicians should likely reject most approaches to intervention for adults with EF deficits that do not involve helping patients with an active intervention at the point of performance and across the extended EF phenotypic levels that are impaired. Counseling once per week is unlikely to succeed with the patient with deficient EF without efforts to insert accommodations at key points of performance in natural settings to address the impaired domains of major life activities. This is not to say that extensive training or retraining at the instrumental level of EF, as with working memory training, may not have some short-term benefits. Such practice has been shown to increase the likelihood of using EF and self-regulation, and of boosting the self-regulation resource pool capacity in normal individuals, at least temporarily (Bauer & Baumeister, 2011).

An implication for the management of EF deficits from the extended phenotype theory is that only a treatment that can result in improvement or normalization of the underlying neurological and even genetic substrates of EF is likely to result in improvement or normalization of the phenotypic deficits. To date, the only existing treatment that has any hope of achieving this end is medication, such as stimulants or nonstimulants such as atomoxetine or guanfacine XR (extended release), which improve or normalize the neural substrates in the prefrontal regions and related networks that likely underlie some of these deficits, such as those associated with ADHD. Evidence to date suggests that this improvement or normalization in ADHD-related EF deficits may occur as a temporary consequence of active treatment with stimulant medication, yet only during the time course the medication remains within the brain. For instance, research shows that clinical improvement in behavior occurs in as many as 75–92% of those with ADHD and results in normalization of behavior in approximately 50–60% of these cases, on average. The model of EF developed here, then, implies that medication is not only a useful treatment approach for the management of certain EF deficits in ADHD but may also be

a predominant treatment approach among those treatments currently available because to date it is the only treatment known to produce such improvement/normalization rates, albeit temporarily, for ADHD-related EF deficits.

CONCLUSION

In closing, there is obviously much promise in viewing ADHD as a disorder of self-regulation. It encourages psychopathologists to develop more fully models of how normal self-control arises across childhood and even into adulthood, and to examine where in these models disorders such as ADHD disrupt the normal structure and processes of self-regulation to produce what is known about the disorder. Moreover, such model building also suggests new hypotheses that can be pursued in not only testing the models but also providing a greater understanding of what is disrupted by the disorder and to best to manage it (see Barkley, 2015d). I have also argued here that taking an evolutionary or adaptive perspective toward self-control and its associated EFs can further enlighten us on the nature of these relatively unique human abilities and what larger domains of social functioning may be deficient in those with ADHD. That perspective implies that self-control may have arisen for a set of largely social functions, such as reciprocal exchange, cooperative coalitions, and vicarious learning. This perspective gives further grounds for the development of testable hypotheses about not only self-control but also the social deficiencies that arise in disorders of self-regulation such as ADHD.

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CHAPTER 28

Self-Control and Crime

Theory, Research, and Remaining Puzzles

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In a very famous court case over pornography, Justice Potter Stewart famously noted, “I know it when I see it” (*Jacobellis v. Ohio*, 1964). Oft-repeated, this comment can also be the answer to the question “What is self-control?” Rather simply, it is refraining from doing what one impulsively wants to do without consideration of the consequences of one’s actions. Such a general construct, self-control is invoked in many disciplines and is used to explain virtually all human behavior. Given its centrality, it is important to take stock of what is known about its relationship to various behaviors. In this chapter, we focus on the relationship between self-control and crime within the criminological domain. And while our overview and remarks must be constrained (controlled!) by page length, we nevertheless seek to provide the reader with some of the most important theoretical and empirical issues surrounding self-control and offending. In this regard, we begin our foray with what has become the starting point in all matters related to self-control and crime, Gottfredson and Hirschi’s (1990) general theory of crime. We then proceed to outline the empirical research and challenges to emerge from said research and close with an identification of some of the pressing issues and highlight some promising directions going forward.

THE THEORY

Gottfredson and Hirschi’s (1990) general theory of crime, with its focus on self-control, had its genesis in work that was developed throughout the 1980s. Commencing with their classic article documenting the relationship between age and crime (Hirschi & Gottfredson, 1983), the two scholars began to argue that explaining criminal behavior is likely rooted in individual-level propensity, which they initially called “criminality.”

In a series of publications criticizing the criminal career approach, which argued that the different dimensions of offending (participation, frequency, specialization, career length) may have unique correlates (Blumstein, Cohen, Roth, & Visher, 1986; Piquero, Farrington, & Blumstein, 2003), Gottfredson and Hirschi built the case that across time and place, crimes have had something in common, and this reality may lead to a more simple and parsimonious explanation than that offered previously by more complicated theoretical frameworks, including typological and developmental theories. For example, Gottfredson and Hirschi (1987, p. 596) stated, “most criminal acts and delinquencies are assumed to be different manifestations of the same phenomenon.” The perspective was more fleshed out in 1986, when they made their now classic distinction between *crime* (an event) and *criminality*, which they defined as “stable differences across individuals in the propensity to commit criminal (or equivalent) acts” (Hirschi & Gottfredson, 1986, p. 58).

The theory was fully specified in Gottfredson and Hirschi’s 1990 book, *A General Theory of Crime*. The perspective starts with the idea that to understand why people engage in crime, one must fully understand what crime involves. By defining *crimes* as “acts of force or fraud taken in the pursuit of self-interest” (p. 15), they do not exclude similar behaviors not sanctioned by the state, thus avoiding problems with a scientific approach to studying a social construct such as crime. They then described the common characteristics of criminal acts, noting that they are generally simple, physical acts that do not require much in the way of advanced planning, and that, importantly, generally result in short-term or immediate gain at the expense of long-term costs. These elements of crime led to a theory that views offenders as individuals who prefer to engage in physical as opposed to mental activities, who do not have high cognitive abilities, and who do not consider the long-term consequences of their behavior. In all, Gottfredson and Hirschi specified six interrelated elements of self-control: short-term focus, a preference for simple over complex tasks, a preference for physical over mental activities, a capacity for risk taking, difficult temperamentality, and insensitivity to the needs of others.

In *A General Theory of Crime*, the theorists argued that self-control, developed virtually entirely via parental socialization efforts aimed at monitoring the child’s behavior, recognizing deviant behavior, and effectively punishing such behavior, is a relatively stable characteristic in that between-individual differences or rank order remains over time. By around age 8 or 9, a person’s relative level of self-control is generally fixed. Yet the debate concerning whether self-control is psychological or biological in nature continues. Moreover, and perhaps more importantly, self-control was referred to by other terms such as *self-regulation* or *impulsivity* in psychological research for decades preceding Gottfredson and Hirschi’s incorporation of the construct into criminology.

The individual-level characteristic of self-control is not the only component to the theory, however, as crimes will only occur when individuals with low self-control are met with opportunity. It is unclear exactly how much of a role this concept has in the theory as, later, Hirschi and Gottfredson (1993) argued that opportunities for crime were common and therefore should not be a focus in theory testing. In fact, they later take an even stronger stance, stating that their theory “does not see or require opportunity in any meaningful sense of the term” (Hirschi & Gottfredson, 2008, p. 221).

Since publication of their 1990 work, there has been a significant amount of theoretical and empirical research aimed at critiquing, testing, and modifying the theory (see Goode, 2008). Next, we review some of these efforts and their key findings.

EMPIRICAL ANALYSES

Tests

Perhaps no theory of crime has enjoyed the degree of empirical success as the general theory. A decade after its inception, a meta-analysis assessing the relationship between self-control and offending behaviors found “fairly impressive empirical support for Gottfredson and Hirschi’s theory” with effect sizes larger than 0.20 (Pratt & Cullen, 2000, p. 951). Whereas that meta-analysis examined the ability of self-control to explain crime and deviance, a more recent meta-analysis found impressive support for the theory’s ability to explain victimization as well (Pratt, Turanovic, Fox, & Wright, 2014), although the overall strength of support was weaker than that for offending. This is interesting and speaks to the notion that self-control is an individual trait that reflects a diverse array of tendencies, including the tendency to find oneself in harm’s way. By far, the majority of tests of the theory have focused on explaining crime and analogous acts, and to date, research has consistently found support.

Because the general theory is wide-reaching and ambitious in its claims, many studies have been conducted on various aspects of the theory. For example, research has shown that self-control predicts crime across cultures (Vazsyoni, Pickering, Junger, & Helsing, 2001; Vazsyoni, Wittekind, Belliston, & Van Loh, 2004), and that self-control relates to various criminal and analogous behaviors (Evans, Cullen, Burton, Dunaway, & Benson, 1997; Paternoster & Brame, 1998), thereby providing confirmation to the theory’s versatility-in-offending hypothesis. Still, other aspects of the theory have been challenged, including the extent to which parental socialization bears sole responsibility for the development of self-control (Beaver, Wright, DeLisi, & Vaughn, 2008; Beaver et al., 2009; Gibson, Sullivan, Jones, & Piquero, 2010; Pratt, Turner, & Piquero, 2004), the extent to which self-control is more stable than dynamic and hence not malleable (Piquero, Jennings, & Farrington, 2010; Turner & Piquero, 2002), and the extent to which self-control is relevant to explaining corporate or white-collar crime (Piquero, Schoepfer, & Langton, 2008; Simpson & Piquero, 2002).

Measurement

Since the development of the theory, ambiguity has surrounded the best way to measure self-control. As Piquero (2009) stated, “Other than to say that the six characteristics that comprise self-control ‘come together’ within persons, in the initial statement of the theory Gottfredson and Hirschi defined self-control in such a way that precluded any assistance with respect to the best way to operationally measure self-control in empirical research” (p. 155; see also Piquero, 2008).

The first empirical tests of the theory utilized two contrasting approaches to operationalize self-control, one behavioral and one attitudinal. Keane, Maxim, and Teevan (1993) used a behavioral measure of self-control (seat belt use), Hirschi and Gottfredson’s (1993) preferred strategy, but its dichotomous coding created the impression that one has self-control (or not) as opposed to being arrayed on a continuum. Another measure—of impulsivity—asked respondents whether anyone had tried to stop them from drinking and driving; again a binary measure. The second study employed a battery of questions, many of which came from the California Personality Inventory (CPI) that the authors felt reflected the six dimensions of self-control (Grasmick, Tittle, Bursick, & Arneklev, 1993).

After a series of validity tests, Grasmick and colleagues (1993) developed a 24-item scale and found it to predict offending.

By far, the Grasmick and colleagues (1993) scale is the most utilized measure of self-control in the criminological literature. For example, of the 94 studies in Pratt and Cullen's (2000) meta-analysis, 82 were attitudinal, and half of these used the Grasmick and colleagues scale or a modified version of it. Yet that scale has been a subject of some concern regarding its dimensionality, with some researchers finding that the items are uni-dimensional (Piquero & Rosay, 1998; Piquero & Tibbetts, 1996) and others finding that the scale does not have useful psychometric properties (Cochran, Wood, Sellers, Wilkerson, & Chamlin, 1998; DeLisi, Hochstetler, & Murphy, 2003; Higgins, 2007; LaGrange & Silverman, 1999; Longshore, Turner, & Stein, 1996). We return to this issue later.

In 2004, Hirschi offered a reconceptualized version of self-control in the first edition of this volume, as well as a more explicit suggestion of how self-control may be profitably measured by providing example items for a self-control scale. The key to measuring self-control, Hirschi explained, was to add up the number of "inhibitions" that a person has when considering deviant acts. A person who feels that his or her mother *and* father would disapprove of an act should ostensibly have a greater level of self-control than a person only thinking of one parent. The first empirical test of this new conceptualization was conducted by Piquero and Bouffard (2007), who measured self-control by having respondents think of "costs" that may accrue if they engage in delinquency. They found that this measure of self-control was significantly related to hypothetical intentions to offend (elicited from a vignette) and interestingly, that it rendered the Grasmick and colleagues (1993) attitudinal measure insignificant. In a similar study, Rocque, Posick, and Zimmerman (2013) found that the Grasmick and colleagues scale and the revised Hirschi measure were about equally well suited to explain a variety of delinquent acts. A recent study, however, found that the inventory had stronger effects on crime across a cross-national sample than the new Hirschi measure (Vazsonyi & Huang, 2015).

Additional work on conceptualizations of self-control has also been undertaken. In one novel approach, and aided by research in psychology more generally (see Baumeister, Heatherton, & Tice, 1994), Tittle, Ward, and Grasmick (2004) parceled out an individual's capacity for self-control vis-à-vis his or her desire to exercise self-control. As these authors noted, "Some people may have a strong capacity for self-control but may not always want to exercise it, while others may have weak self-control ability but have such a keen interest in controlling their deviant impulses that they end up conforming" (p. 146). Their preliminary analyses provided evidence that both conceptualizations of self-control were related to offending. Muraven, Pogarsky, & Shmueli (2006) advanced the idea of self-control depletion, such that with repeated use, much like a muscle being used repeatedly to bench-press 300 pounds, one's self-control can be diminished. Analysis by this team of researchers showed that self-control depletion was important for understanding drinking and cheating behaviors.

With respect to measurement, self-control is certainly not the only factor relevant in Gottfredson and Hirschi's theory. As Gottfredson (2006) stated, "Sometimes our work is miscited to indicate that we argue that self-control is the sole cause of crime, an odd conclusion given our discussions of age, opportunity, and of the nature of criminal acts" (p. 83). Thus, other aspects of the theory, such as opportunity, are integral aspects to measure in examining its empirical status. One of the first tests of the theory measured opportunity with a set of questions reflecting the "ease" and "gratification" of crimes in

particular circumstances (Grasmick et al., 1993). The researchers found that self-control interacted with opportunity in leading to crime. Other work has found similar interactions (Cochran et al., 1998; Longshore, 1998; Longshore & Turner, 1998). Pratt and Cullen's (2000) meta-analysis of self-control examined whether opportunity interacted with self-control, such that self-control was related to crime only in the presence of opportunity. Their findings did not show support for this supposition. In any case, most tests of the theory, for reasons we describe below, have focused mainly on self-control to the exclusion of opportunity (Piquero, 2009).

Stability/Versatility

Another interesting element of the general theory of crime concerns Gottfredson and Hirschi's (1990) argument that self-control, once established, is relatively stable throughout the life course. The theorists also claimed (in support of the moniker, "the general theory of crime") that the theory could explain all crime and analogous acts. This latter point was made in light of the belief of the authors that offenders are "polymorphous perverse" (Geis, 2008, p. 211). With respect to stability, although some research has pointed to between-individual stability, in general, research tends to indicate that rank-order stability is not as strong as Gottfredson and Hirschi claimed. In a recent analysis, Burt, Simons, and Simons (2006) used two waves of data from the Family and Community Health Study (FACHS), and found that respondents often moved from one quartile of self-control to another over time. In other words, relative stability was not found. The preponderance of the evidence thus far indicates that indeed, self-control is *not* relatively stable for all persons, and that there is a nontrivial amount of movement across low, medium, and higher levels of self-control (Arneklev, Grasmick, Tittle, & Bursik, 1993; Hay & Forrest, 2006; Turner & Piquero, 2002).

Gottfredson and Hirschi's (1990) stance on versatility was another linchpin of their theory. Drawing on the criminological literature, which by and large has shown that offenders do not specialize in specific types of behavior (e.g., they are not professional thieves who commit no other types of crime), the theorists sought to dispel the notion that there are crime-specific causes of offending (an explanation that was emerging with the rational choice/routine activities theories; see Clarke & Cornish, 1986). While specialization versus generality is in some sense a matter of interpretation—some researchers see some limited specialization in certain types of offending—the research tends to show that offenders are versatile (Piquero et al., 2003).

Invariance

Part of what made Gottfredson and Hirschi's (1990) theory a "general" theory of crime was that they claimed it could explain all crimes at all times across various places. This is what some have referred to as the "invariance" hypothesis: that self-control should explain offending by males and females, offending in both 2015 and 1915, offending by Americans and Japanese, offending among New York Yankees fans and Red Sox fans, and so on. The evidence on whether self-control equally predicts offending for different demographic groups is generally supportive of the theory, showing that self-control is important for females and males (Burton, Cullen, Evans, Alarid, & Dunaway, 1998;

Keane et al., 1993; but see LaGrange & Silverman, 1999) and for various race/ethnicities (Vazsonyi & Crosswhite, 2004). In addition, limited research has indicated that the psychometric properties of measures of self-control are invariant across sex (Piquero & Rosay, 1998).

There is also a burgeoning literature demonstrating that the effect of self-control is cross-cultural (i.e., the causes of crime are invariant across place). The work of Vazsonyi has been especially influential here, showing that self-control applies in Asian cultures (Vazsonyi et al., 2004), and European nations (Vazsonyi et al., 2001). Other work has shown self-control to be important in the prediction of crime and deviance in Russia (Tittle & Botchkovar, 2005) and a host of non-Western nations (Rebblon, Straus, & Medeiros, 2008). Research in a variety of countries such as Canada (Morizot & Le Blanc, 2007), Switzerland (Vazsonyi, 1996), and the Netherlands (Vazsonyi et al., 2001) supports the invariance of self-control in predicting behavior. Research using large international samples also supports the ability of self-control to predict adolescent delinquency (Posick, 2013; Rocque, Posick, Marshall, & Piquero, 2015).

Recent work has indicated that self-control, which may have been integral in the “civilizing” of society over the years, has had the effect of considerably lowering violence (see Pinker, 2011). This is related to the idea of a social contract, whereby being included in society requires some level of self-control (DeWall, Baumeister, & Vohs, 2008). While quantitative data to test this idea about self-control do not exist this far back in time, the idea draws on the work of Eisner (2001, 2003, 2014), who has argued that civilizing effects in essence lead to more restrained behavior and delay of gratification. Thus, self-control may be a perspective that is more historically relevant than previously thought and indeed may apply to crime at “all times” (Gottfredson & Hirschi, 1990, p. 117).

Development of Self-Control

One of the more interesting characteristics of the general theory of crime is the way in which the authors utilize both social and psychological factors. Recall that self-control is hypothesized to develop from the actions of parents in terms of discipline and attention to their child’s behavior. However, once a child reaches a certain age, parental, school, and other influences that could ostensibly affect or influence self-control no longer have an impact.

A growing body of emergent research is testing parental effects on self-control. This literature tends to show that not only do parenting styles influence self-control (Hay, 2001), but parenting also has an effect on delinquency over and above self-control (Botchkovar & Broidy, 2013; Burt et al., 2006; Perrone, Sullivan, Pratt, & Margaryan, 2004), which was not anticipated by Gottfredson and Hirschi (1990). Other authors have sought to determine whether parenting mediates male–female differences in offending. Theoretically, if the difference in crime and deviance levels between males and females is due to self-control, parenting should account for this—showing differences in parenting styles, for example, by gender. Some researchers have indicated that gender remains a significant predictor of crime, controlling for both self-control and parenting styles (LaGrange & Silverman, 1999). In two relatively recent studies using international data, one study indicated that self-control was more strongly predictive of delinquency for males than for females (Steketee, Junger, & Junger-Tas, 2013) whereas the other indicated that several

other factors, such as neighborhood bonding, affect the development of self-control (Botchkovar, Marshall, Rocque, & Posick, 2015). Thus, issues related to the source of self-control and the effect of parenting remain in question. We return to this topic later.

Extensions of the Theory Beyond Offending

In recent years, several researchers have sought to extend and clarify aspects of self-control in the general theory of crime. One of the most notable expansions is the application of the concept of self-control to victimization. This was first undertaken by Schreck (1999), who argued that low self-control increases an individual's risk of victimization and found support for this proposition using data from the Tucson Youth Project. In subsequent research, Schreck, Stewart, and Fisher (2006) showed that self-control influences another correlate of victimization, engaging in risky lifestyles (e.g., engaging in crime or having criminal peers), which exposes individuals to victimization. An impressive body of literature has since indicated that self-control is an important risk factor for various kinds of victimization (Holtfreter et al., 2010; Piquero, MacDonald, Dobrin, Daigle, & Cullen, 2005; Pratt et al., 2014).

Other extensions of the general theory of crime have looked at the wider social structure to examine how self-control translates to delinquent or criminal behavior. For example, scholars have studied whether the effects of impulsivity and self-control vary by neighborhood (Gibson et al., 2010; Pratt et al., 2004). The research here is somewhat mixed, with some studies indicating that impulsivity has a larger effect on crime in areas of disadvantage (Lynam et al., 2000; Meier, Slutske, Arndt, & Cadoret, 2008), other studies finding the opposite to be true (Zimmerman, 2010; Zimmerman, Botchkovar, Antonaccio, & Hughes, 2015), and still other research showing no such contextual effect (Vazsonyi, Cleveland, & Wiebe, 2006).

THEORETICAL CLARIFICATIONS

Definition/Relationship with Social Control

Hirschi's (1969) foundational work on social bonding theory brought to the forefront of criminology the idea that strong relationships with other persons, especially family members, prevent deviant behavior. He theorized that the social bond includes *attachment* to others, *commitment* to conventional behavior, *involvement* in prosocial activities, and *belief* in societal rules. While espousing this theoretical approach to explaining delinquency, Hirschi's collaboration with Gottfredson resulted in a different perspective. Here, it is not so much bonds that matter but how parenting inhibits criminal behavior by instilling self-control. Hirschi (2004) has attempted to reconcile these ideas and has even revised his conceptualization of self-control to define it as "inhibitions" that people carry with them on a daily basis. In addition, Gottfredson (2006) has argued that self- and social control theories are largely compatible: "If self-control and social control share indicators for children and for adolescents and are said to be caused by the same factors (largely parental and secondarily friend and school influences), then the old view in criminology that there are two types of control—internal and external—may well be incorrect and misleading" (p. 90).

Despite this effort, some have suggested that the two ideas are virtually irreconcilable. For example, Nagin and Paternoster (1993) believe that the self-control approach neglects important facets of bonding theory, including the well-established finding that social bonds themselves are significant and not “secondary” to individual self-control. Perhaps most importantly, the crux of the general theory of crime is that self-control is a relatively stable individual difference that changes little over time. However, social bonds, and the inhibitions that Hirschi (2004) describes in his revised theoretical piece, change over time. Sampson and Laub (1995) believe that this lack of attention renders the theory largely baseless (see also Taylor, 2001), but Gottfredson and Hirschi remain recalcitrant in the prospects that both self- and especially social controls matter for anti-social behavior.¹

Morality

In an important theoretical and empirical extension, contemporary research has begun to consider the role of morality in criminal behavior and the role that morality plays in interacting with self-control to produce poor individual outcomes. Leading this discussion is Wikström, who has integrated self-control and morality into his theory of crime causation. Situational action theory (SAT) incorporates morality into the self-control perspective by suggesting that morality is the mechanism that one employs when deciding to commit a crime. Those with high morality do not engage in crime regardless of their level of self-control or their opportunity to commit crime. Testing this assumption, Wikström and Svensson (2010) found that both self-control and morality had an effect on offending, but that the effect of self-control relied on, or was conditional upon, individual levels of morality.

SAT views individual morality as the “fundamental” cause of crime as it moderates self-regulation. This theoretical view has recently been extended to the macro level. Neighborhood levels of morality have been found to moderate the effect of individual levels of self-control, such that self-control has a larger effect on crime in neighborhoods with weak morality (Zimmerman et al., 2015), suggesting that beyond individual-level morality, contextual levels of morality also play a part in crime causation. More generally, the incorporation of morality and self-control into a larger theoretical framework remains in its infancy, with empirical research slowly emerging but with mixed results (see, e.g., Piquero, Bouffard, Piquero, & Craig, 2016).

REMAINING PUZZLES

Gottfredson and Hirschi’s (1990) general theory of crime emerged during a time period in criminology that one criminologist called a “state of theoretical paralysis” (Wellford, 1989), in which there had been very little new or imaginative thinking on the causes and correlates of crime. In fact, the publication of their general theory of crime ushered in a large set of theoretical modifications, extensions, challenges, and new frameworks (especially developmental/life course theories) that likely arose in response to their claims. Not surprisingly, the theory has amassed one of the largest bodies of empirical literature of any theory of crime and delinquency. As we have discussed, much of this literature

supports the theory. In addition, the theory has been included in new theoretical perspectives that seek to further the understanding of crime and criminality. We anticipate that the future will hold much more for self-control perspectives as we continue to learn the ways in which it applies to crime and other behaviors over the life course and across contexts (see Vohs et al., 2008). In addition to learning new applications for self-control, there remain several puzzles that have yet to be solved with respect to theory, which we detail in the following section.

Conceptualization and Measurement

One important point that research has yet to resolve is how self-control should be best conceptualized and measured empirically. As discussed, the first two empirical tests of the relationship between self-control and offending utilized two distinct methods of measuring self-control, one using the familiar Grasmick and colleagues (1993) attitudinal inventory and a second using a behavioral method (e.g., seat belt usage; Keane et al., 1993). Much research has been conducted using the attitudinal measure of self-control—generally dismissed by Gottfredson and Hirschi, who prioritize behavioral measures of self-control. As they stated, “Methodologically, the Keane et al. approach has much to recommend it. Although we would agree that multiple measures are desirable, behavioral measures of self-control seem preferable to self-reports” (Hirschi & Gottfredson, 1993, p. 48).

The suggestion that “self-reports” are not an ideal measure of self-control is logical for several reasons. First, self-control is an unobserved construct that is somewhat difficult to put into words and must therefore be measured in a valid fashion using surveys (see Baumeister, Vohs, & Funder, 2007). Second, the very act of filling out a survey requires some level of diligence that is itself likely to be affected by self-control; that is, people with low self-control are not likely to sit through an entire survey and answer questions consistently and accurately. Research has found this to be the case: Piquero, MacIntosh, and Hickman (2000) showed that responses to the Grasmick and colleagues (1993) attitudinal measure were in fact influenced by self-control; that is, persons with lower self-control were more likely to respond to items in a measure of self-control in particular ways when compared to persons with higher self-control. This casts some grey clouds on the sole use of attitudinal measures.

The alternative is to use behavioral indicators as a reflection of self-control. Aside from seat belt usage, other work has examined such things as squeezing handgrips (Muraven, Tice, & Baumeister, 1998), eating too much, and relationship patterns (Tittle, Ward, & Grasmick, 2003). The argument that behaviors are the best indicator of self-control has, from the start, been met with charges of tautology—explaining crime and deviance with crime and deviance (Akers, 1991). For example, if one suggests that poor self-control is the cause of crime and “imprudent acts,” using imprudent acts or prior crime to index self-control is problematic. An interesting but generally overlooked measure of self-control was offered by Marcus (2003), who argued that most measures of self-control “misinterpreted” the concept. His Retrospective Behavioral Self-Control Scale (RBS) attempts to rectify this issue, using measures of previous behavior. Marcus’s analyses showed that the RBS was a more valid measure of self-control than the Grasmick and colleagues (1993) inventory. Some may quibble that this demonstrates nothing

more than the stability of deviance (something criminologists have long known), but in any event, the RBS has yet to make solid headway into the mainstream criminological literature and resolve (in Marcus's view) the measurement of self-control.

Tittle and colleagues (2003) also attempted to contrast the Grasmick and colleagues (1993) scale with behavioral indicators of self-control (such as seat belt use, substance use, and financial behavior). They found that both measures were significantly related to crime but did not find evidence that one version was superior to the other. While the attitudinal inventory had good psychometric properties, the behavioral items did not correlate with each other consistently, leading to an unclear scale. This differs from the RBS, which demonstrated good psychometric properties. This finding also seems to cast doubt on whether self-control really does predict all manner of "imprudent acts" or whether it has a differential impact on those that provide more or less benefit.

Opportunity

It remains unclear whether opportunity should be an integral part of the theory, and if so, how it should be included. Scholars have taken Gottfredson and Hirschi's statement at its word and included measures of opportunity in tests of the theory (Burton et al., 1998; Cochran et al., 1998; Grasmick et al., 1993; Tittle et al., 2003). However, as Simpson and Geis (2008, p. 51) noted, "the precise part to be played by opportunity in the general theory . . . remains uncertain." As we mentioned earlier, opportunity has not been included in many tests of self-control, particularly in light of Gottfredson and Hirschi's clarification that "opportunities for crime are ubiquitous [citations omitted]. *This fact answers the criticism of self-control theory that it does not deal sufficiently with the concept of opportunity.* It confirms that self-control can be measured and the theory assessed without undue concern for differences in opportunities to commit criminal, deviant, or reckless acts" (Gottfredson & Hirschi, 2003, p. 9, original emphasis).² In other words, the authors seem to be arguing that opportunity is *not* a primary part of the theory.

Arguably however, the role of opportunity in the theory may be more about the type of crime in which those with low self-control engage than about a moderator to explain when and in what circumstances those with low self-control will offend (Gottfredson & Hirschi, 2003). Tracing back the intellectual foundations of the general theory of crime reveals much in this regard. In their commentary regarding white-collar crime, they state that "white-collar crimes can be defined as crimes that can only be committed by persons occupying positions of power and influence. This approach rules out crimes committed by high-status people that can be committed by low-status people as well" (Hirschi & Gottfredson, 1987, p. 956). Gottfredson and Hirschi (2003) argue that white-collar crimes are generally made to seem much different than ordinary street crimes by comparing white-collar criminals to street criminals (see, e.g., Benson & Moore, 1992). Such a method would likely indicate that white-collar criminals have higher self-control than street criminals. Thus, it is not self-control that distinguishes type of crime here, but rather opportunity. To Gottfredson and Hirschi, a proper test of the general theory of crime would compare individuals at similar social locations, which suggests that opportunity is useful not solely as a moderator of any criminal behavior but as a way to understand which type of offending one engages in.

The General Theory?: Performance against Other Theories

Because Gottfredson and Hirschi (2003) made very ambitious claims regarding their theory, that it could explain all crimes at all times, and in fact took aim at other theoretical perspectives, it is important to evaluate it relative to other theories of crime and deviance. There are several ways in which this might be accomplished, but we begin with a comparison of the strength of the self-control → crime link, as demonstrated in meta-analyses. The first meta-analysis of self-control revealed consistent support for the theory but rather modest effect sizes (ranging from 0.14 to 0.57; Pratt & Cullen, 2000). Meta-analyses of other primary theories of crime, such as social learning theory, have found similar effect sizes (Pratt et al., 2010). The impact of self-control on victimization was, however, considerably smaller than that on offending (Pratt et al., 2014).

Other research has directly compared theories in the same regression model. Wright, Caspi, Moffitt, and Silva (1999) provided one such test, specifically focusing on whether social bonds (e.g., relationships with others and social institutions) are related to crime due to some type of selection bias; that is, self-control influences both one's social bonds and one's likelihood of offending, as anticipated in the general theory of crime. Their findings were largely mixed, which suggests that selection does occur, but social bonds may have an effect on crime over and above that process. In their influential *Crime in the Making*, Sampson and Laub (1995) controlled for childhood temperament and impulsivity, and still found that adult social bonds, such as a good job and stable marriage, predicted involvement in adult crime. Other researchers have similarly found that in statistical models that include self-control, other theoretical variables continue to have an effect (Evans et al., 1997; Higgins, 2004; Posick, 2013; Simpson & Piquero, 2002).

In general, self-control tends to be a relatively strong predictor of crime, but its overall effect is not very large. In a review of explanatory power of criminological theories, in fact, Weisburd and Piquero (2008) found that in terms of R^2 value, self-control ranked 14th out of 16 theoretical areas with an average R^2 value of .275. In summary, it is not clear whether self-control theory is the primary correlate of crime that the original authors assumed, though it does appear to be related to a variety of different behaviors, as the authors argued.

Is the General Theory General?

Another nagging issue is whether the general theory is truly general; that is, does the theory, as it claims, truly explain *all* crimes and analogous acts? Overall, research has indicated that poor self-control is related to a wide variety of antisocial behaviors and “imprudent acts” (Arneklev et al., 1993). For example, Reisig and Pratt (2011) even found support for the notion that self-control explains the breaking of common social norms such as “public flatulence” (p. 592). This is consistent with Gottfredson and Hirschi's (1990) perspective that a wide range of deviant and antisocial acts all share common ground, namely, they are easy to commit, require little forethought, and have short-term benefits but often long-term costs.

Nonetheless, as mentioned earlier, some theoretical constructs remain statistically significant in models that include self-control. In addition, poor self-control does not appear to be the strongest predictor of crime and antisocial behavior. More importantly, it is not clear whether self-control is related to *all* types of crime and misconduct,

especially with respect to white-collar/corporate crime. As Piquero (2009, p. 164) noted, "Given that there needs to be some modicum of (high) self-control to occupy such high-level positions that require significant education (which is also likely correlated with self-control), how does the theory explain why some doctors become addicted to drugs, why some doctors prescribe illegal prescriptions, why some CEO's engage in price fixing, collusion, and other forms of deviance."

Development of Self-Control

One of the more controversial aspects of the general theory of crime has been the ways in which Gottfredson and Hirschi (1990) argued that it is formed and develops throughout life. Recall that according to the theory, self-control is developed through attentive parenting early in life. This is a pure control theory perspective, in which natural, hedonistic impulses must be curbed via socialization and attachment to significant others. Curiously, though, after childhood, Gottfredson and Hirschi suggest that other social institutions, such as the school, workplace, or marriage, fail to have an effect on personal attributes and behavior.³ This argument contains several problems that have yet to be resolved.

First, the notion that social institutions other than parenting have no effect on self-control has come into question because research has shown that other environmental factors *do* influence self-control, above and beyond parenting (Forrest & Hay, 2011; Gibson et al., 2010; Na & Paternoster, 2012; Turner, Piquero, & Pratt, 2005). Forrest and Hay (2011) demonstrated that marriage may increase self-control, whereas Turner and colleagues (2005) found evidence that the school can (contrary to explicit arguments by Gottfredson and Hirschi) influence self-control. In fact, a review of studies that examined developmental programs targeting self-control found that programs do have an overall positive effect on the development of self-control, and that these programs often reduce crime and delinquency (Piquero et al., 2010). In other words, parents do not appear to be the only influence on self-control, nor does self-control appear to be "set" around age 8 or 9. How much influence other institutions or programs may have in general and how variable self-control is over time remain open empirical questions that have yet to be subjected to much empirical research.⁴

Second, the hypothesis that parental socialization is the most important determinant of an individual's self-control and, consequently, indirectly accounts for differences in crime remains an open question. Some researchers who have specifically examined the parenting question (as noted earlier) found that, in terms of gender, parenting does account for some, but not all, of the differences in self-control and crime (Botchkovar et al., 2015).

Third, even the transmission of self-control from parent to offspring has been recently questioned. Gottfredson and Hirschi drew from the work of Gerald Patterson in the Oregon Social Learning Center (Akers, 2011), who argued that parents must monitor their children, recognize deviance, and punish it when it occurs. This parenting style, in the theory's view, instills self-control on the part of the child. Biological factors were explicitly denied.

However, studies have started to show that self-control may be attributed to parents, but in large part to some set of genetic factors rather than to parenting styles (Beaver et

al., 2008, 2009). These researchers have found, for example, that a majority of the variation in self-control is actually attributable to genetic influences. If self-control is heritable, it becomes less clear how important parenting styles are in reducing crime in children. We anticipate that this issue is far from settled, however, because research has shown that the relationship between parenting styles, parent genes, and child behavior is incredibly complex (Moffitt, 2005).

CONCLUSION

In this chapter, we have touched on what we view as the major issues and unresolved questions relating to the general theory of crime. We hope that readers find our review useful and of interest as they continue to assess the self-control and crime relationship.

It is clear that self-control will be a mainstay in the criminology and social scientific literature for years to come. No other theory has at once demonstrated as much empirical support and revitalized discussions of theory, method, and analysis as the general theory of crime. Looking forward, we believe there are remaining extensions and clarifications that may lead to a better understanding of how self-control is related to crime and antisocial behavior. While self-control is clearly more than just impulsivity, arguably *impulsivity*—the inability to delay gratification and making split-second decisions without stopping to think—is a central component. Yet the relationship between impulsivity and behavior in general has not been fully explored in relation to the general theory of crime. It is typically assumed that impulsivity is related to poor decision making and deviant behavior, but not everyone who makes split-second decisions makes them poorly. For example, surgeons, bystanders, and others often make quick—even impulsive—decisions, but the decisions are good, and the actions are sometimes heroic. Decomposing impulsivity into its components, identifying what leads to “good” impulsive decisions and “poor” impulsive decisions, we think, will advance the theory even more. As this discussion illustrates, Gottfredson and Hirschi’s theory, despite being so parsimonious, is a treasure trove of ideas and has encouraged scholars to examine their own ideas in a new light. We see this as nothing but positive for science.

NOTES

1. Hirschi admitted that his early thoughts on age and crime led him to rethink the importance of bonds throughout life and consider crime to be largely the result of a stable individual trait: “But when we actually looked at the age–crime curves and decided they were the same, regardless, the justification for social control theory disappeared” (Laub, 2002, p. xxxi).
2. Interestingly, this argument was made prior to Simpson and Geis’s critique that Gottfredson and Hirschi do not pay enough attention to opportunity in the theory.
3. Gottfredson and Hirschi are not altogether clear on this point. While they emphatically state that social institutions other than parents do not matter in the development of self-control or criminal behavior, they note that “socialization continues throughout life” (1990, p. 107), which is related to desistance. If socialization in school, workplace, and

marriage is not what matters, then we do not know where this socialization they write of happens.

4. For example, findings from a self-regulation improvement program showed that “the pre-school children who watched clips featuring Cookie Monster practicing executive function skills exhibited stronger inhibitory control of their actions and better working memory skills compared to their peers who watched other *Sesame Street* clips that did not feature executive function skills” (Linebarger, 2014, p. 4).

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CHAPTER 29

Deciding to Curtail Persistence

JOSEPH T. MCGUIRE

JOSEPH W. KABLE

Imagine that a few seconds ago you called a restaurant to book a reservation and were placed on hold. How soon do you expect to be helped? Are you having any difficulty waiting?

Now imagine 5 minutes have gone by and you are still hearing hold music. Is it getting more difficult? Have your expectations changed? How much longer will you give them?

Voluntary persistence toward delayed rewards has often been framed, in the psychological literature, as a self-control problem. This view presumes that it is generally beneficial to direct one's behavior toward valuable prospects in the future, but that the fallible nature of self-control makes people sometimes succumb to immediate temptations instead. In laboratory studies, individuals who wait longer for delayed rewards have been deemed to possess greater self-control capacity.

In real life, though, how long it is worth holding out for future rewards can be a more vexed question. Not all long-run prospects are worthwhile goals, and not all immediate rewards are wayward temptations. Evaluating the relative merits of immediate and long-run rewards is complicated by the fact that future events are uncertain in both their substance and their timing. When it comes to choosing how long to wait for everything from city buses to customer service representatives, decision makers can as easily err by waiting too long—chasing sunk costs—as by waiting too little. In this chapter we review research suggesting that the challenge of delaying gratification does not emerge merely from psychological limitations but instead reflects the genuine complexity of the environments in which real-world decisions take place.

SEEMINGLY INCONSISTENT DECISION BEHAVIOR

When it comes to diagnosing self-control failure, one of the most incriminating phenomena occurs when people reverse their own previous choices about the future. Take, for

example, decisions about exercise. If you encounter someone who does not regularly exercise, you might simply assume he or she has other priorities. If, however, you encounter someone who began an exercise routine and dropped it within a week, you might be more inclined to suspect he or she is having difficulty following through on goals.

One of the best-known laboratory paradigms for eliciting reversals of future-oriented behavior was developed to study delay of gratification in children (Mischel & Ebbesen, 1970; Mischel, Ebbesen, & Zeiss, 1972; Mischel, Shoda, & Rodriguez, 1989). In the delay-of-gratification task, an experimenter offers a 4-year-old child a choice between a smaller and a larger food reward. The child can obtain the larger and more preferred reward by waiting alone in a room until the experimenter returns, or can obtain the smaller reward by summoning the experimenter at any time.

Behavior in this paradigm varies greatly across individuals. Data from a large replication study sponsored by the National Institutes of Health are shown in Figure 29.1 (McGuire & Kable, 2013; National Institute of Child Health and Human Development [NICHD] Early Child Care Research Network, 2002). The results are plotted in the form of a survival curve, showing what fraction of the children were still waiting at each time from the beginning of the delay until the 7-minute mark, when the large reward was delivered. At one extreme, about 53% of the participants waited the entire time. At the other extreme, about 17% quit within the first 15 seconds, consistent with having rapidly decided that it was not worth waiting for the larger reward. In between, the remaining 30% of the participants showed a more puzzling and seemingly inconsistent pattern: They waited at first, but at some point gave up and received the same small reward they could have obtained without waiting at all. It seems reasonable to construe this reversing sequence of choices—first trying to wait but then quitting—as a *delay of gratification failure*.

Various potential explanations for delay of gratification failure have been discussed in the psychological literature, and most appeal to the idea of limited self-control capacity. The child’s initial choice is thought to reflect a belief that the benefits of waiting outweighed the costs, but the subsequent reversal is taken as evidence that the child lacked the ability to follow through (Mischel, Ayduk, & Mendoza-Denton, 2003). The specific cognitive skills that make the difference between successful and unsuccessful waiting are

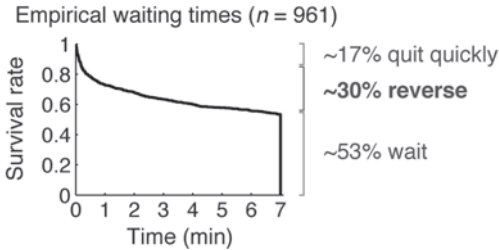


FIGURE 29.1. Behavior of 4-year-olds in the delay-of-gratification paradigm. The experimenter returned and delivered the large reward after 7 minutes if the child was still waiting. Data are from the Study of Early Child Care and Youth Development (NICHD Early Child Care Research Network, 2002). From McGuire and Kable (2013). Copyright 2013 by the American Psychological Association. Adapted by permission.

thought to include cognitive tactics, such as the strategic control of attention, that help to manage the balance between hot and cool motivational systems (Duckworth, Gendler, & Gross, 2014; Eigsti et al., 2006; Metcalfe & Mischel, 1999; Mischel et al., 1972; Rodriguez, Mischel, & Shoda, 1989).

Less-often appreciated, however, is that decision makers faced with delay might have good reason to reverse their original patient choice even if their self-control abilities are fully intact. When the timing of future events is uncertain, it can be appropriate to change one's subjective valuation of future rewards merely as a function of how much time has passed already.

TEMPORAL UNCERTAINTY AND TIME-VARYING REASSESSMENT

Most future rewards are associated with some degree of uncertainty, and this uncertainty can take at least two forms. Sometimes one is unsure whether the rewarding event will occur at all. In laboratory experiments, children quite reasonably become less interested in waiting for future rewards if they have reason to mistrust whether the experimenter will deliver the rewards as promised (Kidd, Palmeri, & Aslin, 2013; Mahrer, 1956). In other cases, one might believe an event is fairly sure to occur eventually but still might face substantial uncertainty about the duration of the delay. Consider real-life situations such as waiting for a city bus, waiting in a long checkout line, or waiting for the end of a boring speech. In these situations there is no real risk of the awaited event never arriving, but one might be anxious about the possibility that it might take an unreasonable amount of time.

The original delay-of-gratification laboratory experiments included deliberate measures to remove the first kind of mistrust as a factor. The protocol ensured that the children knew the large reward existed and the experimenter would eventually deliver it (Mischel & Ebbesen, 1970; Mischel et al., 1972). However, the paradigm was designed to create a high degree of temporal uncertainty. Participants received no specific information in advance about how long they would be expected to wait: The experimenter told them the delay would last "a while," and added, "Sometimes, I'm gone a long time" (Mischel & Ebbesen, 1970, p. 332). Even if a specific time interval had been mentioned, it is far from guaranteed that 4-year-old participants would have been able to make full use of the information. This is an important and face-valid feature of the paradigm, since temporal uncertainty is the rule rather than the exception for many kinds of real-life future rewards.

When people are unsure how long something will take, they nonetheless are able to express an intuitive sense of what the possibilities are. People's explicit predictions about the timing of various kinds of future events turn out to be reasonably well calibrated to the true statistics of the relevant domain (Griffiths & Tenenbaum, 2006). People understand, based on their background knowledge, that different forms of uncertainty characterize different situations.

A decision maker's expectations about an uncertain future event can be thought of in terms of a subjective probability distribution. For example, if you were wondering when the next subway train would arrive during a typical evening commute, your expectations might be well characterized by the normal distribution in the top-left of Figure 29.2.

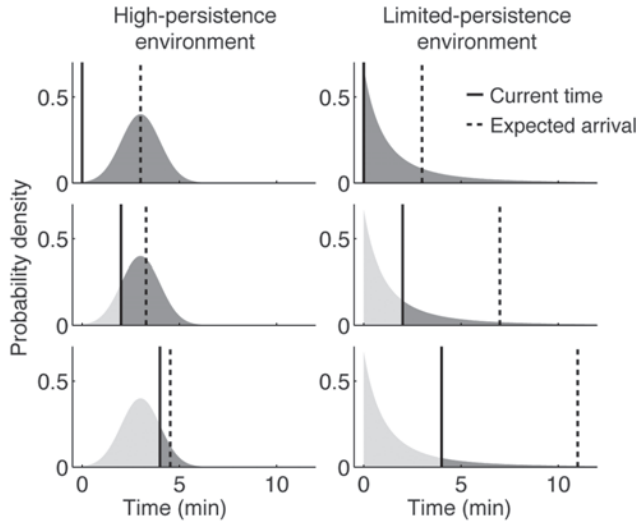


FIGURE 29.2. Two environments that entail opposite implications for behavioral persistence. The filled regions represent a decision maker’s subjective probability distribution for a reward’s arrival time. Faded areas represent times that have been ruled out because they are shorter than the time one has already waited; darker areas represent times that are still possible. The dashed line represents a prediction of the reward’s arrival time, obtained by averaging over the times that are still possible. This prediction evolves as a function of elapsed time (solid line), and does so differently in the two environments. From McGuire and Kable (2012). Copyright 2012 by Elsevier B. V. Adapted by permission.

This reflects an expectation that the train will probably take somewhere between 1 and 5 minutes. If pressed for a prediction, you might use the average of all the possibilities (or perhaps the median) and predict a waiting time of 3 minutes.

Once the subjective probabilities are written down in this way, it becomes straightforward to think about how one’s prediction would evolve with the passage of time. As time elapses (with no train in sight), short delay lengths are ruled out. This is represented in the left-hand column of Figure 29.2, with rows representing the situation in which zero, 2, or 4 minutes have already elapsed. As long as the train does not appear, one can adjust one’s expectations by excluding all the delays shorter than the amount of time that has already elapsed. At any given moment, one might offer an updated prediction based on the average of the times that are still possible. The result of this, in this scenario, is that time is felt to be bringing the event progressively nearer (Griffiths & Tenenbaum, 2006; McGuire & Kable, 2013). Even when the delay has exceeded the original prediction, one infers that there must be only a short time still remaining (bottom-left panel of Figure 29.2).

However, not all events are as reliable as the rush-hour subway train. Other situations involve a different form of temporal uncertainty, which leads to a qualitatively different pattern of dynamic change in one’s predictions. Suppose that instead of waiting for the subway one is waiting for a reply to an e-mail. Normally distributed expectations would no longer be appropriate, since e-mail reply times follow something more like the power-law distribution shown on the right-hand side of Figure 29.2 (Barabási,

2005). This distribution represents a mixed and open-ended set of possibilities: Many replies come quickly, but others can take a very long time. As in the previous scenario, one might initially predict a delay of 3 minutes based on the average of the distribution. Here, however, one's prediction would increase rather than decrease as time elapsed. As shorter delays were ruled out, longer and longer delays would remain possible, and the awaited event would be felt to be receding into the future (Griffiths & Tenenbaum, 2006; McGuire & Kable, 2013; Rachlin, 2000). This would be like inferring that someone who has not written back immediately is probably away from e-mail and will take hours rather than minutes to respond.

It might seem counterintuitive that decision makers would change their predictions in the absence of an obvious change in their situation. The previous example illustrates, however, that time passage itself can constitute a source of novel and relevant information. If one initially believed there was some chance that the event could happen quickly, its nonoccurrence should lead to revised expectations in light of what possibilities remain.

HIGH-PERSISTENCE AND LIMITED-PERSISTENCE ENVIRONMENTS

When a reward's predicted arrival time changes, its subjective value changes as well. Decision makers discount future rewards according to their delay. Although the exact shape that best describes the discounting function is a matter of debate, it is well established that when rewards are at stake, delay counts as a cost. More temporally remote rewards are worth less in terms of their present subjective value to the decision maker than otherwise equivalent rewards that are available sooner (Frederick, Loewenstein, & O'Donoghue, 2002). There is nothing irrational about treating delay as a cost, especially in situations such as the delay-of-gratification task, in which waiting prevents the decision maker from doing anything else. A cost-benefit assessment of the future reward should pit the expected gain (the margin by which one prefers the large reward to the small reward) against the expected opportunity cost of time (the value of whatever else one could be doing during the anticipated delay).

The large reward's attractiveness should therefore vary inversely with the predicted remaining wait time. When rewards have normally distributed timing and are felt to be approaching, like the subway train, their subjective value to the decision maker should increase as the wait progresses (Figure 29.2, left). If one preferred to wait when the predicted delay was 3 minutes, this preference should be even stronger when the predicted delay is only 1 minute. Environments with normally distributed timing statistics are conducive to high persistence. A decision maker who chose to wait at the outset would not be expected to want to reverse this decision later.

The opposite is true for events with power-law timing statistics, like e-mail responses (Figure 29.2, right). As time passes and the predicted delay grows longer, the subjective value of the delayed reward progressively deteriorates. Eventually it might be worth less to the decision maker than the immediate alternative, and at that point the value-maximizing course of action would be to give up. The fact that one was willing to wait 3 minutes for a particular delayed reward does not necessarily imply one is also willing to wait 10 minutes. Environments with power-law timing favor limited persistence: A decision maker who was willing to wait at first would have some giving-up time, beyond which the expected costs of waiting outweigh the expected benefits. In these

circumstances, a reversing pattern of choices (first waiting, then quitting) can be consistent with rational, value-guided behavior.

Effective self-regulation in delay-of-gratification scenarios is therefore considerably more complex than merely finding a way to resist the temptation to quit. Decision makers must continually gauge whether the reward is still worth waiting for, given their internal model of the statistics of the environment, and calibrate persistence accordingly. Because we all find ourselves sometimes in high-persistence environments and sometimes in limited-persistence environments, it is important that the mental processes supporting this behavior be flexible and context-sensitive.

Actual waiting behavior might therefore depend not merely on how much self-control one has, but more importantly on what kind of environment one thinks one is in. Because adaptive behavior varies across situations, it is possible to go wrong either by waiting too long or too little. For example, a decision maker might actually be in a high-persistence environment but incorrectly believe that a more limited degree of persistence is appropriate (Figure 29.3, top). To an observer who knows more about the environment it might look like the decision maker has self-control problems and lacks the capacity to delay gratification. Conversely, a decision maker might actually be in a limited-persistence environment but incorrectly think that high persistence is warranted (Figure 29.3, bottom). A better-informed observer might notice that the person is waiting too long and assume he or she is irrationally unwilling to abandon sunk costs (Arkes & Blumer, 1985; Navarro & Fantino, 2009).

THE UBIQUITY OF LIMITED-PERSISTENCE ENVIRONMENTS

Limited-persistence environments are ubiquitous. We routinely encounter delayed outcomes that are worth waiting for up to a point, but not indefinitely. One reason for this is that the ecological time intervals in many domains of human activities are well

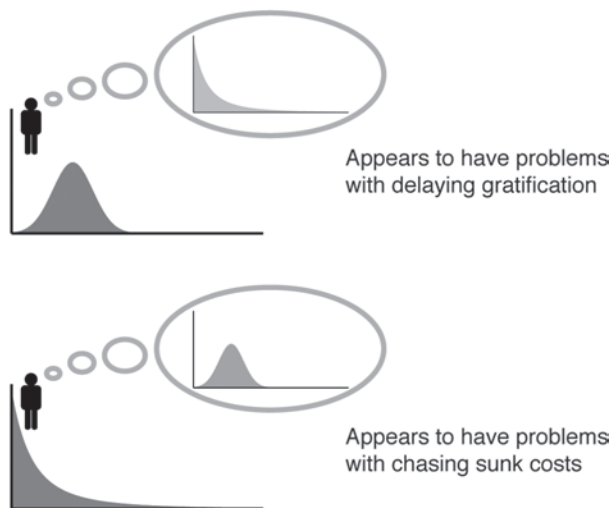


FIGURE 29.3. Two ways a decision maker's beliefs can be miscalibrated to the environment.

characterized by power-law distributions (Anderson & Schooler, 1991; Barabási, 2005). Power-law timing represents situations in which there is a mixture of possibilities, with events able to happen on either a fast or slow time scale. Because this type of distribution allows for multiple time scales, it also makes a reasonable default assumption in situations where one initially does not know what time scale is applicable (Caves, 2000; Griffiths & Tenenbaum, 2006; Sozou, 1998). As a delay drags on, a decision maker can begin to infer that a slower time scale is more probable.

Data on people's explicit judgments lend support to the idea that limits on persistence could have their basis in temporal expectations. In several relevant domains people express temporal beliefs that resemble a power-law distribution. This can be assessed by asking people to predict how long something will take given that it has taken a certain amount of time already (Griffiths & Tenenbaum, 2006). For open-ended situations such as waiting on hold, people's predictions imply that the longer they have waited already, the more time they think is left. A similar pattern also holds for situations that are usually perceived as presenting self-control challenges, such as waiting for a diet to show positive results. When a diet had shown no results after 5 days, people predicted it would take about 10 more days, but if it had already been 15 days, people predicted that another 15 days would be required (see Figure 29.4). A similar pattern occurred when people were asked to make a prediction about a scenario modeled after the original delay-of-gratification experimental paradigm. At first they predicted that the experimenter would only take a few minutes to return and deliver the large reward, but by the time 10 minutes had elapsed, they predicted an additional 10-minute wait (McGuire & Kable, 2013). These findings support the idea that rewards can grow subjectively more remote as a function of elapsed time, implying that at some point they would cease to be worth waiting for.

ADAPTIVE CALIBRATION OF PERSISTENCE

If persistence is governed in a rational manner, this predicts that people ought to be able to adapt their behavior to contexts in which either high or low persistence is more beneficial. The hypothesis of adaptive calibration is consistent with previous demonstrations

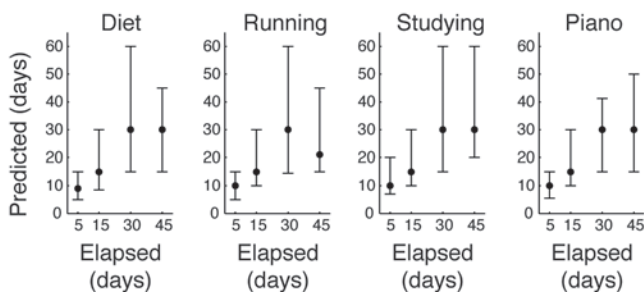


FIGURE 29.4. Explicit temporal predictions for everyday self-control dilemmas. Points show median predictions, and bars show interquartile range ($n = 256$). From McGuire and Kable (2013). Copyright 2013 by the American Psychological Association. Adapted by permission.

that environments differ in how much they reward future-oriented behavior (Fawcett, McNamara, & Houston, 2012; Otto, Markman, & Love, 2012), and that decision makers can flexibly adapt to environmental structure (Schweighofer et al., 2006; Simen et al., 2009). It stands in contrast to the alternative possibility that persistence is primarily dictated by a more rigid factor, such as a limitation on self-control capacity.

We tested the adaptive calibration hypothesis by giving participants direct experience with high-persistence and limited-persistence environments in a laboratory task (McGuire & Kable, 2012). The basic structure of the task was the same across both environments: Participants had repeated opportunities to wait for a monetary reward (e.g., \$0.15), which would be delivered at the end of an unspecified and randomly determined delay. Their alternative option was to take a smaller monetary reward immediately instead of waiting (e.g., \$0.01). Either the large or small reward was followed, a moment later, by a new trial, with a new opportunity to wait. Participants had a fixed period of 10 minutes to play and could obtain as many new trials as time allowed. Their goal was to make as much money as possible in the available time.

The most beneficial strategy depended on the probability distribution from which the random delays were sampled. In the high-persistence environment, the delay had a uniform probability of taking on any duration between 0 and 12 seconds. Like a normal distribution, this implied that the expected remaining delay steadily decreased throughout the trial. The reward-maximizing strategy was to wait as long as necessary. In the limited-persistence environment, conversely, the delay duration was sampled from a power-law distribution that encompassed a more heterogeneous set of possibilities. Many of the delays were very short (the fastest quartile of trials took less than 1 second), but others were very long (the slowest quartile took longer than 15 seconds, and up to 90 seconds). The reward-maximizing strategy was to wait for each trial at first but to quit if the reward were not delivered in about 2 seconds, at which point one could infer that the current delay would probably fall in the long tail of the distribution. The most advantageous behavior in the limited-persistence environment entailed the same reversing sequence of choices that is sometimes viewed as emblematic of delay-of-gratification failure: waiting at first but then quitting partway through the delay.

Participants adapted their behavior successfully to the two timing contexts. In a between-subject design, two groups received identical instructions but then encountered different distributions of delay intervals. Waiting times in the two groups gradually diverged as a function of experience (see Figure 29.5). Individuals who encountered high-persistence timing statistics increased their willingness to wait, and those who experienced limited-persistence timing statistics did the opposite. Performance in both conditions still fell short of optimality on average, and individuals in the limited-persistence environment tended to be less successful (as indexed by their total monetary earnings) than those in the high-persistence condition.

These empirical results make clear that high persistence is counterproductive in certain situations, and that people recognize and adapt to such situations on the basis of direct experience. At the same time, the results also imply that waiting can be easy in contexts in which one has reason to expect that time brings rewards steadily nearer. The outcomes of delay-of-gratification decisions may be governed not just by how long the decision maker is capable of waiting but by the way in which the decision maker perceives the structure of the environment. Accurately representing environmental structure would presumably be even more difficult in situations—unlike this laboratory task—in which

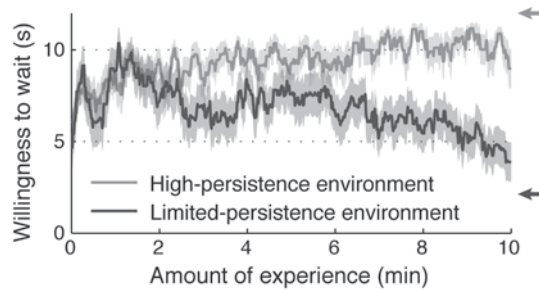


FIGURE 29.5. Modulation of persistence in response to direct experience with different time-interval statistics. Arrows mark ideal performance. From McGuire and Kable (2012). Copyright 2012 by Elsevier B. V. Adapted by permission.

the decision maker lacked the opportunity for experience-based learning in the relevant domain.

ERRING THROUGH OVERPERSISTENCE

The empirical finding that people performed less successfully in an environment that required less waiting (McGuire & Kable, 2012) is counterintuitive according to the classical view that waiting is difficult. There are many other examples of situations in which decision makers err on the side of persisting excessively. Previous work has examined factors that determine how much time people spend unproductively trying to solve difficult or impossible puzzles (McFarlin, Baumeister, & Blascovich, 1984), or how long people persist at an unpleasant activity after compensating incentives have been removed (Halkjelsvik & Rise, 2015). Manipulations designed to induce self-regulatory depletion can sometimes cause people to stick with a pointless task longer, especially if quitting requires a proactive response (Baumeister, Bratslavsky, Muraven, & Tice, 1998). Overpersistence in all these cases is seen as signaling a failure to act in line with well-calibrated cost–benefit assessments.

Overpersistence is also a risk in ecological foraging scenarios. Consider the situation of a predator, such as an owl that hunts by sitting and waiting for prey to come into view. A sit-and-wait predator needs to be able to wait patiently but also should not wait forever. After some period of time with no results, the best thing to do is give up and go forage in a new place. Similarly, an animal whose food is distributed in patches needs to decide when to stop harvesting from the current patch and move on in search of a fresh patch. Research in behavioral ecology has examined in detail how the ideal giving-up time depends on the structure and statistics of the foraging environment (Charnov, 1976; McNamara, 1982; Nishimura, 1991).

Animals in behavioral foraging experiments typically appear well calibrated to their environment, but sometimes they wait too long. In one example, the behavior of macaque monkeys in a patch-foraging task broadly corresponded to the predictions of optimal foraging theory (Blanchard & Hayden, 2015; Hayden, Pearson, & Platt, 2011). The monkeys would repeatedly harvest from the same patch for a period of time amid diminishing

returns, and would eventually depart for a new patch. However, there was a systematic tendency to overharvest; that is, to persist with diminishing returns from the current patch slightly past the point at which it would have been more beneficial to move on (Blanchard & Hayden, 2015; Hayden et al., 2011). Similar phenomena have been documented in species ranging from rats to humans: Compared to an optimal model, decision makers show excessive willingness to tolerate long delays (Constantino & Daw, 2015; Wikenheiser, Stephens, & Redish, 2013).

The specific explanation for overpersistence in each of these cases is up for debate. One possibility is that decision makers experience an extra subjective cost related to abandoning sunk costs or deviating from the status quo. Overpersistence might also arise from misestimating the environmental statistics. For example, if one underestimated how rich the environment was, one might fail to realize how large an opportunity cost was entailed by long delays. Conversely, if one underestimated or neglected the possibility that the delay could turn out to be far longer than originally predicted, this too could make persistence seem unduly beneficial from the decision maker's perspective.

Regardless of which specific explanation fits best, the larger message from these findings is that overpersistence is a commonplace maladaptive feature of behavior. The general challenge in delay-of-gratification situations is to strike a balance, pursuing delayed rewards as long as they remain worth waiting for, but not longer. Because effective self-regulation requires curtailing persistence when necessary, both insufficient and excessive persistence deserve to be considered as important and ecologically relevant forms of self-control failure (Baumeister & Scher, 1988).

ADAPTIVE CALIBRATION AND RULE-GOVERNED SELF-CONTROL

The need to adapt flexibly to incoming information is fundamentally at odds with certain self-control strategies that involve attempting to lock in or constrain one's own future behavior. One of the most frequently discussed forms of self-control is *precommitment* (Ainslie, 1975; Schelling, 1984; Strotz, 1955), which refers to deliberately constraining one's own options in the future, for instance, by handing one's car keys to a friend or freezing one's credit cards in blocks of ice. The reason to take such measures would be to frustrate one's own future preferences in the event these disagree with the preferences one holds now.

Although some precommitment devices involve setting up physical constraints in the external environment, such devices can also be purely internal. Mental tricks such as reframing incentives or shifting the focus of attention can help ensure that one's current decision will be adhered to in the future (Ainslie, 1975; Duckworth et al., 2014). Perhaps the most archetypal form of self-control involves setting up a mental rule—for instance, “keep waiting until the delayed reward arrives”—and rigidly adhering to it even at moments when an alternative course of action begins to seem more valuable. This is one possible way of thinking about dual-system self-control models in which a “cool” system overrides a “hot” system (Metcalf & Mischel, 1999).

Rule-governed behavior is not without its costs. Ainslie (1975, p. 476) made this observation in an early discussion of mental precommitment: “Unpredictability of reward reduces the differential reward for rigid behavior and would be expected to reduce preference for precommitting devices.” Precommitment would be inappropriate in temporally

uncertain delay-of-gratification scenarios (McGuire & Kable, 2012, 2013). These are situations in which the passage of time furnishes new and valid information about the relative value of waiting. Decision makers in these kinds of situations might choose to wait at first, but should not commit to waiting indefinitely. Rather than locking in their initial preferences, they would be best served by reserving the ability to revisit those preferences later in light of updated information.

Our main focus in this chapter has been on changing predictions of remaining delay time, but this is only one of many factors that can drive a dynamic reappraisal of future outcomes. Another such factor is risk: A long delay might alter one's prediction of whether an awaited outcome will occur at all, or of how good it will be. Shortly after a job interview, one might have high confidence in a favorable result, but this confidence might wane after 2 weeks without being contacted. If one's car fails to start on the first attempt, one might try a few more times, but a few more failures will suggest it may be better to stop trying and look for an alternative solution. It is also possible for the attractiveness of future rewards to be altered by tangible feedback beyond the mere passage of time. One might intend to carry a hot lasagna from the kitchen all the way to the dining room but justifiably change plans after the first few seconds. This would not be a self-control failure; it would reflect that in those few seconds, one has learned a great deal about the costs this course of action would entail. In a world that is both changeable and uncertain, well-regulated behavior requires allowing plans to be revised in response to incoming information.

The reason that precommitment strategies are sometimes valuable is that the uncertainty or changeability of the environment needs to be balanced against the potential for erratic variability in one's own future actions. The situations in which rule-governed self-control is most clearly beneficial are those in which the environment is stable and predictable but one's own behavior at the decisive moment is liable to be based on incomplete information. For example, one might place the alarm clock across the room because one does not trust oneself at 6:00 A.M. to give complete consideration to the costs and benefits of continuing to sleep.

A hypothesis worth investigating in the future, therefore, is that people's degree of inclination to precommit and rigidly adhere to predetermined plans should vary adaptively from one context to another. This perspective suggests that self-control is not as simple as overriding impulses by adhering to preestablished rules, but instead requires a more flexible set of cost-benefit assessments (Casey, 2015; Phelps, Lempert, & Sokol-Hessner, 2014). Key variables in these assessments would include both the instability/uncertainty of the environment and the potential for non-value-guided variability in one's own future behavior. Given the omnipresence of uncertainty in real-world decision environments, it is likely that the first of these variables is often the dominant factor, militating against rigidly precommitted decisions. The most significant challenge of self-control might not be to close off nonpreferred alternatives, but rather to leave all alternatives open while reevaluating them in a dynamic and context-sensitive manner.

CONCLUSIONS

Effective self-regulation requires dynamically adjusting one's subjective valuation of choice alternatives in response to new information. Even in situations such as delay of

gratification, which at first glance may look like a static self-control dilemma, value estimates can change over time due to changing assessments of temporal uncertainty. The passage of time can progressively degrade the subjective value of an awaited future reward because in some environments, a long delay so far supports an inference that the delay still remaining is longer than expected. This means one can err through either insufficient or excessive persistence, and either type of error can be explained in terms of a mismatch between one's expectations and the environment. The need to base decisions on dynamically updated inferences puts important limits on the adaptive usefulness of self-control strategies such as precommitment and rule adherence.

So what is the relevance of these ideas to domains in which people chronically exhibit self-control problems or delay-of-gratification failure, such as dieting or substance abuse? First, we should not overlook the possibility that people sometimes correctly infer, as time passes, that the future reward is more remote than they originally thought it was. This could very well be the case in dieting, as most diets are not effective in the long term (Mann et al., 2007). In situations where choosers are clearly miscalibrated (Figure 29.3, top), persistence could be promoted by providing information and/or allowing for learning from accurate feedback. The installation of waiting-time clocks in subway systems is one case in which clear temporal information can transform a situation in which waiting is difficult into one in which waiting is easy. In still other cases, reversals seem more clearly related to variability in the state of the chooser, for example, the smoker who relapses during withdrawal, and these might more clearly be openings for precommitment and rule-based strategies. Beneficial change in persistence might be best achieved through tailored, situation-specific interventions that acknowledge the complexity of calibrating behavior to diverse decision environments.

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CHAPTER 30

Problems with Positive Thinking and How to Overcome Them

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Imagine that a young woman—let us name her Jeanne—dreams of starting a successful jewelry brand. For years, she has fantasized about the joys of designing exquisite jewelry decorated with the finest pearls, diamonds, and gemstones. She has sketched out various designs for necklaces, earrings, and bracelets, and carefully stored the drawings in her drawer as her little secret. She sits in class and fantasizes about her future after launching her brand. Perhaps she would travel to Paris, Rome, and Madrid to meet her clients in their lavish homes; perhaps she would get invited to Michelin-starred restaurants and get introduced to more clients at posh parties. Wouldn't it be wonderful to notice celebrities being photographed wearing the jewelry she so carefully designed? Jeanne treats these dreams like an intimate secret. These mental images are greatly satisfying to her and make her feel relaxed, even a little proud. Eventually, Jeanne graduated from her program, and time passed. Even though her dream was still alive within her, Jeanne simply could not bring herself to take the important step of enrolling in design school. Besides, she told herself, she had no background in that field and, after all, she was too busy with her current life, hardly getting by as it is.

Why didn't Jeanne have the impetus to enroll in design school and finally fulfill her dreams? After all, she seemed to be doing what we are so often encouraged to do—to dream positively about fulfilling our wishes and desires. What was it that stopped her from going forward?

The idea that merely imagining the fulfillment of our deepest desires will support us in realizing them has been a postulate in popular culture for a long time, and it persists today. On the shelves of bookstores, best-selling volumes such as *The Secret* (Byrne, 2006) provide the comforting message that we can fulfill our dreams just by thinking positively. Politicians, educators, and economists celebrate dreamers as heroes who can

save the world, while advising against “negative thinking” if we want to become successful (Galvan, 2012). An inspiring message found in many gift card shops, “Reach for the moon; even if you miss, you’ll land among the stars,” and a common proverb says it all: “Dream it, Wish it, Do it.”

In this chapter, we investigate whether positive thinking about the future is indeed as powerful as pop culture claims, particularly when it comes to its self-regulatory power. Vohs and Baumeister (2011; Bauer & Baumeister, 2011) have defined *self-regulatory power* as the power to expend the effort to control what we think, say, and do, while trying to be the person we aspire to be. Assuming that becoming the person we aspire to become demands overcoming resistance and impediments (Oettingen, 2012; Oettingen & Gollwitzer, 2015), the central question of this chapter is under what circumstances and in what form positive thinking about the future can help—or may in fact hamper—overcoming the challenges that lie in the way of wish fulfillment.

This chapter has four parts. In the first section, we differentiate between two forms of positive future thought: expectancy judgments (expectations) on the one hand, and free thoughts and images (fantasies) on the other. Based on the distinction between expectations and free thoughts or fantasies, we describe in the second section how positive thinking in terms of future fantasies can hamper the self-regulation of effort and success. In the third section we explain how positive future fantasies are not necessarily motivationally harmful: Contrasting them with the obstacles in the present reality (mental contrasting) leads to wise goal pursuit. After investigating the mechanisms behind this strategy, we show that people rarely use this prudent tool in their everyday lives. We therefore propose mental contrasting in the framework of a teachable metacognitive strategy. Finally, we describe in the fourth section mental contrasting combined with forming if–then plans (implementation intentions), resulting in a technique (mental contrasting with implementation intentions) that elicits behavior change more than either strategy alone.

POSITIVE FUTURE THOUGHT

Positive thinking about the future may pertain to proximal or distal events; these events may be construed as specific or vague, concrete or abstract. Future thoughts may aim to increase one’s capabilities through learning, or show off one’s capabilities through performing. People may think about approaching or avoiding a future, or they may think about how they may freeze in light of anticipated events (e.g., Bandura, 1997; Dweck & Leggett, 1988; Elliot, 1997; Gollwitzer, 1999; Gray & McNaughton, 2000; Locke & Latham, 2002; Oettingen & Mayer, 2002; Taylor, Pham, Rivkin, & Armor, 1998).

In the context of this chapter, distinguishing the type of positive future thought people are involved in is important. Do they entertain beliefs or expectations (i.e., judgments about the probabilities of certain events or behaviors) or do they engage in free thoughts and images about future events or behaviors? These two forms of thinking about the future exist in parallel, so that a person can imagine a certain event or behavior, independently of the expectation or subjective likelihood that the event will come true or that the behavior will be carried out (Oettingen & Mayer, 2002). Returning to the earlier example, Jeanne may well positively dream about being the CEO of the fine jewelry start-up business, but at the same time she might have low expectations that she will ever implement her dream in reality.

Animal psychologists, such as the neobehaviorist Edward Chase Tolman (1938; see also Rescorla, 1985; Seligman, 1972) have been laying the groundwork for the extensive literature on beliefs or expectancy judgments. In humans, expectancies refer to the subjective likelihood of whether certain positive or negative events will happen in the future. Over many decades, research testing expectancy models has been dominant in social psychology and other fields of psychology. Indeed, expectancy judgments, which reflect experience and performance in the past, are valid predictors of specified intentions, as well as actual behaviors (Ajzen, 1991; Bandura, 1977; Maddux, 1999; Mischel, 1973; Oettingen & Mayer, 2002; Scheier & Carver, 1992; Seligman, 1972; Taylor, 1989).

Beliefs versus Free Thoughts

A future event or behavior may appear in the stream of consciousness irrespective of whether it is believed to be true or false. It may appear as an image *per se*, or it may be subject to judgments about whether it is true or not. In other words, while free thoughts and images depict events and behaviors as a continuous stream, beliefs imply a cognitive determination about whether the event is true or not. William James referred to Franz Brentano:

But we must insist that, so soon as the object of a thought becomes the object of an assenting or rejecting judgment, our consciousness steps into an entirely new relation towards it. It is then twice present in consciousness, as thought of, and as held for real or denied. (Brentano, cited in James, 1890, p. 286)

The images described by James refer to the present or past, to what has occurred and to what could have occurred, similar to what more recently has been investigated as ruminative thought (Martin & Tesser, 1989; Moberly & Watkins, 2008; Nolen-Hoeksema, 2013) or as counterfactual thinking (Epstude & Roese, 2008; Kahneman & Miller, 1986; Markman & McMullen, 2003; Roese, 1997; Smallman & Roese, 2009). In this chapter, however, we refer not to images and beliefs about the present and past, but to those about the future.

Research on future thought has traditionally focused on beliefs and expectancy judgments based on past experiences, referring to judgments about the probabilities that specified events or behaviors will or will not occur. However, researchers have been much less interested in free thoughts and images about the future, with notable exceptions such as Jerome Singer (1966), who pioneered investigations on fantasy in the 1960s. He asked his participants to rate their own daydreams and fantasies regarding diverse characteristics, such as acceptance, affect, frequency, subjective experience, and tense. In recent years, the emotional, motivational, and neuropsychological processes underlying mental time travel and episodic future thinking have been investigated, as well as their downstream consequences (e.g., D'Argembeau & Mathy, 2011; Schacter, 2012; Szpunar, Spreng, & Schacter, 2014). An interest has also developed as to how people's heuristics influence the emergence and content of free future thoughts or mental simulations (e.g., Kahneman & Tversky, 1982), and which conditions may lead the mind to wander and generate task-unrelated thoughts (Killingsworth & Gilbert, 2010; Smallwood & Schooler, 2015). Finally, free future thoughts are a topic of studies on mental simulations (Kahneman & Tversky, 1982; Taylor et al., 1998), affective forecasting (Buechel, Zhang, Morewedge, &

Vosgerau, 2014; Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998), and anticipated regret (Gilbert, Morewedge, Risen, & Wilson, 2004).

Another pioneer in the research on free thoughts and images is Eric Klinger, whose book *Structure and Functions of Fantasy* (1971) provides a compelling summary of the facets of fantasies and their motivational concomitants. He observed that the frequency of events and scenarios in a person's daydreams and fantasies can be taken as an indication of his or her current concern, and that these frequencies predict selective attention and the processing of relevant information (Klinger, 1975). Similarly, research on the information-processing concomitants of a deliberative versus implemental mindset showed that the deliberative mindset promotes cognitive tuning toward making an informed decision, while the implemental mindset promotes cognitive tuning toward effective planning and goal striving (Gollwitzer, 1990, 2012).

Free Thoughts about the Future and Behavior

Research on the behavioral consequences of free thoughts and images is relatively rare, with a few notable exceptions. For instance, Taylor and colleagues (1998) investigated mental simulations related to the cumbersome process of reaching a goal (process simulations) versus the pleasant outcome of attaining it (outcome simulations). Process simulations (as opposed to outcome simulations) facilitated performance by spurring plans and reducing anxiety. Similarly, counterfactual thinking about how a past negative event could have been avoided promoted negative thoughts about the future, which in turn spurred attempts to remedy the negative situation (Epstude & Roese, 2008; Smallman & Roese, 2009).

Recently, mind wandering has been analyzed alongside mindfulness with the aim of reducing its detrimental effects for performance on cognitively demanding tasks. Indeed, *mindfulness training* (i.e., mindfully observing present emotions, thoughts, and sensations) reduced mind wandering and its downstream consequences (Mrazek, Franklin, Phillips, Baird, & Schooler, 2013; Smallwood & Schooler, 2015). Finally, once people feel committed to a goal, future thought in the form of implementation intentions or "If situation X, then I will goal-directed behavior Y" spurs automatic goal striving and increases the likelihood of goal attainment (Gollwitzer, 1999, 2014; Gollwitzer & Sheeran, 2006).

Positive Fantasies Emerge from a Person's Needs

Expectations are judgments concerning the likelihood of future events or behaviors (Bandura, 1977; Mischel, 1973; for a review, see Olson, Roese, & Zanna, 1996), which summarize a person's past experiences and achievements. Free fantasies, in contrast, depict future events or behaviors in the stream of thought (Klinger, 1975; Oettingen, 2014; Singer, 1966), and are independent of past performance. Indeed, H. B. Kappes, Schwörer, and Oettingen (2012) observed that positive fantasies emerge from a person's aroused needs. Needs in the context of research on motivation refer not only to physiological needs (e.g., hunger and thirst) but also to idiosyncratic psychogenic needs, including achievement, affiliation, and power, among others (McClelland, Clark, Roby, & Atkinson, 1949; Murray, 1938). Abraham Maslow's hierarchy of needs (1943) depicts the most basic physiological need at the bottom and the need for self-actualization at the

top. In their research, H. B. Kappes and colleagues showed that people with an aroused need generated more positive fantasies depicting idealized future scenarios relevant to addressing the need than did people for whom the need was not aroused. For instance, the authors aroused the need for affiliation or relatedness (Baumeister & Leary, 1995; Deci & Ryan, 2004; Murray, 1938) by asking older adults to list 12 recent instances of “close contact with others who care about you,” while control participants were only asked to list four such instances. Need-relevant fantasies were measured by having participants imagine the ending to scenarios, such as “You are on your way to a store when you suddenly recognize one of your close friends. You go over to the friend and . . .” Need-irrelevant fantasies were measured by having participants fantasize the ending of matched scenarios that did not allude to a close friend. After writing down their fantasies, participants indicated how positive or negative their thoughts and images made them feel. Those with an aroused need for relatedness came up with more positive fantasies in response to the relevant (vs. irrelevant) scenarios; control participants did not show this difference. This pattern of findings was also observed for other needs, such as the need for meaning in life, the need for water (thirst), and the need for power, and it emerged regardless of whether the needs were measured or manipulated.

These results are in support of classic research on motivation, which postulates that needs influence the content of people’s thoughts and images (McClelland et al., 1949). For instance, as basic physiological needs such as the need for food increase, people are more likely to come up with thoughts and images in which food is the central theme and the need for food is mentioned (Atkinson & McClelland, 1948). Consequently, when basic needs are strong and cannot be satisfied in the here and now (e.g., when thirsty people are not given an opportunity to obtain water), satisfying the needs in one’s positive fantasies may help satisfy needs in actuality by decreasing anxiety and arousal, so that the person can focus on problem solving. Furthermore, to the extent that positive fantasies originating from these unsatisfied needs guarantee that solving the task remains the focus of attention, they should uphold the task of eventually satisfying these needs (James, 1890). However, when a person *can* satisfy his or her need through exerting real effort or using other resources, positive fantasies may sap the necessary energy to take action.

THE DARK SIDE OF POSITIVE FANTASIES

Positive thinking in the form of free thoughts and images about the future is often thought of as the recipe for high effort and successful performance. However, positive fantasies might prevent people from taking the necessary precautions for wish fulfillment. For instance, people may fail to foresee potential opportunities for goal-directed actions (Gollwitzer, 1999; Taylor et al., 1998); they may fail to shield against distractions (Achtziger, Gollwitzer, & Sheeran, 2008; Shah, Friedman, & Kruglanski, 2002); and they may fail to plan for temptations or hindrances on the way to the desired future (Taylor et al., 1998). By feigning a smooth path to a grandiose outcome, positive fantasies may even sap the energy to pursue actively the wished-for future. We discuss research that tests whether positive fantasies about a desired future put people at risk for low effort and little success, and if so, the mechanisms that underlie this effect.

Evidence

Health

Among a sample of patients undergoing hip replacement surgery (Oettingen & Mayer, 2002, Study 4), the evening before their surgery, we measured their expectations of recovery and the positivity of their recovery-related fantasies. To assess expectations, we asked participants simple questions, such as “How likely do you think it is that 2 weeks after surgery you will be able to go for a brief walk using an assistive cane?” To obtain a measure of the positivity of their fantasies, participants had to imagine themselves as the main characters in five recovery-related scenarios with open endings. Participants were asked to fantasize them to completion and to write their fantasies down. For example, one scenario read, “At the end of your hospital stay you want to buy a newspaper in the hospital shop. . . .” One patient wrote in response, “I am walking down the stairs without help, and I walk easily and quickly to the newspaper stand.” In contrast, another patient wrote, “I am trying to walk to the door first, using my cane. But how shall I open the door? Uh, and then walking to the elevator? How would I ever do it?” After writing down their thoughts and images, participants indicated on a scale of 1 to 5 how positive and how negative their thoughts and images were.

Two weeks after their surgery, patients’ physical therapists reported how well the patients could move their hip joint, how many steps on a staircase they could walk, as well as their general recovery. In line with past work, the more positive patients’ expectations were, the better the patients had recovered; however, the more positive their *fantasies* were, the *less* they had recovered. These results show that while positive expectations predict high effort and successful recovery, positive fantasies predict the reverse.

Interpersonal Relations

Moving forward from the health domain to the interpersonal domain, the same pattern of results emerged (Oettingen & Mayer, 2002, Study 2). American university students who had a crush on someone reported their expectations of starting a relationship with their “crushee.” Participants were then asked to identify with the main characters of eight scenarios depicting opportunities to get to know their crushee better. They imagined these scenarios to completion and rated the positivity and negativity of their own thoughts and images. Four months later, participants were contacted again to assess whether they had started an intimate relationship with the adored person. The higher participants’ initial expectations of success, the more likely it was that they had started an intimate relationship with their crushee; in contrast, the more positive their *fantasies* were, the *less* likely they were to actually have started the desired relationship. This negative relation was mediated by the extent to which they openly acknowledged their adoration to their crushee.

Achievement

The effort-hampering effects of positive fantasies were observed in the achievement domain as well. The more graduating students fantasized about successfully finding a job postgraduation, the fewer applications they sent off, the fewer job offers they received,

and the lower their salaries were 2 years later (Oettingen & Mayer, 2002, Study 1). In another study, positive fantasies predicted lower effort and lower course grades (Oettingen & Mayer, 2002, Study 3), and this finding was extended to students from financially disadvantaged backgrounds (H. B. Kappes, Oettingen, & Mayer, 2012).

Prediction of Economic Downturn

Beyond the individual and interpersonal levels, could positive fantasies also predict these outcomes on a larger societal scale? Sevincer, Wagner, Kalvelage, and Oettingen (2014) investigated this question by looking at the relationship between positive thinking and economic development using a computerized content analysis (linguistic inquiry and word count [LIWC]; Pennebaker, Chung, Ireland, Gonzales, & Booth, 2007) of historical documents. Consistent with the studies described previously, the analysis revealed that positive economic and political rhetoric predicted worse national economy: Between 2007 and 2009, the years of the financial crisis, the more newspaper articles in the economy page of *USA Today* displayed positive future thinking, the lower the Dow Jones Industrial Average was in the subsequent week and after 1 month. Another study indicated that between the New Deal era and the present day, the more presidential inaugural addresses displayed positive future thinking, the lower the gross domestic product and the employment rate in the following presidential terms. This inverse relationship between positive thinking and economic development suggests that positive fantasies can predict downturns even at the societal level.

Mechanisms

While prior studies demonstrated that positive fantasies predict low effort and success, the reason as to *why* this effect occurs is still open to question. In order to discover the underlying mechanisms, experimental work manipulating positive fantasies versus relevant control instructions was carried out.

Mental Attainment

Oettingen and Mayer (2002) suggested that positive fantasies about an idealized future would lead people to respond as though they had already attained the future. A series of experimental studies tested this hypothesis. The studies used valid indicators of implicit affect (H. B. Kappes, Kappes, & Oettingen, 2015) and behavior (Sciarappo, Norton, Oettingen, & Gollwitzer, 2015) as dependent variables.

IMPLICIT AFFECT

Based on findings that people implicitly evaluate instrumental objects more positively during goal pursuit, as compared to when goals have been attained (e.g., Ferguson & Bargh, 2004), H. B. Kappes and colleagues (2015) argued that positive fantasies about a desired future should lead to less positive automatic evaluations of words related to the desired future, as they feign already having achieved the desired future. Using an automatic evaluation paradigm (Fazio, Sanbonmatsu, Powell, & Kardes, 1986), they found

that student participants who generated positive fantasies about the idealized experience of taking a neuroenhancing drug (vs. questioning thoughts, negative thoughts, or no thoughts) generated less positive automatic evaluations of words related to neuroenhancing drugs. Apparently, positive fantasies led to mental attainment of the desired experience.

BEHAVIOR

In two studies, Sciarappo and colleagues (2015) used a delay discounting task that measures the extent to which the value of a reward declines the more the anticipated receipt of the reward is delayed (Ainslie, 1992; Loewenstein & Prelec, 1992; Rachlin & Raineri, 1992). Based on the previous finding that possessing greater financial resources is associated with a decrease in delay discounting (Green, Myerson, Lichtman, Rosen, & Fry, 1996), the authors reasoned that mental attainment of financial resources, like actual attainment of financial resources, should increase people's tolerance to wait, and therefore to show less delay discounting. Indeed, Mechanical Turk users who positively fantasized about a large monetary prize discounted future rewards less steeply compared to the control groups (who either questioned the desirability of winning, or neither fantasized nor questioned the prospect of winning money). These findings suggest that positive fantasies allowed people to mentally attain their desired futures, leaving relatively little motivation for actual pursuit.

Low Energization

Based on the finding that positive fantasies foster mental attainment, H. B. Kappes and Oettingen (2011) speculated that positive fantasies would lead to low rather than high energization. Energization is vital to pursue and achieve one's desired futures (Brehm & Self, 1989). In line with traditional approaches of motivation, Elliot (2006) argued that "a full account of motivation will attend to both direction and energization" (p. 114). Energization or energy mobilization was a central variable in Cannon's (1915) work on stress being defined as "the extent to which the organism as a whole is activated or aroused" (Duffy, 1934, p. 194). Energy can be mobilized not only by engaging in actual effort, but also by merely anticipating that one will exert effort in the future (Wright, Brehm, & Bushman, 1989). By pretending that the wished-for future has already been attained, positive fantasies should conceal the fact that effort is required and should therefore relax people instead of energize them (Oettingen & Mayer, 2002).

H. B. Kappes and Oettingen (2011) supported this hypothesis in a series of experiments. In the first experiment, women who were induced to fantasize positively about looking great in high heels displayed lower systolic blood pressure (SBP), which is a reliable physiological measure of energization (Wright, 1996), compared to those who were induced to question how good they looked in the heels. Two more experiments replicated this effect in regard to excelling in an essay contest and accomplishing desired outcomes during the upcoming week, as indicated by self-reported feelings. Finally, a fourth study showed that the more positive fantasies pertained to currently pressing needs, the more deenergizing they were (e.g., need for achievement vs. need for water).

It should be noted that the deenergizing consequences of positive fantasies are limited to pursuits of a desired future that demand energy in the first place. In other words,

if a thirsty person can easily obtain water at a nearby store, positive fantasies will not get in the way of obtaining the water. It is when getting water requires energy and effort that positive fantasies may hinder successful goal pursuit. The role of positive fantasies in responding to tasks that require high (vs. low) resources is the topic of the following experiments.

Little Charitable Giving

In three studies, H. B. Kappes, Sharma, and Oettingen (2013) investigated the effects of positive fantasies on charitable giving when high (vs. low) resources were demanded. Charity solicitations often try to elicit plentiful giving by having people imagine a positive future of effectively supporting others. However, in all three studies, positive fantasies about effectively giving to a charity caused participants to become *less* willing to give (e.g., time or money) when helping required a large number of resources; this effect did not emerge when helping required a relatively small number of resources. In comparison to control manipulations (e.g., factual thoughts), positive fantasies made participants feel that donating larger (but not smaller) amounts of resources would be overly demanding. These results imply that positive fantasies hinder giving, especially when giving means yielding many resources (e.g., time, energy, money).

MENTAL CONTRASTING

Positive fantasies hamper effort and success when attaining the desired future requires energy and effort. However, these findings do not imply that positive fantasies and dreams should be avoided entirely. In fact, used in the proper way, they can become change agents that foster persistent and effortful goal pursuits. The theory of fantasy realization (Oettingen, 2000, 2012), outlines how one can turn positive fantasies into such change agents: by complementing them with thoughts about the obstacles of reality standing in the way. The theory differentiates mental contrasting of future and reality from three other modes of thought: indulging in the future, dwelling on obstacles of reality, and reverse contrasting.

Indulging pertains to engaging in positive fantasies regarding a desired future, as described in the first part of the chapter. In contrast, *dwelling* consists solely of pondering the obstacles of present reality standing in the way. *Reverse contrasting* alludes to mentally elaborating the obstacles of reality and only then imagining the desired future. Interestingly, all three modes of thought do *not* produce a discrepancy between one's wishes and the obstacles of reality that stand in the way of wish fulfillment. Accordingly, no behavior change has been found to occur. It is only when people engage in *mental contrasting*, that is, *first* imagining the desired future (e.g., solving a nagging problem with one's partner), *then* shifting gears to identify and imagine the obstacle of reality (e.g., anxiety, resentment), that behavior change occurs. This is because in mental contrasting, the future fantasies provide the direction in which to go, and the obstacles of reality instill the energy to overcome the hardships on the way to wish fulfillment. Specifically, when the obstacles are surmountable (i.e., expectations of success are high), people fully commit and persistently pursue the desired future; when the obstacles are insurmountable (i.e., when expectations of success are low), people delegate, postpone,

or let go of the fulfillment of their wishes, or otherwise adjust to a more feasible wish. In this way, mental contrasting helps people to discriminate prudently between feasible and unfeasible wishes.

In reverse contrasting, people first elaborate the reality, then the future. Here, the future does not serve as the anchor for reality; thus, reality is not understood as an obstacle *impeding* the desired future. Reverse contrasting therefore fails to induce behavior change. In the same vein, indulging and dwelling do not change behavior. In indulging, the future stands alone and no obstacle spurs energy, whereas in dwelling, no dreams about the future point to the direction in which to act.

Importantly, mental contrasting does not operate on expectations of success; expectations of success remain unchanged throughout the entire procedure. Studies have shown expectations of success *before* and *after* mental contrasting to be almost perfectly correlated. In fact, expectations remain the same through any of the four modes of self-regulatory thought (indulging, dwelling, reverse contrasting, and mental contrasting). These findings demonstrate that the power of mental contrasting lies in *activating* expectations of success rather than in altering them in any way (Oettingen, Pak, & Schnetter, 2001).

Evidence

Most evidence on mental contrasting has accumulated in the achievement domain. However, the following studies focus on the role of mental contrasting in the interpersonal domain because the need to develop and sustain strong, healthy relationships has been shown to be a fundamental and important human motive (Baumeister & Leary, 1995).

Getting to Know an Attractive Stranger

One cannot reap the benefits of a romantic relationship unless the effort is made to encounter that special person. Mental contrasting has been shown to guide prudent goal pursuit in regard to getting to know an attractive stranger (Oettingen, 2000). Female college students were ostensibly given the chance to get to know a random volunteer whose picture they were given. In reality, all of the participants saw the same picture of "Michael S.," a model from a catalogue who had previously been rated as very attractive. In regard to getting to know this attractive stranger, participants were assigned to one of three conditions: mental contrasting, indulging, or dwelling. One week later, commitment to getting to know Michael S. was assessed in terms of participants' eagerness to get to know him, and frustration and anticipated disappointment if they failed to do so. When participants positively fantasized about getting to know Michael S. and elaborated on obstacles standing in the way (mental contrasting), they adjusted their commitment in line with their expectations for both measures of commitment; that is, when their expectations were high, they were eager and committed strongly to getting to know Michael S., and when their expectations were low, they let go of getting to know Michael S., thus becoming open to pursue other relationships. Those who indulged in a positive future or dwelled on the present obstacle did not adjust their commitment to getting to know Michael S. according to their expectancies.

Other beneficial effects of mental contrasting on interpersonal relationships have been demonstrated in areas such as conciliatory behavior in the aftermath of a

transgression (Schrage & Oettingen, 2015), exerting tolerance and social responsibility (Oettingen, Mayer, Thorpe, Janetzke, & Lorenz, 2005), seeking and giving help in academic and patient–nurse relationships, respectively (Oettingen, Stephens, Mayer, & Brinkmann, 2010), going abroad and exploring new cultures (Oettingen et al., 2001), and solving idiosyncratic interpersonal conflicts (Oettingen et al., 2001). There is also robust evidence that mental contrasting improves prudent self-regulation in various other domains, such as health (e.g., reducing cigarette smoking; Oettingen, Mayer, & Thorpe, 2010), achievement (e.g., improving teacher-rated math scores: Oettingen et al., 2001; improving teacher-rated language scores: Oettingen, Hönig, & Gollwitzer, 2000), and life management (e.g., combining work and family life: Oettingen, 2000; enrolling in a vocational program: Oettingen et al., 2005).

Mechanisms

Missing from our discussion so far is the empirical analysis of how mental contrasting works. As shown by the studies we report in the following section, mental contrasting produces changes in implicit cognition, energization, and responses to setbacks, which in turn predict selective goal pursuit and effective behavior change.

Cognitive Processes

STRENGTH OF ASSOCIATION BETWEEN FUTURE AND REALITY

A. Kappes and Oettingen (2014) measured the strength of associations between the future and reality using a primed lexical decision task (Neely, 1977), hypothesizing that the effects of mental contrasting would be mediated by the strength of the association between the future and reality. One study used an acute stress paradigm, in which participants were tasked with describing their professional skills in front of a camera, and were told that the content would be evaluated by human resource experts. Participants first reported their expectations of success; they then fantasized about giving a good presentation and identified an important obstacle standing in their way, summarizing each aspect (positive future and obstacle of reality) in one word. Participants were then assigned to one of three conditions: a mental-contrasting condition, a reverse-contrasting condition, or a control condition (positive and negative thoughts regarding an irrelevant situation). Unlike the reverse-contrasting and control conditions, mental contrasting led to expectancy-dependent future-reality associations, which mediated performance; that is, when expectations were high, mental contrasting led to strong future-reality associations; when expectations were low, future-reality associations were inhibited. The strength of the future-reality associations in turn predicted participants' success in describing their professional skills in front of the camera.

These results were replicated via affective and behavioral, as well as self-reported and other-rated, measures of performance. Interestingly, when mental-contrasting participants were told that their goal was completed, the future-reality associations vanished. This finding is in line with research showing that cognitive, affective, and behavioral effects of goal striving disappear once a goal is reached (Förster, Liberman, & Higgins, 2005; Masicampo & Baumeister, 2011; McCulloch, Fitzsimons, Chua, & Albarracín, 2011).

STRENGTH OF ASSOCIATION BETWEEN REALITY AND INSTRUMENTAL MEANS

Mental contrasting also modulates the strength of associations between obstacles of reality and the means to overcome or circumvent the obstacles (i.e., instrumental means). Using the design and procedure described earlier, A. Kappes, Singmann, and Oettingen (2012) demonstrated that when expectations of success were high, mental contrasting strengthened the cognitive association between obstacles of reality and instrumental means, whereas when expectations of success were low, this association was weakened. Importantly, the associations between obstacles of reality and instrumental means mediated goal pursuit, as indicated by actual behavior (e.g., skipping the elevator and taking the stairs in favor of a fitness goal).

OBSTACLE IDENTIFICATION

To test whether mental contrasting leads to expectancy-dependent identification of relevant obstacles, a task-switching paradigm (for a review, see Kiesel et al., 2010) was used. Specifically, implicit obstacle categorization was measured in the context of being accepted at a competitive graduate school (A. Kappes, Wendt, Reinelt, & Oettingen, 2013). Goal pursuit was indicated by the degree to which participants felt responsible for getting accepted into the desired graduate school (Cantor, Norem, Niedenthal, Langston, & Brower, 1987; Oettingen et al., 2001). Mental contrasting (vs. reverse contrasting and control) was found to foster implicit obstacle identification in line with expectations, and this pattern of results mediated the effects of mental contrasting on goal pursuit.

Motivational Processes

ENERGIZATION

As for motivational mediators, Oettingen and colleagues (2009) investigated whether energization underlies the effects of mental contrasting on goal commitment and performance. Energization was again measured using a reliable physiological indicator, systolic blood pressure (SBP; Wright, 1996). After participants indicated their expectations of resolving an important interpersonal issue, they were instructed to mentally contrast or indulge with regard to this concern. In addition to SBP, participants' commitment to resolve the issue was measured by asking them to rate how disappointed they would be if their concern was not resolved. For both change in SBP and goal commitment, mental-contrasting participants displayed greater expectancy dependence than those in the indulging condition. Importantly, the effects of mental contrasting on goal pursuit were mediated by energization, as indicated by SBP. Other studies substantiated these findings, using SBP measures, as well as self-reported feelings of energization. Taken together, energization was shown to be an important mechanism, responsible for the effects of mental contrasting on behavior change (see also Sevincer, Busatta, & Oettingen, 2014).

Responses to Setbacks: Negative Feedback

Extracting useful information from negative feedback allows people to identify problems and adjust their behavior accordingly (Audia & Locke, 2003), and it promotes the acquisition of abilities and skills (Ball, Hoyle, & Towse, 2010; Nussbaum & Dweck, 2008). However, people often refrain from processing such information because it

is self-threatening, whereas they readily process positive feedback because it is self-affirming (Sedikides & Green, 2009). Mental contrasting has been shown to enable participants to process useful information contained in negative feedback in line with expectations of success (A. Kappes, Oettingen, & Pak, 2012). More specifically, when prospects were promising, mental contrasting enabled participants to use this negative feedback for plan formation, while protecting and maintaining their sense of competence. However, when prospects were grim, mental contrasting decreased the processing of negative feedback, as well as the self-view of competence and future outlook, thereby enabling disengagement and freeing up space to pursue more promising projects. Participants who indulged in the desired future or dwelled on the reality were insensitive to negative feedback whether or not they perceived their goal pursuit as feasible. When prospects are high, mental contrasting enables people to effectively process goal-relevant information entailed in setbacks, even when it is critical, while simultaneously preserving their sense of competence.

In summary, mental contrasting changes behavior via cognitive and motivational processes that are outside of awareness, and via responses that reap the benefits of negative feedback. Specifically, it modulates the strength of the associations between future and reality, as well as between reality and instrumental means, and it changes whether the reality is classified as an obstacle. It also energizes people and heightens constructive responses to setbacks.

Spontaneous Mental Contrasting

Since mental contrasting has an impact on selective goal commitment and performance, it seems meaningful to investigate which variables affect the spontaneous use of mental contrasting. Just like induced mental contrasting, spontaneous mental contrasting predicted selective goal pursuit as assessed by self-reported and observed indicators. This finding was replicated across domains (interpersonal, academic, and professional), contexts (in the laboratory, online), cultures (Germany and the United States), and samples (university students and online users).

Context Variables

SAD MOOD

Because sad mood encourages problem solving and alludes to a need for changing the status quo, it should promote mental contrasting more than does happy or neutral moods. To test this idea, H. B. Kappes, Oettingen, Mayer, and Maglio (2011) used a series of mood inductions (e.g., reading a text, imagining oneself in a hypothetical scenario, listening to music, experiencing a real event, or being exposed to incidental information). Regardless of how mood was induced, sad mood promoted self-initiated mental contrasting more than did neutral or happy mood. However, mood did not affect the predictive relation between mental contrasting and expectancy-dependent goal pursuits. These findings support the notion that sad mood can help people to initiate and use self-regulation strategies that lead to wise goal pursuits.

In order to investigate further variables that predict spontaneous mental contrasting, Sevincer and Oettingen (2013) developed a content analytic measure to observe spontaneous mental contrasting in people as it occurs in their stream of thought while

writing about an important wish. The following studies were conducted using this coding scheme.

ANTICIPATION OF GOAL-RELATED ACTIONS

The prospect of having to garner resources for goal-directed action in the near future was found to be a context variable that predicted spontaneous mental contrasting: Compared to participants who were not given a prompt that action is impending, participants who thought about their wish of being admitted to graduate school, while anticipating having to write a relevant essay directly afterward, were more likely to spontaneously use mental contrasting (Sevincer & Oettingen, 2013). Given this finding, it may also be possible that people who indicate pressing wishes in the near (vs. distant) future will be more likely to initiate mental contrasting.

Person Variables: Cognition, Self-Regulation Skills, and Implicit Theories

First, because mental contrasting demands more mental effort compared to indulging (Achtziger, Fehr, Oettingen, Gollwitzer, & Rockstroh, 2009), people who have a high need for cognition (i.e., people who tend to engage in and enjoy effortful processing; Cacioppo, Petty, & Kao, 1984) may be more likely to spontaneously use mental contrasting. Second, because mental contrasting leads to the regulation of goal pursuit, people who report having high (vs. low) self-regulation skills (Baumeister & Heatherton, 1996; Tangney, Baumeister, & Boone, 2004) may also be more disposed to use mental contrasting. Considering that trait self-control was found to be linked to affective well-being and life satisfaction (Wilhelm, Luhmann, Fisher, Vohs, & Baumeister, 2014), it seems fruitful to teach mental contrasting as an avenue through which people can develop their self-control. Finally, people's implicit theories (Dweck & Leggett, 1988) may affect their self-regulatory thought: Those who were made to believe that intelligence is a product of the environment and can be changed for the better (incremental theory) focused more on the desired future (mental contrasting or indulging), whereas those who were made to believe that intelligence is due to genetic factors and cannot be changed (entity theory) focused more on the present reality (reverse contrasting or dwelling; Sevincer, Kluge, & Oettingen, 2014).

Cultural Variables: Social Norms

In tight cultures, social norms are firmly imposed, whereas in loose cultures, going against the norm is tolerated (Triandis, 1989). Since people in tight cultures are more constrained by social roles and obligations in pursuing their goals than those in loose cultures, their goals should be guided by their culture rather than by their expectations. On the other hand, people in loose cultures should have greater flexibility in selecting their goals, thus making mental contrasting relevant and useful (Oettingen, 1997).

While the reported studies elucidate *whether* and *how* people use mental contrasting, they simultaneously demonstrate how relatively few people spontaneously use this strategy: Only 15% of the participants used mental contrasting (averaged across all three studies; Sevincer & Oettingen, 2013). To encourage people to benefit from mental contrasting regardless of their contextual, person, and cultural variables, a more guided metacognitive approach to engage in mental contrasting was developed.

Mental Contrasting as an Intervention

As an intervention, mental contrasting should support people in prioritizing between projects that should and should not be tackled, thereby freeing up valuable resources for other, more promising endeavors. By enabling people to separate the wheat from the chaff, mental contrasting should also support them in finding integrative solutions, for example, when negotiating tasks that demand perspective taking and cooperation.

Mental Contrasting Supports Management of Everyday Life

Oettingen, Mayer, and Brinkmann (2010) tested whether teaching mental contrasting as a metacognitive strategy enhances flexible decision making and effective time management during everyday life. Middle-level managers in the health domain were randomly assigned to two conditions: In one condition, they were taught mental contrasting; in the other condition, they were led to indulge in solving everyday wishes and concerns. Two weeks after the intervention, participants in the mental-contrasting (vs. indulging) condition had managed their time better and had less difficulty making decisions. Such prudent pursuit of everyday goals should also help in finding integrative solutions when dealing with others.

Mental Contrasting Facilitates Integrative Bargaining

Kirk, Oettingen, and Gollwitzer (2011) investigated the role of mental contrasting in an integrative bargaining task, “New Car,” developed by the Dispute Resolution Research Center at the Kellogg School of Business. Here, partners (seller and buyer) can arrive at agreements that are beneficial to both if they find trade-offs on aspects of a car deal that are more important to one partner than to the other. Mental contrasting promoted finding more integrative solutions and therefore produced higher joint profits compared to the indulging, dwelling, or no-strategy modes of thought. In addition, mental contrasting led to heightened equity of achieved profits. The results show that mental contrasting can help people find creative and cooperative solutions in negotiation settings.

The reported studies have shown that teaching mental contrasting as a metacognitive intervention can help people prioritize which goals to pursue and which ones to let go. However, when disengagement is not advisable or feasible, mental contrasting can also be taught to help people wholeheartedly pursue a desired future by ensuring that they hold high expectations of success. High expectations can be guaranteed in one of three ways: (1) strengthening expectations of success via positive feedback, (2) asking for idiosyncratic feasible wishes, and (3) providing feasible tasks. The following three studies provide examples of each of these approaches to ensuring high expectations of success.

Mental Contrasting Heightens Creative Performance

The first way to ensure high expectations of success is by strengthening them via positive feedback. In two studies (Oettingen, Marquardt, & Gollwitzer, 2012), participants received positive or moderate bogus feedback regarding their creative potential. Afterwards, they were assigned to a mental contrasting, indulging, dwelling, or control conditions with respect to performing on a creativity test. Participants in the mental contrasting condition who received positive feedback about their creative potential performed

better on the creativity task than did mental contrasting participants who received moderate feedback. They also performed better than participants in the indulging, dwelling, and unrelated contrast conditions, regardless of bogus feedback type. These findings demonstrate that mental contrasting can translate high expectations from positive feedback into strong performance.

Mental Contrasting Improves Health Behavior

The second way to ensure high expectations of success is by asking for idiosyncratic, feasible wishes. Johannessen, Oettingen, and Mayer (2012) invited dieting students to identify a dieting wish that they deemed both important and attainable within a 2-week period. Students were then taught either mental contrasting or indulging in thoughts and images about their dieting wish, or they did not receive an intervention. After 2 weeks, participants in the mental contrasting condition reported having consumed fewer high-calorie foods, more low-calorie foods, and fewer calories overall than those in the indulging and control conditions. These benefits in the diet domain transferred to the exercise domain: Students who used mental contrasting also reported having exercised more.

These health benefits were also observed in particularly vulnerable individuals, such as overweight, middle-aged fishermen of low socioeconomic status, for which mental contrasting promoted physical activity (Sheeran, Harris, Vaughan, Oettingen, & Gollwitzer, 2013), and among patients with type 2 diabetes, for which mental contrasting improved diabetes self-management (Adriaanse, de Ridder, & Voorneman, 2013). By helping individuals identify wishes that they deemed attainable, mental contrasting was shown to trigger goal-pursuit.

Mental Contrasting Increases School Performance

The third way to ensure high expectations of success is by providing feasible tasks. A. Gollwitzer, Oettingen, Kirby, Duckworth, and Mayer (2011) taught mental contrasting of a feasible academic task to German and U.S. schoolchildren in low-income neighborhoods. As early as second grade, teaching mental contrasting promoted academic performance in terms of language acquisition, and these findings were replicated in U.S. fifth graders. Apparently, mental contrasting can be taught to, and effectively applied by, young children to solve feasible academic tasks even in larger classroom settings, without leaving a child behind.

Thus, these three lines of studies reported above demonstrate that individuals can be taught mental contrasting not only to select between feasible and unfeasible future endeavors but also as a strategy to vigorously pursue their feasible wishes.

MENTAL CONTRASTING WITH IMPLEMENTATION INTENTIONS

As described earlier, whereas mental contrasting strengthens the implicit association between obstacles of reality and instrumental means (A. Kappes, Singmann, et al., 2012; Oettingen, 2012), explicit planning in the form of implementation intentions or “If situation X, then I will perform goal-directed response Y!” (Gollwitzer, 1999) should strengthen these implicit associations even more. By instigating automatic action control when the specified situation is encountered, implementation intentions have proven to be

highly effective in fostering goal attainment, with hundreds of studies showing a medium to large effect ($d = 0.61$; for a meta-analysis, see Gollwitzer & Sheeran, 2006).

On the other hand, mental contrasting provides the prerequisites for the effects of implementation intentions by fostering energization and goal commitment (Sheeran, Webb, & Gollwitzer, 2005). Moreover, mental contrasting helps to identify one's personal obstacles that then can be used for the if-part of the implementation intention, and it helps one to understand the means to overcome the obstacles that then can be used for the then-part. Thus, mental contrasting and implementation intentions are complementary strategies, and are therefore combined in a self-regulatory tool called mental contrasting with implementation intentions (MCII).

MCII as an Intervention

MCII Facilitates Insights and Integrative Behavior

To extend the previously reported finding that mental contrasting promotes integrative bargaining more than indulging, dwelling, and no mode of thought, Kirk, Oettingen, and Gollwitzer (2013) used the same bargaining task to test the impact of MCII versus mental contrasting and implementation intentions alone. MCII led to more joint gains than using either mental contrasting or implementation intentions alone, and this effect was mediated by cooperative planning. Apparently, MCII favored the insights needed for finding integrative solutions, and it did so more effectively than did mental contrasting or implementation intentions alone.

MCII Breaks Bad Habits

MCII also helped to break bad habits more than either strategy alone. College students plagued by unwanted snacking habits were more successful in reducing them after they engaged in MCII compared to mental contrasting or forming implementation intentions alone. The MCII students also gained clarity about their individual obstacles that impeded mastering their unwanted habits (Adriaanse et al., 2010).

MCII Benefits Romantic Relationships

To test whether MCII can ease insecurity-based behaviors, students involved in romantic relationships were asked to name a specific insecure behavior they wanted to attenuate. They then applied MCII, a reverse contrasting control strategy, or no strategy (Houssais, Oettingen, & Mayer, 2013). After a week, participants in the MCII condition (vs. the control conditions) had more effectively reduced their insecure behaviors and reported increased commitment to the relationship. In another study, MCII was found to benefit couples by increasing their initiation of communication about a sensitive topic (Cachia, Thorson, & Oettingen, 2016). Thus, MCII was effectively shown to both reduce *and* enhance behaviors that promote beneficial relationship outcomes.

Summary

MCII was found to benefit self-regulation in other life domains as well. In the health domain, for example, MCII fostered physical activity and intake of fruits and vegetables

in middle-aged women (Stadler, Oettingen, & Gollwitzer, 2009, 2010), promoted regular exercise and weight loss in stroke patients (Marquardt, Oettingen, Gollwitzer, Sheeran, & Liepert, 2016), and heightened mobility in chronic back pain patients (Christiansen, Oettingen, Dahme, & Klinger, 2010). In the academic and professional domains, it improved time management in low-income working mothers who attended a vocational program (Oettingen, Kappes, Guttenberg, & Gollwitzer, 2015), improved homework completion in children both at risk and not at risk for ADHD (Gawrilow, Morgenroth, Schultz, Oettingen, & Gollwitzer, 2013) and benefited attendance and academic performance in fifth graders from low-income backgrounds (Duckworth, Kirby, A. Gollwitzer, & Oettingen, 2013).

Taken together, mental contrasting, by itself and in combination with implementation intentions, can be effectively taught as a metacognitive strategy that people can use on their own to successfully change their behavior. It has been shown to be effective for people of all age groups from diverse nations—spanning the United Kingdom, the United States, the Netherlands, and Germany—and from different social backgrounds, from university students to individuals belonging to minority groups and those from disadvantaged areas. It seems evident that mental contrasting and MCII can be used ubiquitously to help people successfully manage their tasks and improve their everyday lives and long-term developments (see also www.woopmylife.org).

CONCLUSION

Let us now come full circle and revisit Jeanne, whom we met at the beginning of the chapter. We saw how, even as time went by, Jeanne's dreams of running her own jewelry company remained just that—a dream. This chapter has revealed that positively fantasizing about our desired futures will relax us, which, although pleasant at the moment, will sap our energy required to actually go after these dreams. Considering the *Zeitgeist* of optimism and positive thinking that has permeated our culture, Jeanne's situation is far from unique.

When we find ourselves in the shoes of Jeanne, dreaming about a desired future, yet find that we lack the impetus to go after it, we are becoming satisfied with our fantasies. Only by combining our fantasies with the resisting reality (mental contrasting) can we come to realize that we may not want to simply sit and enjoy these mental images. Rather, to make our dreams come true, we must actively surmount the obstacles on the way. When we feel that we *can* overcome these obstacles, we become energized to pursue our goals; when we feel that we *cannot* overcome these obstacles, we are liberated from our unrealistic dreams to pursue and realize more feasible endeavors. Following from this concept, mental contrasting and MCII were developed as time- and cost-effective metacognitive strategies, improving all aspects of our lives, from health and achievement to interpersonal relationships.

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CHAPTER 31

Self-Regulatory Failure and Addiction

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Since the publication of *Losing Control: How and Why People Fail at Self-Regulation* (Baumeister, Heatherton, & Tice, 1994) there has been a proliferation of research examining self-regulatory processes and addiction (see Hull & Slone, 2004; Sayette, 2004). Borrowing from Baumeister and colleagues (1994), in our chapter in the first edition of this volume, we considered *self-regulation* to refer generally to any effort by a human being to alter his or her own responses (Sayette, 2004). With respect to addiction, self-regulation often refers to an attempt to override a well-learned drug use behavior or habit in order to realize a positive long-term outcome. As outlined by Baumeister and colleagues, the constituent actions required for drug use (e.g., asking a friend for a cigarette, holding it, lighting it) are voluntary behaviors that can be controlled (see also Vohs & Baumeister, 2009). Accordingly, drug use is a particularly interesting domain for examining self-regulation failure.

Self-regulation failure can be subdivided into failures of *underregulation* and *misregulation*. The former refers to a failure to exert control over oneself, whereas the latter refers to exerting control in a way that fails to produce the desired result (Baumeister et al., 1994). Both types of self-regulation failure likely contribute to addictive behavior and are addressed herein.

This chapter summarizes and updates our previous reviews of the relation between nicotine addiction (more specifically, cigarette smoking) and self-regulation (Sayette, 2004; Sayette & Griffin, 2011). There are several reasons why smoking presents an ideal model for considering the relation between self-regulation and addiction. First, although millions of Americans try to quit smoking each year, 81% of these attempts fail within the first month (Hughes et al., 1992), suggesting that nicotine is an especially good drug to consider when examining self-regulatory failure. Second, the public health implications of nicotine dependence dwarf those of all other drugs (U.S. Department of Health and Human Services, 2004), highlighting the importance of studying self-regulatory processes related to smoking. Third, compared to other substances, such as alcohol, nicotine

is an especially addictive drug, and the majority of regular users become dependent. Fourth, because withdrawal states can be induced via robust deprivation manipulations in a medically safe manner, a substantial amount of research has examined smoking motivation and self-regulatory processes.

Smokers may require self-regulation under two different circumstances. During periods of abstinence–avoidance, one desires to smoke but cigarettes are unavailable (e.g., while watching a film in a theater). Self-regulation here may reflect a need to override temporary urges. In contrast, during periods of abstinence seeking, one wishes to abstain. As noted by Tiffany (1990), in either case, a smoker may experience cravings. Effective self-regulation typically requires overriding the craving to smoke. Accordingly, research protocols that provoke cigarette cravings provide an ideal environment for investigating self-regulation.

Research interest in craving has intensified over the past 20 years, culminating in its inclusion as a criterion for substance use disorder in the latest edition of the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5). *Craving*, a term often used interchangeably with *urge*, is provoked using a variety of manipulations, including drug deprivation, drug use imagery, and drug cue exposure (Niaura et al., 1988; Sayette et al., 2000; Tiffany, 1992).

This chapter addresses research examining self-regulation difficulties faced by smokers who have already developed the habit. Readers interested in the role of self-regulation in the initiation of smoking are referred elsewhere (e.g., Baumeister et al., 1994; Rawn & Vohs, 2011). We first discuss misregulation failures, followed by an analysis of the role of underregulation in smoking.

MISREGULATION

Most discussion of self-regulation failure and addiction has centered on underregulation. Many problems linked to addiction, however, also can be conceived of as *misregulation*, in which one exerts control in a way that fails to bring about the desired result (Baumeister et al., 1994). Rather than assuming that a person who experiences a smoking lapse (i.e., an initial violation of abstinence) does so due to a breakdown in impulse control, it is possible that the act of smoking represents an attempt, albeit misguided, to address a critical problem for the smoker.

One example of misregulation among smokers is the belief that quitting smoking will lead to weight gain (Baumeister et al., 1994; Levine, Marcus, Kalarchian, Houck, & Cheng, 2010). Although quitting often is linked to an increase of 5 or 10 pounds, there is clear evidence that the harmful effects of continuing to smoke override this short-term weight gain (Baumeister et al., 1994). Thus, smoking is mistakenly viewed as a “reasonable” method for controlling weight.

A second example of misregulation is the use of cigarettes to improve mood (Conklin & Perkins, 2005). A fundamental question regarding nicotine addiction concerns why a smoker who appears to be committed to quitting suffers a smoking lapse. It often is assumed that such a lapse indicates a breakdown in impulse control. Alternatively, a lapse may represent a strategic attempt to regulate affect. Tice, Bratslavsky, and Baumeister (2001) found that after a negative affect induction, impulsive behaviors—such as eating fattening, tasty snacks—occurred only when participants believed that their mood was

modifiable. When they believed that their negative affective state was “frozen,” participants’ desire to engage in impulsive behaviors was not enhanced. Tice et al. concluded that regardless of the ultimate success of these actions, the “impulsive” behavior may be viewed as a rational attempt to address a pressing concern.

The research by Tice and colleagues (2001) suggests that a former smoker who is under stress may lapse because the short-term need to alleviate negative affect becomes particularly salient. This raises a question that has interested addiction researchers for years: Just how often does a lapse or relapse occur during moments of distress? Early models of addiction articulated by Wikler (1948) and Conger (1956), for example, posited that drugs and alcohol were consumed by addicts to alleviate negative affective states. These initial negative reinforcement models have been challenged (see Tiffany, 1990). It has been suggested, for instance, that smokers who lapse or relapse often do not report experiencing negative affect (Shiffman et al., 2002), and that many “absentminded lapses” seem to occur outside of awareness (Tiffany, 1990).

Nevertheless, updated versions of negative reinforcement models assert that the chief component of the withdrawal response is negative affect, and that with some modifications to original formulations, “escape and avoidance of negative affect is the prepotent motive for addictive drug use” (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004, p. 33). Baker and colleagues (2004) examined a diverse set of animal and human studies to address many of the criticisms leveled against negative reinforcement models. Their review suggests that, construed broadly, the alleviation or prevention of negative affect can motivate some, if not most, lapses (see also Brownell, Marlatt, Lichtenstein, & Wilson, 1986; Heckman et al., 2013; Piper et al., 2008).

If smoking a cigarette is viewed as an attempt to improve mood, then treatments that focus on mood regulation may prove effective. Consistent with this position is the success of the antidepressant bupropion (e.g., McCarthy et al., 2008). In addition, as argued by Baker et al. (2004), even nicotine replacement products suppress negative affect. From a psychological perspective, smoking interventions that ignore concerns related to negative affect are unlikely to succeed.

UNDERREGULATION

As noted earlier, much of the smoking research on self-regulation failure has emphasized underregulation. Baumeister and colleagues (1994) discussed three basic features of self-regulation that may fail and lead to underregulation: (1) setting proper standards; (2) monitoring oneself in relation to these standards, and (3) altering one’s responses to conform to these standards. Though not all the findings we address below fit cleanly into just one of these categories, it nevertheless remains heuristic to retain this structure.

Setting Standards

Difficulty setting proper standards may interfere with smoking cessation. Most smokers believe that smoking is a bad habit that they would like to break (Baumeister et al., 1994). Yet smokers may hold distorted standards related to smoking and health (Kunda, 1990). In a prospective study of smokers attempting to quit, Gibbons and Eggleston (1996) found that a smoker’s perception of the “typical smoker” at treatment outset reliably

predicted relapse. Specifically, those vulnerable to relapse were more likely to view typical smokers in a positive light than were those who successfully quit. Similarly, a recent study of a large, nationally representative sample of English smokers showed that positive smoker identity at baseline predicted failure to make a quit attempt at 6 month follow-up and a lower likelihood of smoking cessation success among those who did make a quit attempt (Tombor, Shahab, Brown, & West, 2013). Thus, people who continue to smoke may construct a standard of what it means to be a smoker that protects them from feeling irrational for maintaining their habit, and this positive smoker identity may be an important barrier to quitting smoking. Research from a social learning perspective may illuminate how such standards may develop (Marlatt & Gordon, 1985).

Rather than viewing standards solely as stable character traits, it may be useful to consider standards as being subject to momentary fluctuations. Specifically, when smokers crave a cigarette, the way that they think about smoking may change. In her theory of motivated reasoning, Kunda (1990) suggested that motivation could bias how one generates and evaluates information related to the topic of interest. The degree of change in generation and evaluation of information may be a function of one's momentary level of smoking motivation (Sayette, 2004).

As detailed in Sayette (2004), we have tested the effects of craving on the generation of smoking-related information in a study that required smokers to attend two (counter-balanced) laboratory sessions within 10 days of each other (Sayette & Hufford, 1997). While in high- and low-urge conditions, smokers listed as many positive, then negative, characteristics of smoking as they could. Smokers generated significantly more positive items about smoking during the high-urge session than they did during the low-urge assessment. Although craving increased generation of positive smoking-related information, it did not have this effect on negative information. Indeed, craving led to a non-significant drop in the generation of negative smoking-related information. Thus, while craving, smokers generated a list of smoking characteristics that was positively biased, relative to that when they were not craving.

Craving also may be associated with the way that smoking-related information is evaluated. Sayette, Martin, Wertz, Shiffman, and Perrott (2001) examined the effects of craving on the evaluation of smoking consequences. While holding a lit cigarette, smokers who were abstinent and nonabstinent (i.e., smokers able to smoke freely prior to entering the study) were asked to rate the probability that a list of smoking consequences would occur. Abstinent smokers tended to judge positive consequences to be more probable relative to negative ones than did nonabstinent smokers. As suggested by Marlatt (1985), craving may distort outcome expectancies, such that positive outcomes appear more likely than negative ones.

These studies suggest that standards related to smoking may be viewed differently when one is in a craving state than when one is in a neutral state (Sayette, 2004). Consequently, measuring one's views about smoking may require careful consideration of the assessment context. A clinician who learns that a smoker holds a negative view of smoking and is motivated to quit may be surprised to learn of a quick relapse. Had these standards been assessed while the smoker was in a craving state (or perhaps while intoxicated; Kirchner & Sayette, 2007), the information might have revealed that the smoker was ambivalent about giving up the habit. After all, it takes only a single moment of weakness during a high-risk situation for a committed quitter to reconsider and smoke a cigarette.

In addition to appreciating the importance of momentary shifts in attitudes, another complicating factor when considering standards is that smokers may simultaneously hold conflicting standards. For instance, they may believe it is foolish to risk their health by continuing to smoke, yet also believe that because life is uncertain, they might as well enjoy the moment (Stritzke, Breiner, Curtin, & Lang, 2004). Which of these standards predominates may switch moment to moment and when craving, a standard that promotes smoking may emerge.

In summary, there are myriad ways that one's standards regarding smoking may contribute to underregulation. The concept of smoking or being a smoker may shift over time as a smoker becomes more committed to the habit. Furthermore, at particular moments, such as when motivation to smoke is high, one's standards may tilt even more toward a smoking promotion position.

Monitoring

Research also has focused on the adverse consequences of failing to monitor one's thoughts, feelings, and actions regarding one's standards. Even if one holds standards promoting smoking cessation, it is crucial to monitor oneself in relation to these standards. The need to monitor oneself vigilantly is thought to be instrumental in preventing relapse (Brownell et al., 1986). Some research suggests that monitoring is the crucial component of self-regulation and requires allocation of considerable limited-capacity resources (Critcher & Ferguson, 2014).

Attention plays a critical role in monitoring. Baumeister and colleagues (1994) argued that managing attention may be the most effective approach to self-regulation. An individual can exercise self-regulation by attending to information that reaches beyond the immediate stimulus environment, what Baumeister and colleagues label *transcendence*. Rather than merely focusing on the immediate object of desire, one engages in high-level thinking that recognizes the standards that promote self-regulation. Such perspective is needed to override impulses. In contrast, transcendence failure occurs when an individual attends only to the immediate present and does not monitor discrepancies between current interests and long-term goals. Research also suggests that mindfulness practices, which encourage attention to momentary experiences coupled with acceptance of those experiences (Bishop et al., 2004), improve addiction treatment outcomes by strengthening the ability to monitor and cope with the discomfort associated with craving (Bowen et al., 2014; Westbrook et al., 2011).

Monitoring requires self-awareness, which is often compromised during high-risk moments. Social cues (e.g., celebrations) have been implicated in smoking relapse (Brownell et al., 1986). Presumably these situations do not provide fertile ground for self-reflection and monitoring. Similarly, monitoring may prove difficult during highly emotional states. Baumeister and colleagues (1994) posit that affectively charged moments may focus attention on immediate stimuli, leaving little attention available for self-reflection. It also is likely that monitoring of standards related to smoking will be inhibited following alcohol consumption. There is evidence that drinking alcohol increases smoking behavior and smoking motivation (see Piasecki, McCarthy, Fiore, & Baker, 2008; Sayette, Martin, Wertz, Perrott, & Peters, 2005). Moreover, relapse to smoking occurs more often after drinking alcohol than after any other identified situational variable (Shiffman & Balabanis, 1995). Several models of the effects of alcohol suggest that drinking impairs

cognitive processes (Fairbairn & Sayette, 2014; Hull & Slone, 2004). Whether due to an impaired ability to encode information in terms of self-relevance (Hull, 1987), difficulty monitoring internal processes (Sayette, Reichle, & Schooler, 2009), or a reduced capacity to focus on information other than immediate smoking cues (Steele & Josephs, 1990), alcohol intoxication may impede self-regulation by compromising the ability to monitor performance relative to standards (Baumeister et al., 1994). (If cues that inhibit smoking are salient, however, then intoxication might even support self-regulation; see MacDonald, Fong, Zanna, & Martineau, 2000). Research that addresses directly the effects of alcohol on the monitoring of standards and norms would be useful.

One final danger related to monitoring is that smokers may have developed unrealistic expectations about the impact of quitting. Smokers may assume, for example, that quitting will influence all aspects of their lives. Although quitting is likely to improve health, it may not substantially affect one's personality. When cessation fails to produce such global change, monitoring may have the unfortunate effect of revealing a substandard outcome and may precipitate a relapse. This process has been referred to as the "false hope syndrome" (Polivy, 2000). (For a review of behavioral health change models and possible reasons for relapse, see Rothman, Baldwin, and Hertel, 2004.)

Altering Responses

Smokers may recognize that smoking conflicts with their standards, and they may be able to monitor a discrepancy between their smoking behavior and their standards yet still experience a lapse. Indeed, the bulk of research on self-regulation failure centers on an inability to exercise the necessary control or discipline to resist a temptation to smoke. Baumeister et al. (1994) have conceived of this control in terms of *strength*. From this perspective, a smoker requires sufficient "muscle" to resist the impulse to smoke (see Baumeister, Vohs, & Tice, 2007; Muraven & Baumeister, 2000). These authors propose that repeated encounters with high-risk situations over a particular time interval may deplete "muscle" strength, leaving one vulnerable to a lapse.

The concept of self-regulation strength has been examined from three perspectives. The first relates to stable individual differences. Certain people may be "weak" and lack the inhibition necessary to resist succumbing to temptation. For example, higher levels of trait-impulsivity predict a more rapid relapse to smoking following 48 hours of nicotine abstinence (Doran, Spring, McChargue, Pergadia, & Richmond, 2004) and a heightened craving response to a smoking cue in the laboratory (Doran, Cook, McChargue, & Spring, 2009; Doran, Spring, & McChargue, 2007). This person-level analysis of smoking is likely to yield important individual-difference markers for relapse risk (Shiffman & Balabanis, 1995).

A second approach to examining strength involves situational constraints that deplete the limited-capacity resources needed to resist a temptation to smoke (Baumeister et al., 1994; Tiffany, 1990). Given the effort required to override a temptation to smoke, factors that undermine limited-capacity processing resources should hamper self-regulation. For instance, fatigue may prevent effective self-regulatory behavior in the face of a smoking urge. Accordingly, Baumeister and colleagues (1994) suggest that smokers attempt smoking cessation at a time when other demands requiring self-control are relatively low. Mixed findings have been reported, however, in naturalistic studies using ecological momentary assessment (cf. Muraven, Collins, Shiffman, & Paty, 2005;

O'Connell, Schwartz, & Shiffman, 2008), as well as in treatment studies examining the effects of concurrent smoking cessation interventions on smoking and alcohol outcomes in individuals in treatment for alcohol dependence (cf. Bobo, McIlvain, Lando, Walker, & Leed-Kelly, 1998; Joseph, Willenbring, Nugent, & Nelson, 2004). In theory, while under stress, a person may be too exhausted to combat a strong urge to smoke. Stressors that threaten one's self-concept or that require self-monitoring may be especially exhausting; further research is warranted.

Related to stress is tobacco withdrawal. Subtle effects of tobacco withdrawal can begin to occur even after very brief periods of abstinence (Hughes, 1991). Furthermore, it has been argued that the cardinal feature of withdrawal is negative affect or stress (Baker et al., 2004). From a self-regulatory strength perspective, people may smoke when distressed because they cannot cope simultaneously with the stressors and their cravings. Indeed, recent behavioral research suggests that acute ingestion of nicotine can fortify self-regulatory processes (Heckman, Ditte, & Brandon, 2012).

Research also suggests that alcohol may hamper efforts to self-regulate. Because alcohol demands limited-capacity resources (Josephs & Steele, 1990), presumably there would be insufficient cognitive capacity available while drinking to override a well-learned smoking routine (Sayette, Martin, et al., 2005; Tiffany, 1990). Moreover, because alcohol can cue smoking (e.g., Erblich, Montgomery, & Bovbjerg, 2009), drinking may initiate automatized smoking behavior (Burton & Tiffany, 1997). Thus, like fatigue and stress, drinking alcohol may compromise the ability to alter responses in the service of self-regulation.

Another area of cognition that may affect self-regulation is time perception. Data suggest that while waiting to smoke, time may seem to pass more rapidly when subjects are not craving than when they are in a craving state (Klein, Corwin, & Stine, 2003; Sayette, Loewenstein, Kirchner, Travis, 2005). These data are in accord with findings that the act of self-regulation changes the subjective experience of time, such that time feels more extended than it really is, and this state leads to subsequent failures in self-regulation (Vohs & Schmeichel, 2003).

The third approach to examining strength involves temporary states influenced by appetitive cues. Smokers may lack the strength to resist an urge due not only to a weakness—whether it be chronic or temporary—but also powerful appetitive stimuli. Studies reveal that craving draws on limited-capacity processes (see Sayette, 2004). In several studies across multiple laboratories, exposure to smoking cues, for example, led smokers to respond more slowly during a secondary-response time probe than during exposure to control cues, suggesting that limited-capacity nonautomatic processing resources were diverted during the craving manipulation (see Sayette, 2004). These performance deficits suggest a demand on processing resources during craving.

If smoking does represent a well-learned routine, then it will likely take considerable effort, requiring limited-capacity, nonautomatic resources to refrain from completing the smoking action sequence once it has been initiated (Tiffany, 1990). Indeed, the ability to override a well-learned habitual behavior is the central feature of self-regulation (Baumeister et al., 1994; but see Critcher & Ferguson, 2014). Baumeister and colleagues (1994) also suggest that the further into the routine, the more difficult (i.e., the more cognitive resources will be required) it is to terminate. Thus, it is far easier to resist smoking when viewing a friend smoking from afar than after holding a lit cigarette that a friend offers you, a process they label *psychological inertia*. Moreover, once the smoking

routine is fully engaged, we have found that suppression of the urge leads to a subsequent enhancement in the value attributed to smoking a cigarette (Sayers & Sayette, 2013).

After a smoking routine is activated, limited-capacity cognitive resources are likely directed toward several other functions, in addition to struggling to resist completing the routine (Sayette, Martin, Hull, Wertz, & Perrott, 2003). Resources may be directed toward monitoring: the level of motivation or desire to use the drug (e.g., “I really want a cigarette”); the drug cues themselves (e.g., thoughts of how the cigarette will feel in my hand); anticipated positive effects of smoking (e.g., “If I smoke this cigarette, then I will feel better”); feelings associated with the event (e.g., frustration that my friend lit a cigarette in my presence); as well as problem-solving cognitions associated with completing the smoking action plan (e.g., “How can I hide this cigarette from my spouse?”). Resources directed toward any of these cognitions leave fewer resources available for successful self-regulation involved in maintaining abstinence.

Addiction researchers have used measures other than secondary-response time probes to examine shifts in attention and cognitive processing during high-risk situations (Waters & Sayette, 2006). One measure of attentional bias is the *color-naming task*, also called the emotional Stroop task. Participants name the color of words while ignoring word content. When words are personally or emotionally relevant, individuals are thought to be drawn to them automatically, and the latency period required to name the color of the word generally increases. Several emotional Stroop studies have shown that smokers display greater response interference when presented with smoking-related words during withdrawal than when they were permitted to smoke normally (for reviews, see Cox, Fadardi, & Pothos, 2006; Field, Munafò, & Franken, 2009; Waters & Sayette, 2006). More recently, researchers have begun to integrate more direct measures of attentional bias (e.g., using eye-gaze recordings) and neuroimaging techniques to examine neural substrates of attentional bias (Janes et al., 2010b) and individual differences that predict attentional bias for smoking-related cues (Kang et al., 2012). These data are consistent with models of addiction emphasizing shifts in the incentive salience of drug cues, such that these cues “grab attention” and cue the addict to engage in further drug use (Robinson & Berridge, 1993, p. 261).

We have found that performance on a version of the emotional Stroop task on quit day predicted subsequent relapse, even after we controlled for self-reported urge (Waters et al., 2003) (Also see research by Janes et al. [2010a] and Powell, Dawkins, West, & Pickering [2010], who found similar relations between emotional Stroop interference and subsequent relapse without controlling for self-reported urge, while Spiegelhalder et al. [2011] found the relation to exist in the opposite direction). Although more studies are needed, the findings to date suggest that during moments of temptation, attention appears to be biased toward smoking-related stimuli. Such a drift may hamper the ability to produce regulating responses, also known as *coping responses*. There have been attempts to train smokers and drinkers to overcome their automatic distraction for alcohol- and smoking-related stimuli (e.g., Attwood, O’Sullivan, Leonards, Mackintosh, & Munafò, 2008; Wiers, Houben, Smulders, Conrod, & Jones, 2006), though studies examining the effectiveness of such training have yielded mixed findings (see Christiansen, Schoenmakers, & Field, 2015).

The issue of coping is particularly important when we discuss self-regulation. Smokers who relapse often fail to use coping skills (Shiffman, 1982). In many cases, relapsers fail despite having obtained relevant coping skills that they previously used successfully

(Brandon, Tiffany, Obremski, & Baker, 1990). As reviewed in the first edition of this volume (Sayette, 2004), studies suggest a direct connection between temptation and the ability to cope with temptation, such that high-urge situations are associated with weak coping responses.

As cravings emerge, coping resources may become inaccessible, or coping resources may remain accessible but smokers may just choose not to engage them, or both (Sayette, 2004). Regardless, the motivation to smoke may fundamentally influence the way coping-related information is processed. Thus, we might expect a smoker to generate and employ an impressive array of coping resources while experiencing a mild urge but fail to do so during a strong urge. From this perspective, it may be wiser to teach coping skills in a high-urge environment than in a sterile, low-urge context, an approach used with alcohol use disorder (e.g., Monti et al., 1993).

Related to coping is Bandura's (1997) concept of self-efficacy, which has been applied to a range of addictive behaviors (for a review of self-regulation and self-efficacy, see Cervone, Mor, Orom, Shadel, & Scott, 2004). The most prominent conceptualization of self-efficacy in the smoking literature involves *abstinence self-efficacy*, or confidence in one's ability to abstain from smoking (Gwaltney et al., 2001). Individuals with greater confidence in their ability to abstain should be more likely to maintain abstinence (Marlatt & Gordon, 1985; Niaura et al., 1988). As we noted previously, however, pretreatment abstinence self-efficacy judgments do not always predict relapse (Sayette, 2004). Furthermore, abstinence self-efficacy does not appear to mediate the effect of concurrent smoking on future smoking (see Sayette, 2004). One reason may be that initial efficacy judgments usually are made in a neutral state, whereas the temptation periods that one must overcome to remain abstinent are typically affectively charged.

Persons in an affectively neutral "cold" state often underestimate the impact of being in an affectively charged "hot" state on their own future behavior, referred to by Loewenstein (1999) as the "cold-to-hot empathy gap." Consistent with this proposition, a disproportionate number of subjects across behavioral domains inaccurately report maximum self-efficacy scores (for a review, see Forsyth & Carey, 1998). We have observed that smokers in a cold "low-craving" state, but not those in a hot "high-craving" state, underpredict the value of smoking during a subsequent "high-craving" session (Sayette, Loewenstein, Griffin, & Black, 2008). Were initial self-efficacy assessments recorded in a craving state, which more closely approximates high-risk situations, they might prove more accurate than they typically are in the prediction of quitting.

To test the relation between abstinence self-efficacy and cigarette craving we used ecological momentary assessment in smokers participating in a smoking cessation treatment (Gwaltney, Shiffman, & Sayette, 2005). Smokers reported their urge to smoke and abstinence self-efficacy using palm-top computers during multiple temptation and nontemptation periods. When smokers reported high urges, they tended to report less abstinence self-efficacy than when they were reporting weaker craving states. This finding was replicated in another study using ecological momentary assessment to examine self-efficacy in adolescents after a cessation attempt (Van Zundert, Engels, & Kuntsche, 2011). Thus, both laboratory and field research support the notion that smokers' ability, and confidence in their ability, to cope with temptation diminishes during the precise moments they are most needed. In summary, there is converging evidence that cravings brought about by nicotine deprivation, smoking cue exposure, or both, may alter cognitive processes such that the ability to resist smoking may be compromised. It may be

helpful to learn to link automatically the occurrence of a high-risk situation (e.g., “If I am around a person smoking a cigarette”) with a healthy outcome (e.g., “then I will leave the area”), which Gollwitzer (1999) called *implementation intention*, thus delegating the appraisal of the situation to cold states.

ACQUIESCENCE

A strength model implies that self-regulation will fail only when one lacks sufficient strength and is “powerless” to exert self-control. A provocative issue raised by Baumeister and colleagues (1994) was “whether people actually acquiesce in their own self-regulation failures” (p. 29). The idea is that people may sometimes, perhaps unconsciously, cooperate in their failure to self-regulate. These authors suggest that acquiescence may be common and that few impulsive behaviors are truly involuntary. MacAndrew and Edgerton (1969), in their cross-cultural analysis of drinking behavior, posited that most societies need periods of time-out from typical standards of conduct and that drinking alcohol implicitly permits group members to relax their behavioral norms. Similarly, Baumeister and colleagues suggested that there are times when individuals may want to loosen up and relax their level of self-awareness, which is likely to reduce further the monitoring necessary for successful self-regulation.

Although the notion that smokers may indulge their cravings has rarely been studied, indirect evidence suggests that people sometimes acquiesce to their urges. Data across multiple substance-abusing samples reveal that drug cue exposure leads to elevated urge ratings (see Carter & Tiffany, 1999; Sayette & Tiffany, 2013). What is surprising is the variability in the magnitude of this effect. Individuals conflicted about drug use may experience urges in various ways. If they attempt to exert self-control in the situation, then they are likely motivated to suppress their urge. In contrast, were individuals at some level inclined to acquiesce and consume their drug, they would not be motivated to suppress their urge. Indeed, they might even wish to embellish their urge to justify drug use: “I had no real choice but to smoke. Anyone with an urge as strong as mine would have smoked.” Consistent with this position, a review of cue exposure studies found that, across substances, participants who perceived an opportunity to use reported significantly higher urges than those who did not anticipate use (Wertz & Sayette, 2001).

All of the smoking cue exposure studies included in Wertz and Sayette (2001) used smokers not currently interested in quitting. Because these participants were still active smokers, they presumably could cope with urges by simply smoking a cigarette. Accordingly, they would be expected to report strong cigarette urges during cue exposure. Consistent with this hypothesis, these studies reveal that participants report high levels of craving (about 74% of maximum value on scales; see Table 1 in Wertz & Sayette, 2001). In contrast, when smokers are attempting cessation, they may be motivated to cope with urges by suppressing rather than indulging them. Smokers undergoing a cue exposure assessment at the start of a quit attempt do report relatively low urges (Shiffman et al., 2003). We also have observed across multiple studies different neurobiological responses to drug cues based on treatment-seeking status (see Wilson, Sayette, & Fiez, 2004). Recently, we conducted a functional magnetic resonance imaging (fMRI) study that varied both motivation to quit smoking and the perceived opportunity to smoke

following smoking cue exposure. Results indicated a distinct pattern of neural activity among smokers most inclined to indulge their cravings (i.e., those unmotivated to quit who were instructed that they could smoke soon) that may reflect the use of cognitive control to support positive anticipatory processing (Wilson, Sayette, & Fiez, 2012).

In addition to influencing the magnitude of craving, acquiescence may affect the emotional valence of a craving experience. Typically the affect associated with craving is assumed to be negative (Tiffany, 1992). When a smoker expects to satisfy an urge rather than resist it, however, he or she actually may experience positive affect. This pleasant emotional reaction appears to be more likely when anticipating an experience (e.g., smoking) than when anticipating a material purchase (Kumar, Killingsworth, & Gilovich, 2014). The moments just prior to use and even the beginning of consumption may be particularly positive. It is often difficult, however, to capture brief experiences of positive affect in the laboratory. Self-report measures are not ideally suited to assess moment-to-moment fluctuations in emotion response that occur over time. When participants complete self-report measures, they aggregate their experience over time. Moreover, after their responses are filtered through consciousness, they must impose language on what may be a nonverbal experience (Nisbett & Wilson, 1977).

Analysis of expressive behavior may prove to be a nice complement to more traditional measures (Sayette, Wertz, et al., 2003). The most sophisticated and established system for assessing facial expression is the Facial Action Coding System (FACS; Ekman & Friesen, 1978), an anatomically based system derived from 7,000 expressions decomposed into 44 action units that can be combined to describe all possible visible facial movements. FACS has proven to be reliable and to provide accurate and specific information across a range of emotional experiences (Ekman & Rosenberg, 2005; Sayette, Cohn, Wertz, Perrott, & Parrott, 2001).

Studies using FACS indicate that manipulating instructions (i.e., informing smokers that they will or will not be able to smoke a lit cigarette) influence the probability of evincing action units associated with either positive or negative affect (Sayette & Hufford, 1995; Sayette, Wertz, et al., 2003); that is, under certain conditions, craving may even be linked to positive affect (see also Carter & Tiffany, 2001). Similarly, Zinser, Fiore, Davidson, and Baker (1999) used an electrophysiological assessment that suggested a pattern of activation associated with approach motivation during craving. Together, these data suggest that some of the perceived reward generally associated with drug use may actually precede drug consumption. Such a proposition is consistent with neurobiological evidence indicating that dopamine is released during presentations of cues predictive of drug, food, and alcohol use (see Weiss et al., 2000). Thus, craving itself may be rewarding, particularly to those who anticipate using the drug very soon (Kavanagh, Andrade, & May, 2005). We recently observed that craving smokers who are told they can smoke soon prefer viewing smoking images (relative to alcohol images), more so than smokers told that they will not be able to smoke. In other words, the smoking images themselves appear to become more pleasant when smoking soon is anticipated (Sayette & Dimoff, in press). Loewenstein (1987) has described *savoring* as the “positive utility derived from anticipation of future consumption” (p. 667). Children who hoard their stash of Halloween candy rather than eating it, for example, may prefer savoring their candy to actually consuming it. In summary, under certain conditions, smokers may in fact acquiesce or indulge their cravings.

One further implication of acquiescence is that poor coping may not cause lapses but rather may be a reflection of an intended lapse; that is, once individuals decide, perhaps unconsciously, that they are going to indulge their craving, then it stands to reason that they will fail to employ coping skills, even those skills they have mastered. This proposition is at odds with most models of temptation and coping, which, as noted earlier, imply that poor coping causes temptations to become lapses. Alternatively, coping may be a reflection of urges, such that low-intensity urges provide opportunities to employ coping responses, while high-intensity urges, or at least urges associated with an intention to use, may to some extent preclude coping.

This alternative resembles Lazarus and Folkman's (1984) conception of stress and coping. Their three-stage appraisal model holds that an experience of stress reflects a primary appraisal of loss, threat, or harm, coupled with a secondary appraisal of coping resources available to counter the stressor. A third "reappraisal" stage, which takes into account both the primary and secondary appraisals, ultimately determines the degree of stress response. Importantly, these three appraisal processes blend together seamlessly.

In the context of craving, this model suggests that, in an instant, an "urge appraisal" can emerge that actually is a function of (1) a primary appraisal of a desire to smoke; (2) a secondary appraisal of whether one will acquiesce or attempt to resist the desire; and (3) an urge reappraisal that may reveal a high-risk urge along with weak efforts to cope, or less intense urges accompanied by strong attempts to cope. Future research, both behavioral and neural, may prove useful in determining the utility of this conceptualization of urges and coping, and more generally to explore the possible role of acquiescence in self-regulation failure.

CONCLUSIONS AND FUTURE DIRECTIONS

In this chapter we have considered several aspects of self-regulation failure in smokers. The self-regulation framework proposed by Baumeister and colleagues (1994) continues to provide a useful structure for examining a diverse set of findings related to smoking urges and lapses. Studies suggest that misregulation may play a critical role in understanding smoking motivation. As proposed by Baker and colleagues (2004), the possibility that smoking represents an attempt to attenuate, or perhaps ward off negative moods, is a model that still warrants serious attention.

Recognition of the potential role of acquiescence in self-regulation failure highlights the need to develop multiple methods and a wide range of measures to capture processes that may not always be available to conscious awareness (Wiers & Stacy, 2006). Use of implicit cognitive measures may improve understanding of mechanisms underlying self-regulation failure and help generate predictions regarding relapse risk. As noted earlier, use of the emotional Stroop task to predict relapse highlights the importance of attentional processes in self-regulation.

As with cognition, improved understanding of self-regulatory processes in addiction requires development of new approaches for assessing affect. The use of nonverbal measures (e.g., FACS, fMRI, electroencephalography, startle probe) that are conceptually linked to theories of craving and self-regulation may prove especially useful. It remains to be seen whether such affective responses during cue exposure might predict relapse in addiction (see Griffin & Sayette, 2008). Future research also is needed to understand

better the link between affect and cognition. More generally, addiction research that accounts for affective, motivational, as well as cognitive changes, will likely prove especially useful.

Most laboratory research on self-regulatory failure in addiction uses designs in which subjects participate individually (Creswell et al., 2012). Yet it is clear that many lapses occur in group settings. Investigations that incorporate theory and methods from social psychology will help to provide an important context for examining self-regulation (Sayette et al., 2012). Social comparison, group formation, and peer pressure are just a few examples of the kinds of social processes that may influence self-regulation.

Drug use requires a series of voluntary actions; thus, it is fair to claim that addiction is a failure of self-regulation (Baumeister et al., 1994; Marlatt & Gordon, 1985). Yet the studies examined in this chapter do show that during affectively charged moments, the information available to smokers may shift in a manner that promotes smoking. Given the disappointing relapse rates among smokers attempting cessation, it is imperative that researchers begin to translate these laboratory observations into clinical interventions that help smokers recognize and undermine these biases.

This chapter has only briefly addressed individual differences that influence self-regulation processes. This area, of great interest from biological, psychological, and social perspectives, relates to initiation of smoking, as well as to maintenance and relapse. Indeed, it is likely that future efforts will cut across these perspectives to provide a richer understanding of self-regulation processes. Clearly, imaging research already being conducted is an illustration of such integration (Ochsner & Gross, 2007). Instead, this chapter has focused on momentary changes that may affect self-regulation. Research examining changes in cognitive processing during cigarette cravings provides insight into the role of underregulation in addiction.

Clinical Implications

The research described in this chapter also suggests clinical applications. Cognitive-behavioral therapies emphasize that people's cognitive biases and distortions can contribute to a range of psychopathological behaviors. Often, treatment involves helping patients uncover and modify these biases. In the field of addiction, preventing relapse has been the greatest clinical challenge (Brownell et al., 1986; Marlatt & Gordon, 1985). Consider the challenges awaiting smokers who have only recently quit. Data from cognitive studies suggest that when they walk down the street, there appears to be much that reminds them of a cigarette. Every cigarette butt that has been dropped on the pavement grabs their attention like a billboard. Even ambiguous cues may remind them of their habit (Sayette, 2004).

In a clinic setting, patients may be warned that they will face these temptations and need to dispute rationally their distorted perceptions and the judgments that follow. Perhaps writing down the pros and cons of the resumption of smoking may help them to regain perspective. Yet if this list is generated while they experience craving, it may not resemble one generated in a noncraving state. While craving, the balance of pros and cons may shift, and the reinforcing consequences of drug use might be strengthened. Suddenly, the decision to resume drinking or smoking may not appear to be such a bad idea (Sayette, 2004). Pavlov's research suggested the potential of cue exposure/response prevention therapy to extinguish previously conditioned appetites. Similarly, Poulos,

Hinson, and Siegel (1981) suggested that interventions would fare better if they altered their sterile environments to include the types of drug cues likely to elicit cravings. Initial studies found little support for the long-term efficacy of cue exposure therapy in addiction treatment outcomes, however, perhaps due to several methodological flaws in the designs of these studies (see Conklin & Tiffany, 2002). More recent research has focused on understanding the extinction process itself. These studies have generally shown a reduction in craving to smoke over multiple-cue exposure therapy sessions (e.g., Collins, Nair, & Komaroff, 2011; Unrod et al., 2014), suggesting the potential clinical efficacy of extinction-based treatments.

In addition to conditioning models, cognitive theories also may account for the utility of cue exposure treatment (e.g., Marlatt, 1985). Treatment should include helping patients prepare to refrain from smoking in the context of the often powerful cognitive shifts that occur outside the clinic. Craving induction treatments in which smoking is prevented may help patients learn to cope with temptations and better handle powerful craving-related changes in cognitive processing while they are experiencing them. Coping skills taught in the context of a craving manipulation may be especially effective (e.g., Monti et al., 1993). In addition to developing skills to deal with high-risk situations, patients also may enhance their self-efficacy that they will be able to cope, which also may prove important for preventing relapse (Wilson, 1987).

In summary, we have attempted to highlight in this chapter the importance of self-regulation in the context of addiction. By using cigarette smoking as a model, we have presented data to illustrate the multiple domains in which craving might contribute to self-regulation failure (e.g., underregulation, misregulation, acquiescence). Using a self-regulation framework, future work is indicated that promises to provide both conceptual and clinical advances in the understanding of drug craving.

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CHAPTER 32

The Role of Self-Regulation in Financial Well-Being

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The fact that consumers have struggled in recent years to regulate their spending to be able to save for important financial goals (e.g., retirement savings, children's education, health expenses or a nest egg) has been extensively documented both in the academic (Baumeister, 2002; Benartzi & Thaler, 2013) and the managerial literatures (Manning, 2000; McKinsey Global Institute, 2008). Evidence of this failure comes in the form of greater credit card debt, increasing delinquencies, and plummeting savings rates.

Financial decision making at the level of an individual or a household is challenging for several reasons. First, consumers make a series of *distributed decisions*—an aggregation of a large number of spending decisions, each of which might not seem consequential at the disaggregate but are potentially devastating at the aggregate (Herrnstein & Prelec, 1993). Second, the ultimate goal underlying financial management (be it retirement savings or children's education) is typically very distant. Given the temporal distance, the importance and relevance of the goal is often difficult to imagine. In the language of researchers in the multiple-self-paradigm of decision-making research (Hershfield, et al., 2011; Thaler & Shefrin, 1981; van Gelder, Hershfield, & Nordgren, 2013), saving for retirement requires the individual in the present, to empathize with his or her own future self many years from now. This empathy is inherently very low. Third, the advent of modern payment technologies such as electronic wallets and mobile payments makes it very easy for consumers to spend (Liu, Zhuo, Soman, & Zhao, 2012) in an era in which impulsive behaviors are facilitated by easy availability of products and ease of purchasing (Roberts, 2014). Fourth, there are inherent difficulties in determining normatively the right answers to questions such as how much one should save for retirement, the right trade-off between risk and return for investments, or the percentage of discretionary savings that should go toward education accounts. There is too great a level of uncertainty

(e.g., what constitutes a good retirement account depends on the cost of living index and inflation at that time) and heterogeneity in tastes and preferences (e.g., consumers may vary widely in terms of the consumption basket and the lifestyle they seek after retirement) to be able to determine the “right” amount.

Perhaps the most fundamental framework from psychology that helps us understand consumer spending and savings behavior is the theory of goal setting and goal pursuit (Bandura, 1988; Locke & Latham, 2002; Shah, Kruglanski, & Friedman, 2003; Vohs, Baumeister, & Tice, 2008). The theory of goal systems adopts a cognitive approach to motivation. Goal concepts are not only represented in this theory by knowledge structures, but they also possess distinctly motivational contents that determine their manner of functioning. Indeed, goal systems theory posits that the explicit or implicit goals are fundamental drivers of much of consumer behavior. In a separate stream of research in the judgment and decision-making tradition, researchers have shown that providing individuals with a specific, concrete, and measurable goal can improve their levels of motivation toward achieving a particular task (Heath, Larrick, & Wu, 1999). In the world of financial management, goals are, unsurprisingly, central to effective performance.

Our goal in this chapter is to (1) review relevant research in the domain of financial decision making, (2) understand this research in the context of a framework of self-regulation, and (3) review a list of corrective measures in the context of this framework that can improve self-regulation. We first provide a brief overview of the process of self-regulation and deconstruct the model onto specific processes. Next, we discuss each process in detail and review relevant literature that helps us better understand the process. Finally, we review research designed to help people make better financial decisions.

OVERVIEW OF SELF-REGULATION

Self-regulation is a term used to define a set of psychological and perceptual processes by which individuals work toward the achievement of goals and objectives by keeping them on track and minimizing distractions or impulses. The central framework that explains self-regulation in the field of psychology is the Carver–Scheier model (Carver & Scheier, 2001).

The self-regulation model can be understood by drawing an analogy with *speed governors*—devices that for decades have been used in fuel-based engines and power plants to keep the speed of the engine constant (e.g., a cruise control device on a car that keeps the speed constant). Consider, for example, a motor-driven lawn mower that has to navigate over a large tract of grass that varies in its thickness and resistance. If the motor received a constant supply of fuel, the lawn mower would get slowed down and lose its effectiveness on encountering a thick patch of grass. However, if a governor is installed on the motor, its system of gears can sense the increased load on the engine and hence increase the supply of fuel to the motor, so that speed and effectiveness are not compromised.

This simple example of a governor or cruise control serves as a good metaphor for self-regulation models. Note in particular the underlying processes of the mechanism. First, the operator of the lawn mower or a car needs to determine a target rate of operation (say, speed). Second, there needs to be in place a feedback mechanism that is able to detect deviations from this target. Third, when this deviation is noted, it should set off a

corrective action that changes performance by adding more resources. Finally, this feedback and correction loop has to be dynamic and keep the performance on track until the eventual goal has been achieved and the user has switched off the entire system.

The Carver–Scheier model—the psychological equivalent of the mechanical governor—is illustrated in Figure 32.1, in the broader context of the need for self-regulation.

We illustrate the model in the domain of financial decision making with a specific example. Consider the decision to save for retirement. For most individuals, this decision is not automatic and routine, but is often triggered by important life events such as marriage, the birth of children, or the death of elderly relatives. More generally, the need to save for the future and hence to self-regulate current consumption might be driven by empathy for the future self (Hershfield, et al., 2011). If the need for self-regulation is high, the individual will need to impose the proverbial governor on his or her spending.

Consider an individual who has decided to set aside \$1,000 each month toward retirement savings. In the language of the model, the \$1,000 is the *reference value* (see also Heath et al., 1999, who define goals as reference values). The actual amount that this person saves in a given month is referred to in the model as a *comparator*. Discrepancies between the comparator and the reference value trigger an action referred to as the *output function*. Imagine that the consumer saves only \$500 in a given month, resulting in a discrepancy of \$500. This discrepancy might generate specific action—for instance, a tightening down in discretionary spending in a subsequent month to compensate for the discrepancy. This has an effect on the environment and results in a revised input behavior; and the cycle of discrepancies and corrective actions continues repeatedly.

Note that this model of self-regulation assumes a static goal—if the reference value is too high, then this pattern of discrepancies and corrective action might never result in successful regulation. What happens when goals are dynamic and change with time? In relatively recent research, Wang and Mukhopadhyay (2012) propose an extension of the self-regulation model in which consumers can adjust goals over time through feedback achieved on the feasibility of the goal. Their model, called the TOTAL (test–operate–test–adjust–loop) model, still utilizes the same basic processes that the Carver–Scheier model uses.

The successful use of the self-regulation mechanism for spending is moderated by two important contextual variables. The first variable is the quality and measurability of the feedback. In a mechanical governor on a lawn mower, the feedback comes in the form of added load on the motor and consequently its reduced speed. Both of these are easy to measure. In the world of financial decision making, an individual needs to be able to monitor spending accurately and be able to determine the variance of spending levels with the reference value. As we discuss later, several factors may hinder this process, including poor memory for expenses using certain payment mechanisms (Liu et al., 2012; Soman, 2003), poor memory for small expenses (Gourville, 1998), not accounting in-process payments charged to credit cards (Soman, 2001), and mismatches between budgeting periods and credit card billing cycles (Soman & Lam, 2002). The presence of these factors could weaken the effectiveness of the self-regulation mechanism.

A second moderator of the effectiveness of self-regulation has to do with the degree of control that individuals have on potential corrective actions. For instance, imagine that an individual realized that he or she needs to curb consumption in certain product categories. However, in the era of easy payment mechanisms and direct billing of services, the individual is unable to actually take corrective actions. For example, the monthly Netflix

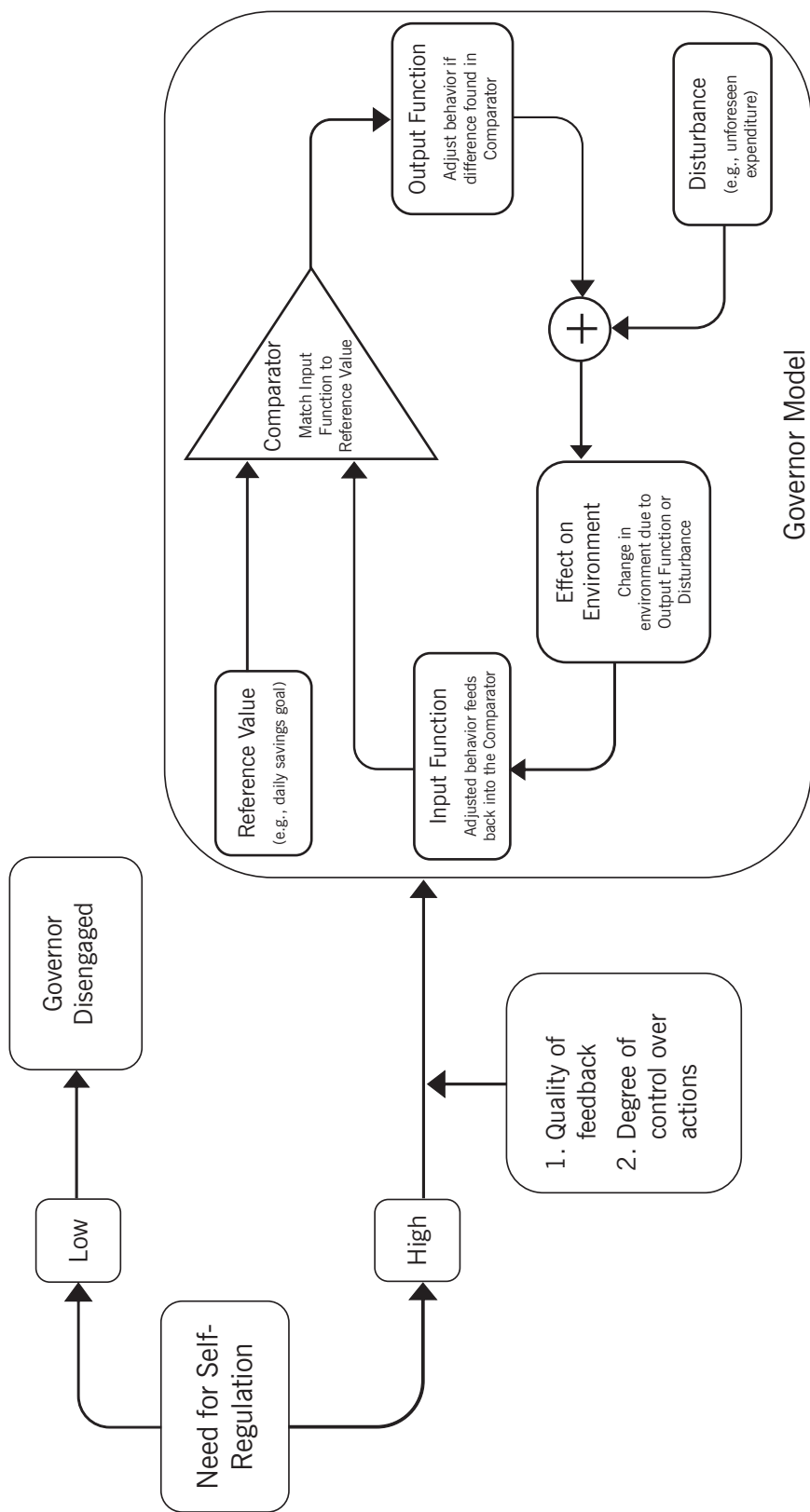


FIGURE 32.1. Self-regulation of financial decisions.

and other leisure memberships are automatically billed to his or her credit card or bank account, and the perceived effort required to reverse these arrangements might be large. In this case, the feedback loop will work, but it might not result in any specific action.

FUNDAMENTAL SELF-REGULATION PROCESSES

As is evident from the description of the self-regulation model, there are four fundamental processes that form the building blocks of self-regulation. These include goal pursuit, the development of a measurement (metering) system, actual monitoring and feedback mechanisms, and the triggering of corrective actions. We next describe each set of processes in the context of financial decisions and summarize some of the key research in these areas.

Goal Pursuit

Goal pursuit can be viewed as two distinct processes: (1) goal setting, which involves processes deliberating the goal and setting a specific target, and (2) goal striving, which is concerned with the methods or tactics by which the goal will be achieved. One popular model—the Rubicon model of goal pursuit (Heckhausen & Gollwitzer, 1987)—breaks down the entire process of goal pursuit into four distinct stages: (1) predecisional, (2) postdecisional, (3) actional, and (4) postactional. Self-regulation enters at the postdecisional stage, in which the goals have been formulated, and the individual is beginning to take actions that will determine the success of goal pursuit. At this point, the consumer moves from a deliberative mindset, in which he or she is considering the goal and deciding whether to commit to it, to an implemental mindset, in which he or she is looking at methods to accomplish the goal (Gollwitzer, Heckhausen, & Steller, 1990).

In the context of self-regulation, goal setting enables people to define an acceptable level of performance to which they need to adhere (Bandura, 1988; Latham & Locke, 1991). However, multiple goals associated with the same means have been found to result in dilution of the association between the means and the individual goals (Zhang, Fishbach, & Kruglanski, 2007).

Goals can range on two dimensions—their level of *achievability* (i.e., how easy or challenging the goal is) and their *specificity* (i.e., how concrete or abstract the goal statement is). An example of a concrete goal might be to “set aside \$1,000 every month in your savings account”; an example of an abstract goal might be to “maximize savings.”

Easy goals typically result in higher satisfaction but lower productivity, while very challenging goals can result in dissatisfaction and high productivity (Locke & Latham, 1990). Challenging goals also have the potential to create a “what the hell” effect (Cochran & Tesser, 1996; Soman & Cheema, 2004); this occurs when people violate one of their goals, which causes them to become demotivated and negative. As a consequence, their future performance suffers, with the result that they are worse off than people who had no goals.

When goals are challenging, the specificity of the goal moderates goal pursuit and hence eventual success (Latham & Locke, 1991; Mento, Locke, & Klein, 1992; Mossholder, 1980). When the goal is clearly defined, people work harder to reach it because there is an objective evaluation of success or failure. However, in the case of abstract

goals, the ambiguity involved in the evaluation of results allows people to give themselves the benefit of the doubt; consequently, they do not strive as hard as when the goal is specific (Latham & Locke, 1991).

In financial well-being, the challenges that interfere with goal achievement range from those of computation and comprehension to uncontrolled spending. While one end of this spectrum of problems can easily be remedied by the use of technology or engaging a financial planner, the other end of the spectrum involves the psychology of the consumer and behavioral changes that are not remedied so easily.

Once the goal is set, the next step is to implement the choices that will take the person toward the goal. With savings goals, the assumption is that once a savings goal is set, consumers will implement the right actions that lead them to attain their goals. Indeed, much research has shown that people who undersave would have liked to save more, and people who overspend on indulgences report that they had not planned to do so (Thaler & Benartzi, 2004). The fact that human behavior diverges from plans has often been referred to in the literature as the intention–implementation gap (Thaler & Shefrin, 1981), which can be explained through Thaler and Shefrin's dual-process model. This model conceptualizes individuals as an organization having two sets of agents; a *planner* who is concerned with lifetime utility, and a series of *doers* who exist only for one period. According to this model, the farsighted *planner* determines the long-term goal but is dependent on the *doers* to accomplish the goal. Conflicts exist because the *doers* are myopic (selfish and live in the present) and hence have no incentive to comply with the planner (also see Soman et al., 2005).

Measurement and Metering

The term *mental accounting* is used to describe a set of processes that individuals use to track, measure, and organize their expenses and receipts. In the broadest sense, mental accounting describes the cognitive processes that individuals and households use to track and manage expenses, to ensure they keep spending under control (Thaler, 1985, 1999).

Mental accounting can be best explained by considering the example of Mr. X, who buys a ticket to a cricket game. When investing in (or prepaying for) a particular endeavor, he creates a mental account for that endeavor and allocates the disutility of the payment to this account. This account will stay open until Mr. X has completed the endeavor and obtained some benefits (i.e., watched the game). The mental account can then be closed after being credited with the value of this benefit (Prelec & Loewenstein, 1998; Thaler, 1985, 1999).

One important ingredient of mental accounting is the manner in which the monetary outcome is evaluated using the value function from prospect theory (Kahneman & Tversky, 1979). A second ingredient involves the assignment of incomes, expenses and activities to specific accounts / categories (Heath & Soll, 1996; Shefrin & Thaler, 1988). A third ingredient relates to the scope and the life of each mental account (Read, Loewenstein, & Rabin, 1999). In particular, accounts can be defined narrowly (at the level of a single transaction) or more broadly (at the level of a spending category; Heath & Soll, 1996; Soman, 2001). In the case of Mr. X, the expense and consumption of the cricket game are narrowly framed in one account. More generally, expenses can be grouped and accounted for in different spending categories (e.g., food, entertainment, travel), and spending in each category could be governed by budgets. Likewise, funds could also be divided into categories (e.g., assets, current income), and funds from a

particular category might be considered to be relatively more appropriate for certain types of expenses (O'Curry, 2001). Finally, mental accounts can be defined with a fixed temporal life (e.g., monthly budgets, Heath & Soll, 1996), or can extend over a period of time (Gourville & Soman, 1998).

In the domain of self-regulation, the process of mental accounting can be used to explain the manner in which people set and use budgets (Heath & Soll, 1996). The first step in the process is the determination of appropriate spending categories (Henderson & Peterson, 1992) and the appropriate time horizon over which budgets are evaluated (typically on a monthly basis). Once the accounts are in place, individuals need to track and account for all of their expenses. Tracking expenses requires two processes. First, individuals need to notice the expense (booking), and second, they need to assign it to the appropriate category budget (posting) based on similarity (Heath & Soll, 1996).

Budgets serve as a self-control mechanism in a world in which we assume that booking and posting processes are perfect, and that an individual has the ability to keep a running total of the expenses in every category. Once a budget limit for a category has been reached, people typically stop consumption in that category. Note the parallels between this process and the speed governor on our lawn mower. In both cases, there is a reference value (a desired speed for the lawn mower and, here, the budget limit), ongoing feedback (through gears in the lawn mower and, here, through booking, posting, and tallying of expenses), and a discrepancy that triggers resulting action (changing the lawn mower's fuel supply and, here, stopping consumption).

Unsurprisingly, the strict use of the budgeting model leads to some inflexibility because it does not allow individuals to increase or decrease budgets at their whim. Although this is a good practice when people are attempting to control expenses in certain categories, it can also result in them missing out on opportunities to maximize satisfaction. Another interesting impact of budgeting on consumption is overconsumption or underconsumption in a certain category (Heath & Soll, 1996). Because budgets are set before consumption, there is rarely sufficient information to predict expenditure accurately. This results in people creating larger or smaller budgets than required, and because their budgets direct their expenditure in that category, they tend to overconsume (in the case of larger budgets) or underconsume (in the case of smaller than required budgets).

Actual Monitoring and Feedback Mechanisms

Note that the analogy of the budgeting model of financial self-regulation to the speed governor on the lawn mower is dependent on the booking, posting, and tallying processes being perfect. However, much behavioral research shows that this is not the case.

In research on the effects of payment mechanisms on spending behavior, Soman argues that the cognitive demands imposed by the Heath and Soll (1996) model are high. Soman (2001) proposed an alternative to their prospective accounting method—retrospective accounting. Rather than relying on a “surplus budget” measurement in a given category as an input into a purchase decision, Soman believes that an individual contemplating a purchase is more likely to ask, “Have I spent a lot on items like this one in the recent past?” If the response is “yes,” the individual might decide to not purchase; if it is “no,” he or she will purchase. This process implies that the cognitive processes of categorizing, determining the evaluation period, booking, posting, and tallying are all done retrospectively rather than *a priori*. This brings processes relating to memory, salience, and motivation into account.

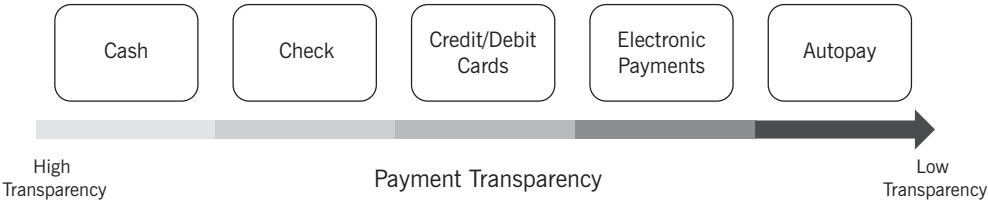


FIGURE 32.2. Payment mechanisms and their relative transparency levels to the consumer.

As a concrete example, small day-to-day expenses are less likely to be remembered than larger, big-ticket items after a temporal delay. Likewise, the payment mechanism used to make a purchase also has an impact on the memory and hence the likelihood of an additional expense. Until some years ago, using checks and cash were the norm, and this made expenses salient because people rehearsed the payment amount while writing out a check or counting out money (Soman, 2003). However, in today’s predominantly cashless society, people use cards, electronic payments, or autopay for their transactions, none of which provide them with immediate feedback or constraints (other than the credit limit) that make the expense salient. This causes reduced transparency in such transactions and results in increased consumption (Soman, 2003).

The payment transparency spectrum, as illustrated in Figure 32.2, shows the changing levels of transaction salience as we move from cash to autopay payment methods. The more transparent a payment mechanism, the more likely it will be remembered in the future.

Corrective Actions

How can individuals better self-regulate their finances? As our conceptual development indicates, two sets of interventions help people better self-regulate their spending. First, interventions that increase the need for self-regulation increase the likelihood that the “money governor” is employed in the first place. Second, conditional on the need for self-regulation, interventions that (1) amplify the impact of a savings goal, (2) highlight goal progress, (3) improve metering and monitoring, (4) highlight the discrepancy between reference value and actual performance, and (5) make corrective action easy, allow the individual to exert better self-regulation.

INTERVENTIONS TO FACILITATE CORRECTIVE ACTIONS

We review below a number of findings from recent research that provide examples of interventions and techniques that generate better financial outcomes through the avenues of enhancing the need for self-regulation and enhancing the effectiveness of the self-regulation apparatus.

Using Image Rendering to Increase Empathy

Individuals may fail to activate their need for self-regulation and attain their retirement goals because they cannot relate to their future selves (Hershfield et al., 2011). Very often,

more urgent financial goals (e.g., saving for a vacation or children's education) compete with retirement savings goals. Compared to saving for retirement, individuals can imagine how these more timely goals benefit their current or near-present circumstances. Not being able to relate to their future selves reduces motivation to save for retirement and allows other financial goals to take priority. In their research, Hershfield and colleagues (2011) found that people allocated more money toward their retirement savings when they are presented with age-progressed photographs of themselves. Presenting participants with photo renderings of their older selves helps them imagine what their future self would be like, thus changing their reference value. This allows them to overcome their present bias when faced with a disturbance, and make decisions that would benefit their future self.

Setting Fewer Goals

Individuals usually have multiple savings goals that require attention and action. Because it is not always possible to work toward all these goals simultaneously, they end up prioritizing some goals over others. In some cases, they also find that these financial goals are conflicting in nature, so that they may have to decide, for example, between saving for retirement and their child's education. The problem with such a situation is that in their desire to balance such conflicting goals, they may end up in a deliberative mindset, which could prevent them from deploying effort to implement these goals. Presenting individuals with one goal rather than many goals makes them more likely to move from a deliberative mindset to an implemental mindset (Soman & Zhao, 2011).

Looking at this from the perspective of the Carver–Scheier model, we can see that ensuring that a person has fewer goals to work toward provides more efficiency for the feedback loop. The smaller number of goals allow for easy tracking of goal achievement and deviations, without challenging cognitive resources that would have been spread too thin.

Having Visual Reminders of Goals

A large body of research indicates that having salient and vivid goals facilitates goal striving. Visual reminders that induce guilt about consumption of savings can help reduce such instances and increase goal achievement. As a specific example, Soman and Cheema (2011) found that participants were less likely to open envelopes of money if a picture of the participant's children was printed on a paper envelope in which the earmarked savings were kept. Placing a picture of the participant's children served as a visual reminder of what the money was intended for, as well as the consequences of spending the money (i.e., less money for the children) on unrelated items.

Peer Effects

Field experiments (Kast, Meier, & Pomeranz, 2012) indicate that participating in self-help groups can improve savings rates. In these experiments, individuals meet on a weekly basis to report on their savings progress, hear about the progress of their peers, and have the opportunity to share useful financial information. To isolate the mechanisms behind the improved savings rates, experiments were conducted using text messages that simply reminded participants of their progress and the progress of their peers. These text

message experiments pointed out that regular feedback on one's progress, as well as peer comparisons, helped improve goal attainment.

However, peer comparisons may not always be helpful. A particular field study, (Beshears, Choi, Laibson, Madrian, & Milkman, 2015) found that upward social comparisons can discourage low-income individuals from participating in retirement savings programs. Knowing that their higher-earning peers are saving more than themselves actually highlights their relative income status and could demotivate individuals from saving. However, peer comparisons can be beneficial for individuals with similar income levels because they provide two levels of comparison in the Comparator—(1) against their own reference value and (2) against their peers—thus motivating individuals to avoid negative deviations from their goals.

Sending Goal Reminders

One of the main hurdles to cross while budgeting and saving is to ensure that the goal is salient. Individuals often forget to contribute to their savings goals because they are pre-occupied with completing other tasks, or they spend their money before they remember to set aside the amount they intended to save. Sending reminders helps to make saving foremost in the mind (Karlán, McConnell, Mullainathan, & Zinman, 2010) and have been shown to be effective in helping individuals attain their goals.

Labeling and Partitioning

Labeling and partitioning of money is another way to provide individuals with concrete goals and reference values. When money is labeled or partitioned, individuals have visual cues, as well as mental accounts associated with each of them, thus allowing them to use the feedback loop effectively and stay on course.

The behavioral life-cycle (BLC) model (Shefrin & Thaler, 1988) shows that labels affect the use of resources, thus violating the economic concept of money being fungible. According to the BLC model, funds are more likely to be saved if they are transferred to mental accounts that are less tempting. There is greater temptation to spend from some accounts than from others, and there exists a hierarchy among such accounts: Cash and checking accounts are most tempting, followed by liquid asset accounts (e.g., savings accounts), then home equity accounts, and finally, the least tempting of all, future income (e.g., retirement savings).

Labeling money reduces the temptation to use that particular amount on unrelated purchases (Heath & Soll, 1996), as does physically partitioning money (Cheema & Soman, 2008). Labeling ("earmarking") money by separating it into envelopes also helped significantly to increase savings among construction labourers in India (Soman & Cheema, 2011). In their study, Cheema and Soman (2008) used envelopes to physically partition money and found that less money was spent when money was physically partitioned. Partitioning reduced the temptation to overspend by creating decision points. Individuals were forced to contemplate whether their actions moved them toward their goal or caused them to deviate from it. This is similar to a reference that Zelizer (1997) makes about "tin-can" accounting, in which household members separate cash into multiple tin cans, and label them for different uses.

An extension of labeling is the process of budgeting, by which the money set aside for various accounts is tracked.

Preventing Imperfect Recall

Until recently, the primary use of cash for transactions gave people the opportunity to keep a track of the money they had in their wallets, and to plan their expenses accordingly. With the proliferation of cashless forms of payment, people have been found to have much lower recall ability for transactions they just completed when they used credit cards compared to cash (Soman, 2001). This imperfect recall of expenditures naturally has some very serious consequences in our current cashless society.

To help people avoid the pitfall of spending without being aware of their expenditure levels, Poddar, Ellis, and Ozcan (2015) made the expenditure more salient by reminding people of their monthly spending and their total current debt on the card, and printing this information on the payment slip received at the end of the transaction. This resulted in a significant reduction in overall spending when compared to the status quo.

Overcoming the Intention–Implementation Gap

The intention–implementation gap can be overcome through different types of interventions. In the Thaler and Shefrin (1981) model, if the *planner* uses a precommitment strategy to circumvent the *doer's* decision choices, the organization (person) will be able to reach the end goal successfully. For example, a person trying to save money for retirement can choose to have a certain amount deducted from his or her salary, before the person even sees it in his or her bank account. In this way, the person is not tempted to use that money in the present, for an impulsive or unforeseen expense, thus circumventing the *doer* in him- or herself, and allowing the farsighted *planner* to achieve the goals the person has set for him- or herself.

Automatic Enrollment

In the United States, many firms are moving away from providing pension plans and are implementing defined contribution retirement savings plan instead. While this shift gives employees more control over how much they want to save for retirement, it has led to a decrease in retirement savings rates (Benartzi & Thaler, 2013).

In the setup stage of defined contribution retirement savings plans, each employee has to put in some effort, and make a few decisions: (1) Sign up for the program; (2) choose his or her own savings rate; and (3) decide on his or her investment mix. In order to complete this successfully, individuals need to determine how the program fits with their overall retirement savings goals, as well as their savings goals within the contribution program. Because this involves multiple, complex decisions, inertia usually comes into the picture, and it may leave individuals in a deliberative mindset. As a result, the default behavior for many individuals is not to participate in defined contribution retirement savings plans.

Automatically enrolling individuals into a retirement savings plan has been shown to significantly increase participation rates (Choi, Laibson, & Madrian, 2004; Madrian & Shea, 2000). And once enrolled, individuals tend to remain in the program. With automatic enrollment, less deliberation and self-regulation is required from the individual because a default contribution rate has been chosen for him or her, and savings amounts are automatically deducted from the individual's regular paycheck.

While the setting of a goal has its advantages, the process of arriving at what the goal should be is often cognitively exhausting. Autoenrollment and defaults help to

create reference values and set goals, which makes planning and goal achievement less effortful.

Adjusting Behavior Using Precommitment

The downside of automatic enrollment is that savers tend to stick with the default contribution rate, which is typically set to a very low rate (Madrian & Shea, 2000). Savers who stick to the default rate typically do not save as much money as those who actively choose a higher contribution rate. Thus, saving behavior still needs to be adjusted to ensure that financial goals are being met. The Save More Tomorrow program (Thaler & Benartzi, 2004) uses a precommitment strategy to increase savings rates by letting individuals precommit to increasing their saving rates whenever they receive a salary increase. This circumvents the dilemma between the farsighted planners, who know they should save more when their salary rises, and the myopic doers, who may not act because of inertia.

Precommitment strategies help individuals protect their savings from disturbances: Once the money is committed to a goal, it gets tagged under a certain mental account, and becomes less tempting to access in the case of a disturbance. This also allows individuals to skip the constant self-monitoring that is required by the feedback loop, allowing them to achieve their goals in a less stressful manner.

CONCLUSION

In this chapter, we have looked at why people find it so difficult to maintain their finances in the black, and the different models that could play a role in helping them overcome their myopia. As is evident from the literature on which we have elaborated, self-regulation has a very important role to play in helping people maintain financial prudence. While there are multiple techniques that can help people circumvent temptation and achieve their financial goals, these techniques are usually applicable only to some areas of financial planning. While techniques such as autoenrollment, precommitment, and viewing photos of their older selves help people avoid their present bias and invest for the future, other techniques, such as making expenses salient, and labeling, help prevent people from over-consuming or eating into other budgets when they do not have to do so.

When we look at transactions that occur on a daily basis, it is mostly self-regulation that is key to ensuring that people manage their finances and keep their long-term interests in mind. One of the advantages of the Carver–Scheier self-regulation model is that it can be easily adapted to different aspects of planning and budgeting. In the case of budgeting, the model can be used to (1) set actionable financial goals that are specific and challenging, so that people can work toward definitive outcomes; (2) create budgets to work with, so that it is less easy to deviate from goals; (3) regularly post transactions to ensure that “depletion” of the account will restrict impulse purchases; and (4) adjust future actions based on feedback from earlier transactions.

We also looked at how different goal strategies affect how people set financial targets for themselves, and how the number of goals can change their mindsets and their ability to achieve their targets. An interesting aspect in all this is the role that technology is playing and will continue to play in the future. Whether it is creating default savings rules, making goals more salient, getting people to compete with their peers, or even just

receiving a reminder to make a payment, technology can make self-regulation easier, which in turn can ensure higher levels of compliance toward goals to which people commit and higher levels of goal achievement.

The use of a self-regulation framework is particularly useful to applied researchers and scientists who are interested in developing interventions to help people better manage their finances. Its utility lies in providing them with specific mechanisms whose effectiveness can be improved through suitable behavioral interventions!

ACKNOWLEDGMENT

The support of an Insight Grant from the Social Sciences and Humanities Research Council of Canada to Dilip Soman is gratefully acknowledged.

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Author Index

- Aarts, H., 89, 155, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 226, 227, 233, 266, 313, 431
Aase, H., 498
Abar, B., 311, 315
Abbott, A., 136
Abramson, L. Y., 157
Acebo, C., 188
Achtziger, A., 88, 225, 226, 230, 233, 234, 551, 560
Ackerly, S., 114
Ackerman, J. M., 118
Adam, H., 389
Adams, E. E., 468
Adams, G. S., 450
Adams, L. M., 383
Adler, T., 387
Adriaanse, M. A., 47, 86, 101, 224, 228, 229, 230, 231, 233, 234, 449, 562, 563
Affleck, G., 133
Aggarwal, P., 151
Agnew, C. R., 250, 287
Agrawal, N., 51, 152, 153, 157
Ahadi, S. A., 14, 15, 423, 463
Aichert, D. S., 349
Ainslie, G., 146, 150, 154, 347, 499, 542, 554
Ainsworth, M. D. S., 298
Ainsworth, S. E., 45
Ajzen, I., 223, 549
Akehurst, S., 390
Akerlof, G. A., 388
Akers, K. G., 428, 525
Akers, R. L., 397, 522
Aksan, N., 462, 463, 465, 467, 468
Alarid, L. F., 518
Albarracin, D., 557
Albayrak, Y., 17
Albert, D., 363, 460
Alberts, H. J. E. M., 51, 85, 327
Aldao, A., 24, 30, 32, 34
Aldenkamp, A., 187
Aldwin, C. M., 307, 315
Alexopoulos, G. S., 483
Alganem, S., 230
Allen, N. B., 31, 469
Allen, T. J., 64, 67, 68
Allessandri, S. M., 13
Allman, J. M., 236, 242, 422
Allport, G. W., 311
Allsopp, J. F., 348, 406
Alexander, J. K., 420
Alexander, K., 490
Alexander, M. B., 171, 307
Alexander, M. P., 114
Alm, P. A., 136
Alony, R., 156
Alper, C. M., 365
Altena, E., 186
Altman, M., 84, 122
Aluja, A., 355
Ambady, N., 151, 388, 488
Amir, O., 44
Amireault, S., 224
Amit, E., 158
Amodio, D. M., 118, 228
An, X., 115
Andersen, S. M., 232
Anderson, C. L., 370
Anderson, J. R., 539
Anderson, R. A., 172
Andrade, J., 77, 78, 84, 581
Anestis, M. D., 390
Ang, R. P., 497
Anstiss, V., 85
Antonaccio, O., 520
Apfel, N., 448
Apfelbaum, E. P., 168, 488, 489
Appleyard, K., 259
Arden, M. A., 230, 231, 448

- Argo, J. J., 317
 Ariely, D., 45, 49, 168, 453
 Arkes, H. R., 538
 Arkin, R., M., 206
 Armeli, S., 32
 Armitage, C. J., 95, 96, 104, 208, 230, 231, 233, 234, 448
 Armor, D. A., 548
 Arndt, S., 520
 Arneklev, B. J., 49, 397, 516, 518, 524
 Arnoux, A., 309
 Arnsten, A. F. T., 357, 419, 420, 421
 Aron, A. R., 114, 303
 Aronson, J., 86, 395
 Arvey, R. W., 324
 Aschersleben, G., 205
 Ashburn-Nardo, L., 64
 Ashforth, B. E., 324, 325, 329
 Ashkanasy, N., 328
 Ashton, M. C., 358
 Aslin, R. N., 535
 Aspinwall, L. G., 13, 448
 Atencio, D. J., 504
 Atkinson, J. W., 11, 211, 550, 551
 Attwood, A. S., 578
 Audia, P. G., 558
 Auerbach, S. M., 33
 Austin, J. T., 35, 207
 Axelrod, S. R., 48
 Avila, C., 348, 349
 Avni-Babad, D., 104
 Ayduk, Ö., 136, 285, 408, 534

 Badagaiyan, R. D., 212
 Baddeley, A. D., 43, 65, 77, 79, 184, 500, 501, 504
 Bader, C. D., 306
 Baer, R. A., 85
 Baeyens, D., 497
 Bagby, R. M., 346, 406
 Baggott, M. J., 348
 Bahn, S., 371
 Bailey, P. E., 486, 489
 Baird, B., 550
 Baker, E., 266
 Baker, M. D., 46
 Baker, N., 85
 Baker, S. L., 449
 Baker, T. B., 120, 573, 577, 579, 581, 582
 Bakker, A. B., 99, 398
 Balabanis, M., 575, 576
 Baldwin, A. S., 576
 Baldwin, M. W., 317
 Balkin, T. J., 189, 191
 Balcetis, E., 211, 224
 Ball, L. J., 558
 Balleine, B. W., 97, 209
 Balliet, D., 250, 252, 256, 259
 Balota, D. A., 184, 351
 Banaji, M. R., 69, 85
 Bandura, A., 213, 223, 238, 270, 305, 313, 444, 548, 549, 550, 579, 592, 595
 Banker, S., 45
 Banks, J. B., 252
 Barabási, A.-L., 536, 539
 Baranski, J. V., 188
 Barbas, H., 113
 Barber, L. K., 398
 Barceló, F., 115
 Barch, D. M., 29, 116
 Barger, P. B., 327
 Bargh, J. A., 20, 22, 31, 63, 64, 159, 204, 205, 206, 207, 210, 211, 212, 214, 266, 285, 341, 373, 423, 431, 553, 568, 570
 Barkley, R. A., 234, 305, 497, 498, 499, 500, 502, 503, 504, 505, 506, 510
 Barlow, D. H., 34
 Barnard, C. J., 138
 Barndollar, K., 206
 Barnes, C. M., 188, 190, 191, 326, 328
 Barnes, R. D., 85
 Baron, E., 49
 Baron-Cohen, S., 486
 Bar-On, R., 114
 Barratt, E. S., 348, 406
 Barrett, L. F., 33, 249, 294
 Barron, K. E., 387
 Barry, R. A., 465, 469
 Barsalou, L. W., 204, 207, 208
 Bartholow, B. D., 70, 166
 Bartone, P. T., 382
 Batchelder, W. H., 66
 Bateman, T. S., 390
 Bates, J. E., 458, 460, 461
 Bateson, M., 317
 Batty, G. D., 42
 Bauer, I. M., 308, 508, 509, 548
 Baulac, M., 116
 Baumann, N., 25, 33
 Baumeister, R. F., 8, 16, 24, 31, 32, 33, 35, 42, 43, 44, 45, 46, 47, 48, 50, 51, 52, 53, 54, 55, 62, 70, 76, 77, 80, 81, 82, 83, 86, 87, 88, 89, 98, 99, 101, 102, 119, 120, 121, 140, 153, 156, 160, 165, 166, 167, 168, 169, 170, 171, 172, 174, 175, 177, 183, 184, 188, 189, 193, 194, 203, 204, 212, 236, 251, 254, 256, 257, 258, 266, 273, 278, 305, 307, 308, 311, 317, 326, 355, 384, 398, 401, 409, 431, 443, 445, 508, 509, 517, 519, 522, 541, 542, 548, 551, 556, 557, 560, 571, 572, 573, 575, 576, 577, 580, 582, 583, 591, 592
 Baxter, E., 404
 Bayer, U. C., 225, 226, 227, 229, 233
 Baynes, K., 481
 Bazerman, M. H., 154, 173, 228
 Bdzola, L., 191
 Beach, S. R. H., 13
 Beal, D. J., 327
 Beal, S. J., 382, 464
 Beardslee, W. R., 467
 Beauregard, M., 29, 119
 Beaver, K. M., 49, 516, 525
 Bechara, A., 114, 119
 Beck, D. M., 424
 Beck, J. E., 462
 Becker, K., 497
 Beckes, L., 259
 Beckmann, J., 52, 409
 Bedny, M., 114
 Beedie, C. J., 139, 194
 Beer, J. S., 113, 114, 487
 Beer, R. D., 4

- Beggan, J. K., 310
 Behnke, J. M., 138
 Behrens, B. C., 288
 Beilock, S. L., 156
 Bélanger, J. J., 211, 224
 Belanger-Gravel, A., 224
 Belayachi, S., 213
 Belding, J. N., 152
 Belenky, G., 186
 Bell, B., 466
 Bell, D., 372
 Bell, S., 485
 Bellavia, G., 249, 287
 Belliston, L. M., 516
 Belsky, J., 465, 466, 468, 470
 Bem, D. J., 103, 275
 Benartzi, S., 591, 596, 601, 602
 Benga, O., 464
 Benning, S. D., 349, 371
 Benson, D., 114
 Benson, D. F., 114
 Benson, M. L., 49, 516, 523
 Benton, D., 139
 Benvenuto, M., 33
 Bereby-Meyer, Y., 174
 Bergin, A. E., 311
 Bergman, H. E., 231
 Bering, J. M., 317
 Berk, L. E., 497, 501, 504
 Berking, M., 34
 Berkman, E. T., 77, 85, 86, 89, 211, 441, 443, 447, 450, 453, 454
 Berlin, L., 466
 Berlow, R., 136
 Bernecker, K., 173, 225
 Bernell, S., 103
 Berns, G. S., 119
 Berman, M. G., 184
 Berntson, G. G., 8, 25, 134
 Bernzweig, J., 462
 Berridge, K. C., 79, 578, 205
 Berstein, H., 383
 Bertram, B. C., 264
 Bertrams, A., 44, 47, 98, 446
 Beshears, J., 600
 Bessenoff, G. R., 65
 Bettman, J. R., 151
 Beversdorf, D. Q., 420
 Biçaksiz, P., 332
 Bieleke, M., 226
 Biernat, M., 6
 Bigelow, G. E., 449
 Bijl, R. V., 368
 Bijttebier, P., 372
 Bilsky, W., 5
 Binder, J., 121
 Birch, D., 11, 211
 Bishop, S. R., 575
 Bjork, J. M., 348
 Black, J., 579
 Blagov, P., 31
 Blair, B. L., 465
 Blair, C., 418, 419, 420, 422, 423, 425, 426, 428, 429, 430, 432
 Blair, C. B., 460
 Blair, E. S., 206
 Blairy, S., 27
 Blake, A., 316
 Blakemore, S.-J., 209, 213
 Blanchard, D. C., 141
 Blanchard, R. J., 141
 Blanchard, T. C., 541, 542
 Blanchard-Fields, F., 372, 480, 488
 Blandon, A. Y., 469
 Blascovich, J., 318, 373, 541
 Blaszczyński, A., 49
 Blehar, M. C., 298
 Block, J., 346, 408
 Block, J. H., 408
 Blumberg, S. J., 550
 Blumer, C., 538
 Blumer, D., 114
 Blumstein, A., 515
 Boakes, R. A., 209
 Boals, A., 33, 252
 Bobo, J. K., 577
 Bobo, L., 480
 Bodenhausen, G. V., 62, 306
 Bodrova, E., 429
 Boesiger, P., 121
 Bogg, T., 349
 Boggero, I. A., 138
 Bohlin, G., 254, 466
 Bohner, G., 10
 Bohns, V. K., 276
 Boies, S. J., 184, 186
 Boiten, F. A., 33
 Boksem, M. A. S., 449
 Boldt, L. J., 465
 Boles, R. E., 103
 Bolger, N., 133
 Bonanno, G. A., 30, 32, 34, 336
 Bono, J. E., 324, 327, 335
 Boone, A. L., 42, 251, 273, 307, 355, 398, 560
 Boone, C., 397
 Booth, L., 419
 Booth, R. J., 553
 Boothby, E. J., 423
 Boswell, R. G., 84, 119, 122
 Botchkovar, E. V., 519, 520, 525
 Botvinick, M. M., 29, 30, 116, 118, 171, 172, 173, 194, 421, 452
 Bouchard, T. J., 308
 Boucher, H. C., 52
 Bouffard, J. A., 517, 521, 397
 Bourgouin, P., 29, 119
 Boutelle, K., 136
 Bovbjerg, D. H., 577
 Bowen, S., 575
 Bowlby, J., 248, 258, 294
 Boyce, W. T., 427
 Bozinovic, F., 264
 Bradbury, T. N., 289
 Bradley, B., 258
 Bradley, B. P., 485
 Bradley, M. M., 8
 Bradvik, B., 500
 Brainerd, C. J., 148
 Brame, R., 516
 Brandon, T. H., 48, 172, 577, 579

- Brandstätter, V., 226, 234, 449
 Brandt, M. J., 80
 Brandtman, M., 497
 Branigan, C., 365
 Bratslavsky, E., 28, 32, 42, 76, 120, 153, 166, 193, 251, 278, 326, 541, 572
 Brauburger, A., 329
 Braungart, J. M., 421
 Braungart-Rieker, J. M., 462
 Braver, T. S., 29, 116, 452
 Bray, S. R., 53, 446
 Brehm, J. W., 13, 554
 Breiner, M. J., 575
 Breland, J. W., 325
 Breiter, H. C., 119
 Brewer, J. A., 135
 Brewer, M. B., 118
 Brice, W. N., 325
 Brickner, R. M., 114
 Bridge, M. W., 139
 Bridgett, D. J., 461, 462, 469, 470
 Brinkmann, B., 557, 561
 Brinkworth, G., 85
 Brion, S. L., 308
 Brockner, J., 225
 Brody, A. L., 119
 Brody, G. H., 466
 Broidy, L., 519
 Bronk, K., 383
 Broos, N., 348
 Brosschot, J. F., 367
 Brotman, L. M., 460
 Brower, A. M., 558
 Brown, C., 259
 Brown, D. L., 189
 Brown, G. W., 13
 Brown, J., 574
 Brown, J. D., 214
 Brown, K. W., 31
 Brown, M., 136
 Brownell, K. D., 573, 575, 583
 Brozek, J., 193
 Brunstein, J. C., 277
 Bruyneel, S. D., 45, 51, 153, 172
 Bryan, C. J., 450
 Bryson, S. E., 432
 Brzustoski, P., 448
 Buchl, S., 383
 Buckholtz, J. W., 353
 Buckland, N., 231
 Buckmaster, C. L., 428
 Buckner, J. C., 467
 Buechel, E. C., 549
 Buehler, R., 157
 Bulik, C. M., 85
 Bunge, S. A., 117
 Burchinal, M., 429
 Burgess, P. W., 115, 227, 419
 Burgin, C. J., 140
 Burke, D., 213
 Burke, T. A., 372
 Burkley, E., 169
 Burnette, J. L., 252
 Burns, D. J., 499
 Burns, K. C., 53
 Burrow, A., 383
 Bursik, R. J., Jr., 49, 397, 516, 518
 Burt, C. H., 518, 519
 Burt, N. M., 469
 Burt, R., 248
 Burton, C. L., 32, 34
 Burton, S. M., 577
 Burton, V. S., 49, 516, 523
 Busatta, P. D., 558
 Bush, G., 422
 Bushman, B. J., 554
 Buss, A. H., 306
 Buss, A. T., 424, 425
 Butler, E. A., 135
 Butz, D. A., 54, 445
 Buunk, B. P., 195
 Buxton, O., 133
 Buyukcan-Tetik, A., 254, 255, 257
 Byrne, R., 547
 Cabanac, M., 449
 Cachia, J. Y. A., 230, 563
 Cacioppo, J. T., 8, 25, 134, 373, 560
 Cadoret, R. J., 520
 Cahn, B. R., 32, 311
 Calanchini, J., 63, 70
 Calder, A. J., 485
 Caldji, C., 427
 Caldwell, J. A., 189
 Caldwell, J. L., 189
 Calkins, S. D., 462, 465, 466, 468, 469
 Callan, M. J., 313
 Callicott, J. H., 422
 Camerer, C. F., 113, 173
 Campbell, A. F., 429
 Campbell, A. M., 420, 421
 Campbell, F., 430
 Campbell, F. A., 429
 Campbell, L., 287
 Campbell, W. K., 31, 252, 256, 257, 285
 Canli, T., 356
 Cannon, D. S., 120
 Cannon, W. B., 4, 554
 Cantor, N., 203, 558
 Cantril, H., 149, 158
 Caprara, G. V., 464
 Caprariello, P. A., 274
 Carden, L., 105
 Carelli, R. M., 119
 Carey, M., 579
 Carlo, G., 464
 Carlson, C. R., 136
 Carlson, L.,
 Carlson, R. A., 5
 Carlson, S. M., 384, 424, 460
 Carlton, E. D., 137
 Carmichael, S. T., 113, 115
 Carmon, Z., 453
 Carnevale, J. J., 150, 154, 158
 Carnevale, P. J., 159, 228
 Carpenter, M., 206, 248
 Carpenter, P. A., 422
 Carr, T. H., 156
 Carrier, J., 188
 Carskadon, M. A., 185, 188

- Carstensen, L. L., 372, 480, 487, 488
 Carter, B. L., 580, 581
 Carter, C., 29
 Carter, C. S., 116, 421, 422
 Carter, E. C., 99, 168, 306, 307, 308, 315, 316, 317
 Carter, K. L., 311
 Carton, J. S., 485
 Carvalho, L. B. C., 187, 188
 Casey, B. J., 16, 117, 119, 397, 497, 498, 543
 Casey, L., 49
 Caspi, A., 524, 465, 465, 466
 Cassoff, J., 188, 189
 Castañeda, J. O., 133
 Castellanos, X., 498
 Caves, C. M., 539
 Caykoylu, A., 17
 Cervone, D., 579
 Chabay, L. A., 504
 Chaiken, S., 31
 Chalmers, J. A., 136
 Chambers, C. D., 115
 Chambers, E. S., 139, 140
 Chambers, R., 31
 Chambers, R. A., 356
 Chamlin, M. B., 517
 Champagne, D. L., 427
 Chan, K. Q., 315
 Chandler, M. P., 134
 Chang, A. E., 116
 Chang, L., 355, 468
 Chang, M. H., 152
 Chapelle, C., 27
 Chapman, J., 233
 Chapple, C. L., 48
 Charak, D., 418
 Charnov, E. L., 541
 Charles, S. T., 487
 Chartrand, T. L., 206
 Chase, H. W., 97
 Chasteen, A., 153
 Chatzisarantis, N. L. D., 43, 76, 99, 121, 140, 167, 172, 194, 446
 Cheavens, J. S., 365
 Chee, M. W. L., 185, 186, 191
 Cheema, A., 595, 599, 600
 Chen, C. C., 420
 Chen, E., 425
 Chen, M., 31, 205
 Chen, M. J.
 Chen, S., 206, 191
 Chen, S. H., 423, 458
 Chen, X., 211
 Chen, X. J., 224, 225
 Cheng, C. M., 70
 Cheng, K., 47, 54, 89, 258, 446, 447
 Cheng, Y., 572
 Chernyshenko, O. S., 352
 Chester, D. S., 120
 Chi, N.-W., 324, 325
 Chiang, A., 100
 Chiao, J., 364
 Chicoine, E., 235
 Childress, A. R., 119
 Chiou, W. B., 152
 Chiu, C., 29
 Choate, M. L., 34
 Choe, D. E., 465, 466, 469, 470
 Choi, J. J., 600, 601
 Christakis, N. A., 265, 266
 Christian, J., 234
 Christian, M. S., 188, 189
 Christensen, A., 288, 289, 290
 Christensen, L., 120
 Christiansen, P., 47, 578
 Christiansen, S., 564
 Christianson, R., 84
 Christou-Champi, S., 33, 34
 Chua, S. N., 557
 Chuah, L., 191
 Chuah, Y. M., 186
 Chung, C. K., 33, 553
 Churchill, S., 231, 234
 Gian, C., 188
 Ciarocco, N. J., 43, 62, 120, 266
 Cicchetti, D., 467
 Ciciolla, L., 308
 Cirelli, C., 185
 Clark, C., 505
 Clark, M., 365
 Clark, M. S., 287, 299
 Clark, R. A., 550
 Clark, R. N., 7
 Clarke, D., 17
 Clarke, D. D., 139
 Clarke, R. V., 518
 Clarkson, J. J., 171, 174, 177, 307
 Cleeremans, A., 203
 Cleveland, H. H., 520
 Cloninger, C. R., 370, 407
 Clore, G., 365
 Clore, G. C., 5
 Clough, P. J., 191
 Cloutier, J., 119
 Coan, J. A., 259, 264
 Cochran, J. K., 517, 518, 523
 Cochran, W., 157, 595
 Coenen, L. H. M., 33
 Cohan, C. L., 289
 Cohen, A. B., 305
 Cohen, A.-L., 227, 229
 Cohen, F., 132, 141
 Cohen, G. L., 266, 448, 452
 Cohen, J., 29, 515
 Cohen, J. D., 29, 112, 114, 116, 173, 176, 210, 353, 419, 420, 421, 422
 Cohen, J. N., 365
 Cohen, J. R., 114, 167
 Cohen, R. A., 116
 Cohn, J. F., 581
 Cohn, M. A., 367
 Coffey, K. A., 367
 Coifman, K., 30, 336
 Colazato, L. S., 316
 Colcombe, S., 365
 Colder, C., 465
 Cole, J. C., 47
 Cole, S., 224
 Coleman, K. J., 103
 Coles, M. G., 170
 Collins, A., 5

- Collins, B. N., 584
 Collins, J. C., 13
 Collins, N. L., 249, 257, 274, 287, 294
 Collins, P. F., 346, 352, 356, 357
 Collins, R. L., 47, 99, 576
 Collins, W. A., 298
 Colvin, M. K., 114
 Colvin, P., 84
 Combs, J. L., 354
 Compas, B. E., 459
 Congdon, E., 356
 Conger, J., 573
 Conklin, C. A., 572, 584
 Connell, J. P., 430
 Connelly, B. S., 355
 Conner, T., 33, 208
 Connor-Smith, J. K., 459
 Conrad, A. K., 189
 Conrey, F. R., 66, 67, 68, 481
 Conrod, P. J., 578
 Constantino, S. M., 542
 Converse, P. D., 170, 171, 194
 Conway, A., 463
 Conway, L. G., 176
 Cook, J., 576
 Cook, W. L., 255
 Cooper, R. P., 207, 209
 Copeland, D. E., 481
 Copinschi, G., 133
 Corfield, D. R., 134
 Corless, T., 49
 Corley, R. P., 187
 Corneille, O., 211
 Cornell, D., 13
 Cornish D. B., 518
 Corrales, C., 316
 Corwin, E. J., 577
 Coskunpinar, A., 349
 Cosmides, L., 173, 176, 184
 Costa, P., 351
 Costa, P. T., Jr., 348, 350, 352, 353, 354, 355, 370, 371, 402, 404
 Cote, K. A., 186
 Côté, S., 324, 327, 328, 336, 338
 Couyoumdjian, A., 186, 190
 Cox, C. M., 381
 Cox, W. B., 578
 Cowan, N., 193
 Coy, K. C., 463
 Craig, J., 521
 Craik, F., 419
 Crant, J. M., 390
 Crepaz, N., 13
 Crescioni, A. W., 252
 Creswell, J. D., 31
 Creswell, K. G., 583
 Cribbet, M. R., 135, 189
 Critcher, C. R., 45, 575, 577
 Critchley, H. D., 119, 134, 422
 Crockenberg, S. C., 465
 Crocker, J., 443
 Crockett, L. J., 464
 Crofford, L. J., 136
 Crone, E. A., 116, 422
 Cronkite, R. C., 368
 Crosswhite, J. M., 519
 Croyle, M. H., 327, 328, 337
 Cruess, L., 424
 Crumling, A. J., 119
 Csikszentmihalyi, M., 334
 Cuenca, I., 348
 Cuevas, K., 469
 Cuijpers, P., 34
 Cullen, F. T., 49, 516, 517, 518, 520, 524
 Cumberland, A., 467, 468, 469
 Cunningham, W. A., 118, 147
 Curry, J. F., 504
 Curtin, J. J., 575
 Curtis, C. E., 114
 Custers, R., 204, 205, 206, 207, 209, 210, 211, 212, 213, 214
 Cyders, M. A., 17, 348, 349, 352, 353, 354, 355, 356
 Czajkowski, L. A., 189
 Czopp, A. M., 64
 d'Acremont, M., 17
 Dahl, D. W., 317
 Dahl, R. E., 371, 372
 Dahling, J. J., 337
 Dahme, B., 564
 Daigle, L. E., 520
 Dal Cin, S., 119
 Dalton, A. N., 235
 Daly, M., 42
 Damasio, A. R., 114, 205, 501
 Dambacher, M., 226
 Damiani, M., 387
 Damon, W., 390
 Daneri, P., 423
 Danforth, J. S., 497
 Dang, J., 172, 174, 177
 Dangelmayer, G., 277
 Daniels, L., 387
 Daniels, M. A., 329
 Dannenberg, L., 213
 Danner, D. D., 365
 Danner, U. N., 208
 Dantzer, R., 134
 D'Argembeau, A., 549
 Daryanani, I., 374
 Daprati, E., 213
 da Silva Lobo, D. S., 49
 Dagevos, H., 208
 Davatzikos, C., 351
 David, S. P., 119
 Davidson, R., 581
 Davidson, R. J., 9, 117, 459
 Davies, P., 254
 Davis, C. M.,
 Davis, J. H., 250
 Davisson, E. K., 174, 355
 Daw, N. D., 15, 97, 99, 542
 Dawe, S., 49
 Dawkins, L., 578
 Dawkins, R., 502
 Day, J. C., 427
 Dayan, P., 15, 119
 Deary, I. J., 42, 165
 Deater-Deckard, K., 469
 de Boer, B. J., 398
 De Bruijn, G.-J., 208
 De Carvalho, L. B., 188

- DeChurch, L. A., 326
 Deci, E. L., 82, 169, 173, 192, 213, 238, 443, 452, 551
 Deckman, T., 349
 Declerck, C. H., 397
 Dedmon, S. E., 462, 465
 de Fockert, J. W., 86
 Degnan, K. A., 462, 466
 Degos, J. D., 116
 de Graaf, R., 368
 De Houwer, J., 63, 203
 Dekovic, M., 468
 de Kraker, J., 62
 Delaney, L., 42
 de Leeuw, R., 136
 Delgado, M. R., 119, 122
 Del Giudice, M., 418
 DeLisi, M., 49, 516, 517
 DelParigi, A., 119
 Demas, G. E., 137
 Demaree, H. A., 30, 46, 441
 Demareem, H. A., 504
 Dement, W. C., 185
 Demos, K. E., 119
 Dempster, F. N., 479
 Dumontheil, I., 227
 Demurie, E., 497
 Denburg, N. L., 114
 Denckla, M. B., 498
 Dennis, T. A., 420, 460, 467
 Denollet, J., 364
 Denson, T. F., 446
 Dent, C. W., 48
 Depue, R. A., 17, 346, 352, 356, 357, 358
 de Raad, B., 351
 de Ridder, D. T. D., 43, 47, 55, 80, 101, 102, 146, 165,
 166, 196, 224, 228, 230, 231, 233, 234, 257, 384,
 398, 399, 401, 406, 454, 562
 Derrick, J. L., 172
 Derryberry, D., 32, 423
 Desantis, A., 213
 DeShon, R. P., 170, 171, 194
 Desmond, J. E., 422
 Desmond, S. A., 306, 307, 315
 D'Esposito, M., 114, 500
 DeSteno, D., 367
 Deters, F. G., 154, 373
 Deutsch, R., 85, 86, 203
 Deveney, C. M., 364
 de Vet, E., 47, 234
 Devine, P. G., 118, 480
 Devlin, H. C., 364
 de Vries, N. K., 51, 52, 204, 208, 226
 de Vries, R. E., 403, 404
 DeWall, C. N., 8, 33, 42, 46, 51, 83, 120, 140, 252,
 256, 258, 266, 307, 315, 349, 519,
 de Wit, H., 348
 de Wit, J. B. F., 224, 228, 230, 231, 233
 de-Wit, L., 213
 de Wit, S., 99, 345
 De Witt Huberts, J. C., 80
 DeWitte, S., 45, 51, 153, 172
 DeYoung, C. G., 345, 349, 350, 351, 352, 353, 355,
 356, 357, 358, 359, 402, 405, 406
 Dhar, R., 44
 Diamantopoulou, S., 254
 Diamond, A., 420, 424, 449, 460
 Diamond, J. A., 258, 324, 325
 Diamond, D. M., 421, 429
 Dias-Ferreira, E., 100
 Diaz, R. M., 501, 504
 Di Chiara, G., 119
 Dick, D. M., 17
 Dickenson, J., 453
 Dickerson, M., 49
 Dickerson, S. S., 428
 Dickhäuser, O., 44
 Dickinson, A., 96, 209
 Dickinson, D. L., 191
 Dickman, S. J., 346, 347, 353
 Dickter, C. L., 70
 Dickter, D. N., 337
 Diefendorff, J. M., 323, 327, 328, 329, 330, 332, 333,
 334, 335, 337
 Diener, E., 390
 Diener, M. L., 466
 DiGirolamo, G. J., 16
 Digman, J. M., 355, 370
 Dijk, D., 187
 Dijksterhuis, A., 203, 204, 207, 208, 201, 212, 213,
 227, 313
 Dijkstra, K., 491
 Dillon, D. G., 364
 Dillon, M., 308
 Dimoff, J. D., 581
 Dinges, D. F., 185, 186
 Diorio, J., 427
 Dir, A. L., 349
 Dishion, T. J., 48, 120
 Ditre, J. W., 48, 172, 577
 Ditto, P. H., 152
 D'Mello, S., 389
 Doan, S. N., 465
 Dobrin, A., 520
 Dodson, J. D., 420, 427, 431
 Dolan, R. J., 119, 134
 Donchin, E., 170
 Donegan, N. H., 117
 Donohoe, R. T., 139
 Donzella, B., 428
 Doobay, A. F., 463
 Doran, N., 576
 Doran, S. M., 186
 Dorfman, H., 385
 Dotsch, R., 211
 Dougherty, D. M., 348
 Douglas, V. L., 349, 497
 Downey, L. A., 334
 Downing, L. L., 389
 Doyen, S., 203
 Doyle, A. E., 498
 Doyle, W. J., 365
 Draganich, C., 174
 Dreezens, E., 52
 Dreisbach, G., 11
 Drigotas, S. M., 276, 292
 Drolet, A., 43, 101, 209
 Drummond, S. P., 185, 190, 191
 Duckworth, A. L., 49, 101, 102, 165, 171, 195, 209,
 231, 252, 313, 349, 381, 382, 383, 384, 385, 397,
 406, 410, 430, 535, 542, 562, 564
 Duclos, R., 120
 Dudley, K. L., 296, 298, 299, 300

- Due, D. L., 119
 Duffy, E., 554
 Duffy, M. K., 335
 Duggan, K. A., 187
 Duke, A. B., 325
 Duke, S. C., 157
 Dunaway, R. G., 49, 516, 518
 Dunbar, R., 480
 Duncan, J., 419
 Dunlop, S. M., 482, 489
 Dunning, D., 211
 Dunton, B. C., 63
 Durkin, K., 497
 Durmer, J. S., 186
 Dutra, S. J., 364
 Dweck, C. S., 52, 171, 225, 238, 273, 307, 430, 432,
 444, 450, 548, 558, 560
 Dyer, R. L., 423

 Earle, F., 174
 Eastin, M. S., 253
 Easting, G., 348, 406
 Ebbesen, E. B., 166, 534, 535
 Ebbsen, E. B., 407
 Ebert, D., 34
 Ebner, N. C., 372
 Eccles, J. S., 387, 430
 Edgerton, R. B., 580
 Edmonds, G. W., 307, 349
 Edwards, B. D., 327
 Edwards, E. P., 465
 Edwards, E. S., 469
 Egeland, B., 259
 Eggleston, T. J., 573
 Eggum, N. D., 461, 464, 465
 Egner, T., 30, 167
 Eid, J., 103
 Eidelman, S., 6
 Eiden, R. D., 465
 Eigsti, I.-M., 535
 Eisenberg, N., 459, 460, 461, 462, 463, 464, 465, 466,
 467, 468, 469, 470
 Eisenberger, N. I., 259
 Eisenlohr-Moul, T. A., 137, 140
 Eisner, M., 519
 Eitam, B., 210
 Ekinci, O., 17
 Ekman, P., 581
 Elia, M., 137
 Elkins-Brown, N., 441
 Elliot, A. J., 4, 213, 312, 554
 Elliott, E. S., 430
 Ellis, A. P. J., 188, 189
 Ellis, B. J., 423, 427
 Ellis, C. M., 601
 Ellis, L. K., 14, 460
 Emerson, M. J., 86
 Emslie, H., 419
 Engell, A. D., 212
 Engels, R. C. M. E., 254, 579
 Engert, V., 100
 Engle, R. W., 451
 Engle-Friedman, M., 190, 192
 Englert, C., 44, 47, 98
 Ensor, R., 419

 Erdal, K., 174
 Epstein, J. N., 504
 Epstein, S., 14
 Epstude, K., 549, 550
 Epton, T., 448
 Erber, M. W., 24, 25, 28
 Erber, R., 24, 25, 27, 28, 266
 Erblich, J., 577
 Erdfelder, E., 45
 Erickson, K. I., 140
 Erickson, R. J., 326
 Ericsson, K. A., 383
 Ernst, M., 371, 372
 Erol-Korkmaz, H. T., 332
 Ersche, K. D., 345
 Erskine, J. A. K., 85
 Erwin, J. M., 422
 Esch, T., 33
 Eskreis-Winkler, L., 382, 387, 389, 390, 408
 Espy, K., 418
 Esquievie, D., 188
 Essex, M. J., 467
 Esteves, F., 421
 Etkin, A., 30
 Evans, D. E., 14
 Evans, D. R., 131, 138
 Evans, G. W., 425, 426, 427, 465
 Evans, J., 114
 Evans, J. S., 15
 Evans, J. S. B., 97
 Evans, M., 157
 Evans, T. D., 49, 516, 518, 524
 Evenden, J. L., 346
 Everitt, B. J., 104
 Evers, C., 80, 196, 233
 Eyal, T., 149
 Eysenck, H. J., 348, 350, 406
 Eysenck, S. B. G., 350, 406

 Faber, R. J., 49, 167, 168
 Fabes, R. A., 460, 462, 463, 465, 466
 Fadardi, J. S., 578
 Fairbairn, C. E., 576
 Falk, E. B., 86, 453
 Fallone, G., 188
 Farah, M. J., 426
 Faraone, S. V., 498
 Farley, J. P., 306
 Fantino, E., 538
 Farr, O. M., 353
 Farran, D., 429
 Farrell, A. K., 271, 297
 Farrington, D. P., 515, 516
 Farrow, T. F., 33
 Fast, N. J., 151
 Fawcett, T. W., 540
 Fayard, J. V., 307
 Fazio, R. H., 62, 63, 205, 553
 Fearon, R. M. P., 466
 Feather, N. T., 381
 Fecteau, S., 115
 Fedorikhin, A., 84
 Feeney, B. C., 249, 257, 266, 274, 285, 294
 Feeney, J. A., 294
 Fehr, E., 113, 115, 560

- Feinholdt, A., 327
 Feldman, D., 324
 Feldman, G. C., 372
 Feldman, S., 203
 Felix, V., 348
 Felmingham, K. L., 136
 Fenigstein, A., 306
 Fennis, B. M., 45, 47, 168, 176, 234
 Fera, F., 117
 Ferguson, M. J., 45, 204, 205, 206, 210, 211, 431, 553, 575, 577
 Fernyhough, C., 213
 Ferrer, R. A., 231
 Ferris, D. L., 188
 Festinger, L., 326, 327, 443
 Field, M., 47, 578
 Fiez, J. A., 580, 581
 Filigno, S. S., 103
 Fillmore, M. T., 48, 137
 Finan, P. H., 190
 Finch, D. M., 327
 Finkel, E. J., 42, 54, 251, 252, 256, 257, 258, 266, 267, 273, 275, 276, 277, 284, 285
 Finkel, S. M., 367
 Finkelhor, D., 259
 Finkenauer, C., 43, 102, 165, 251, 252, 253, 254, 256, 257, 258, 273, 384, 401
 Finlay-Jones, R., 13
 Finney, J., 449
 Fiore, M. C., 573, 575, 581
 Fischer, D., 328
 Fischer, M., 497, 498
 Fischer, S., 354
 Fishbach, A., 87, 154, 155, 173, 205, 208, 210, 212, 275, 444, 595
 Fisher, B. S., 520
 Fisher, P. A., 454
 Fisher, R. R., 55, 82, 560
 Fiske, S. T., 118
 Fitzsimons, G. M., 11, 174, 206, 255, 266, 267, 273, 275, 284, 285, 314, 315
 Fitzsimons, G. R., 557
 Fleenor, J., 328
 Fletcher, G. J. O., 285, 286, 287, 289, 290
 Fletcher, R. B., 397
 Fliers, E. A., 497
 Floerke, V. A., 370
 Florsheim, P., 84
 Flory, J. D., 351, 352, 355
 Flykt, A., 421
 Fockenberg, D., 33
 Foerde, K., 99
 Folkman, S., 25, 369, 582
 Fong, G. T., 576
 Forbes, E. E., 353, 372
 Ford, B. Q., 370
 Ford, D. H., 4
 Forehand, M., 62
 Forgas, J., 365, 368
 Forrest, W., 518, 525
 Forster, D. E., 99, 250
 Förster, G., 55, 77, 101
 Förster, J., 31, 205, 212, 213, 557
 Forsyth, A., 579
 Fortier, M. S., 448
 Foshee, V. A., 42, 252
 Fossella, J., 16
 Foster, C. A., 287
 Fournier, P., 209, 212
 Fowler, J. H., 265, 266
 Fox, E., 33
 Fox, H. C., 48
 Fox, K. A., 516
 Fraley, R. C., 228
 Francis, D. D., 427
 Franken, I. H., 135, 578
 Frankl, V. E., 32
 Franklin, M. S., 550
 Fraundorf, S. H., 460
 Frayn, K. N., 141
 Frazier, T. W., 504, 505
 Frederick, S., 44, 437
 Freeman, G. L., 49
 Freeman, N., 195
 Freitas, A. L., 150, 152
 Frenette, S., 188
 Fresco, D. M., 34, 369, 373
 Freud, S., 31, 43, 384
 Freund, A. M., 157
 Fricchione, G. L., 33
 Friedman, H. S., 187
 Friedman, N. P., 86, 187, 418, 422, 461
 Friedman, R., 8, 211, 444, 551, 592
 Friedman, R. S., 87, 155, 205, 208
 Friedman, S. L., 465
 Friesen, M., 14, 50, 79, 84, 86, 121, 159, 172, 173, 273, 309, 310, 346, 406, 441
 Friesen, J., 11
 Friesen, W. V., 365, 581
 Frijda, N. H., 5, 6, 11, 25, 33
 Friston, K., 119
 Frith, C. D., 209, 213
 Frost, L. A., 65
 Fry, A., 554
 Fry, A. F., 255
 Frye, D., 424
 Fugelsang, J. A., 118
 Fujita, K., 52, 65, 84, 146, 147, 150, 151, 152, 153, 154, 155, 156, 158, 160, 166, 273
 Fukuyama, F., 247
 Fulford, D., 11
 Fuller-Rowell, T. E., 465
 Funder, D. C., 408, 522
 Fung, H., 372, 487
 Furley, P., 98
 Fussner, L., 372
 Fuster, J. M., 112, 419, 498, 499, 501
 Gable, S. L., 259
 Gabriel, A. S., 323, 325, 328, 329, 330, 332, 337
 Gabrieli, J. D., 117, 422
 Gabrieli, W. F., 165
 Gaertner, B., 461, 462, 468
 Gagné, M., 51, 172, 337
 Gaillard, A. W., 195
 Gailliot, M. T., 33, 43, 46, 48, 53, 54, 139, 140, 167, 168, 169, 211, 256, 258, 445, 446
 Galanter, E., 4
 Galen, L. W., 309
 Galetti, A. M., 49

- Galinsky, A. D., 389
 Galla, B. M., 101, 102, 209, 383, 406
 Gallagher, P., 409
 Galton, F., 380, 381, 384
 Galvan, V., 548
 Gandevia, S., 213
 Gangemi, A., 17
 Garavan, H., 119
 Garcia, J., 448
 García, L. F., 355
 García, O., 355
 García-Orza, J., 460
 Gardner, M., 372
 Gardner, W. L., 8, 328
 Garland, E. L., 135
 Garon, N., 432
 Garos, S., 310, 314
 Garretsen, H. F. L., 253
 Gartstein, M. A., 461, 469
 Gaucher, D., 313
 Gaunt, R., 16
 Gawrilow, C., 234, 235, 564
 Gawronski, B., 46, 62, 63, 64, 66, 481
 Geangu, E., 464
 Geeza, A. A., 355
 Gehring, W. J., 116, 184
 Geier, C., 372
 Geis, G., 518, 523, 526
 Geisler, F. C., 136
 Gendler, T. S., 535
 Gendolla, G. H. E., 306
 Gentil, V., 49
 Georgieff, N., 213
 Gerardi-Caulton, G., 423, 461, 462
 Gershman, S. J., 15, 99
 Gervais, W. M., 308, 315
 Gevirtz, R., 136
 Geyskens, K., 172
 Ghashghaei, T., 113
 Ghumman, S., 188, 190, 191
 Giacomantonio, M., 176
 Gianaros, P. J., 134
 Gibbons, F. X., 306, 573
 Gibson, A. S. C., 138
 Gibson, C. L., 516, 520, 525
 Giesler, R. B., 306, 309, 310
 Gilbert, D. T., 16, 549, 550
 Gilbert, S. J., 227
 Giles, L., 286
 Gill, K. L., 462
 Gill, M. J., 258
 Gill, P., 49
 Gillan, C. M., 97, 104, 345
 Gillath, O., 206
 Gillebaart, M., 101, 166
 Gillin, C. J., 420
 Gillin, J. C., 185
 Gilliom, M., 462, 468
 Gillis, M. M., 119
 Gilmore, R. O., 5
 Gilovich, T., 581
 Giner-Sorolla, R., 487
 Ginis, K. A., 53
 Gino, F., 49, 168
 Giovanelli, A., 366
 Gitter, S. A., 46
 Giuliani, N. R., 85, 367
 Glaser, J., 65
 Glass, B. D., 194
 Glimcher, P. W., 452
 Glisky, E. L., 230, 234
 Glomb, T. M., 355
 Glover, G. H., 422
 Godin, G., 224
 Goel, N., 186
 Gohar, A., 193
 Goldberg, L. R., 350, 351, 352, 370
 Goldberg, L. S., 326
 Goldberg, R. F., 114
 Goldman-Rakic, P. S., 420, 501
 Goldsmith, H. H., 459
 Goldstein, A. N., 189
 Gollwitzer, P. M., 29, 30, 52, 64, 88, 97, 146, 150, 156, 191, 192, 204, 206, 207, 214, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 266, 273, 312, 444, 449, 453, 454, 548, 550, 551, 553, 557, 560, 561, 562, 563, 564, 580, 595
 Gomillion, S., 257
 Gonda, T., 483
 Gonsalkorale, K., 62, 68, 69, 72, 86, 481, 482
 Gonzales, A. L., 553
 Gonzales, F., 209
 Goode, M. R., 52, 515
 Goodin, B. R., 190
 Goodman, J. M., 325
 Gordon, A. M., 191
 Gordon, H. L., 117
 Gordon, J. R., 574, 579, 583
 Goschke, T., 11
 Gosserand, R. H., 337
 Gottfredson, L. S., 165
 Gottfredson, M. R., 42, 49, 397, 398, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526
 Gottlieb, G., 425
 Gottman, J. M., 289, 290, 480
 Gouley, K. K., 460
 Gourville, J. T., 593, 597
 Govorun, O., 70
 Graeve, C. M., 49
 Grafman, J., 114
 Graham, A. M., 454
 Graham, J., 80
 Graham, J. D., 53
 Grahn, J. A.,
 Gramling, S. E., 33
 Grandey, A. A., 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 334, 336, 337, 338
 Granö, N., 17, 187
 Grant, H., 231
 Grasmick, H. G., 49, 397, 516, 517, 518, 522, 523
 Gratton, G., 170
 Gratz, K. L., 34, 369
 Grawitch, M. J., 398
 Gray, E. K.,
 Gray, F., 116
 Gray, J. A., 192
 Gray, J. R., 168, 373, 420
 Green, J. D., 559
 Green, L., 255, 554

- Green, S. G., 327
 Greenberg, J., 31
 Greenberg, L., 373
 Greenberg, M. T., 418
 Greene, J. D., 29,
 Greenfield, D. N., 253
 Greeno, C. G., 32
 Greenspan, R. J., 185
 Greenwald, A. G., 62, 69, 118, 481
 Greenwell, L., 449
 Greer, S. M., 189
 Gregg, A. P., 62
 Greguras, G. J., 328, 330, 337
 Griffin, D. W., 148, 157, 158, 249, 287
 Griffin, K. M., 571, 579, 582
 Griffiths, T. L., 535, 536, 537, 539
 Grigg, M., 79
 Groom, C. J., 66, 481
 Gröpel, P., 52, 409
 Gross, J. J., 8, 24, 25, 27, 28, 29, 30, 31, 33, 77, 85,
 117, 135, 188, 189, 323, 329, 330, 331, 332, 333,
 334, 335, 336, 337, 365, 366, 367, 369, 372, 373,
 384, 408, 420, 535, 583
 Grossier, D. B., 498
 Gruber, J., 364, 365, 366, 367, 368, 369, 370, 373
 Gruber, R., 188, 189
 Gruenfeld, D. H., 206
 Gschwendner, T., 273
 Guay, F., 430
 Guenzel, F. M., 100
 Gujar, N., 117, 189
 Gullone, E., 31
 Gunderson, J. G., 369
 Gunn, H. E., 135, 189
 Gunnar, M. R., 371, 425, 426, 428
 Gunstad, J., 490
 Guo, L., 114
 Gusnard, D. A., 196
 Gustafsson, J., 422
 Guthrie, I. K., 460, 463, 465, 466
 Gutsell, J. N., 121
 Guttenberg, K. B., 453, 564
 Gwaltney, C. J., 579
 Gyurak, A., 136, 328

 Haber, S. N., 113
 Haedt-Matt, A. A., 120
 Haggard, P., 212, 213
 Hagger, M. S., 43, 76, 86, 99, 121, 140, 167, 168, 172,
 175, 194, 446, 447
 Hailey, S. E., 423
 Hajcak, G., 136
 Hakeem, A., 422
 Halali, E., 174
 Halberstadt, J., 485
 Halford, W. K., 288
 Halkjelsvik, T., 541
 Hall, P. A., 236
 Hall, W. G., 119
 Halonen, J., 420, 421
 Hamann, S., 31
 Hambrick, D. Z., 184
 Hamstra, P., 206
 Han, H. A., 158
 Hanish, L., 462

 Hanks, A. S., 84
 Hansen, A. L., 134
 Harackiewicz, J. M., 387
 Harber, K. D., 259
 Harden, K. P., 354
 Hardin, M., 372
 Hardy, J. K., 131
 Hare, T. A., 113, 117, 173, 397
 Harenski, K., 31
 Hariri, A. R., 117
 Harlan, E. T., 459
 Harlow, J. M., 502
 Harman, C., 421
 Harmon-Jones, C., 121, 173
 Harmon-Jones, E., 7, 8, 9, 118, 121, 173
 Harper, S., 140
 Harris, A., 173
 Harris, B., 257
 Harris, P., 562
 Harris, P. A., 231
 Harris, P. L., 254
 Harris, P. R., 231, 448
 Harris, R. C., 139
 Harrison, J., 313, 318
 Harrison, Y., 185, 186
 Hartman, C. A., 465
 Hartshorne, H., 381
 Harvey, A. G., 373
 Harvey, W., 497
 Hasher, L., 479, 482, 484
 Hassin, R. R., 170, 203, 206, 210, 212, 266
 Hastie, R., 114
 Hastorf, A. H., 149, 158
 Hatfield, E., 373
 Häubl, G., 104
 Hauger, R. L., 420
 Haws, K. L., 80
 Hay, A. C., 364
 Hay, C., 519, 525
 Hayden, B. Y., 541, 542
 Hayes-Roth, B., 12
 Hayes-Roth, F., 12
 Haynes, T., 387
 He, J., 462
 Head, D., 351
 Heath, C., 592
 Heatherton, T. F., 16, 42, 46, 76, 79, 80, 84, 86, 87,
 88, 116, 117, 118, 119, 120, 121, 122, 134, 140, 165,
 166, 167, 168, 176, 251, 384, 398, 487, 517, 560,
 571
 Heavey, C. L., 289, 290
 Heavin, S., 84
 Hebert, M., 259
 Hechter, F. J., 387
 Hechtman, L., 364
 Heckhausen, H., 595
 Heckman, B. W., 48, 172, 174, 573, 577
 Heckman, J. J., 429, 430
 Hedgcock, W. M., 121
 Heerey, E. A., 487
 Heider, F., 251
 Heikamp, T., 468
 Heimberg, R. G., 369, 373
 Heintzelman, S. J., 104
 Heitmann, M., 45

- Heiy, J. E., 365
 Heller, A. S., 367
 Henderson, M. D., 159, 225
 Henderson, P. W., 597
 Henna, E., 17
 Hennecke, M., 157
 Hennes, E. P., 231
 Henrich, J., 314
 Henry, B., 69, 464
 Henry, J. D., 481, 482, 485, 486, 488, 489
 Henschel, A., 193
 Heppen, J. B., 15
 Herlache, A. D., 192
 Herman, C. P., 119, 120, 157
 Herman, J. L., 390
 Herman, S., 153
 Hermansen, L., 139
 Herrenkohl, R. C., 259
 Herrenkohl, T. I., 259
 Herrnstein, R. J., 151, 591
 Hershey, K. L., 463
 Hershfield, H. E., 591, 593, 598, 599
 Hertel, A. W., 576
 Hertel, P. T., 483
 Hervey, A. S., 504, 505
 Heslenfeld, D., 31
 Hessing, D., 516
 Hewitt, J. K., 187, 461
 Heyman, R. E., 289
 Hickman, M., 397, 522
 Higgins, E. T., 7, 8, 9, 78, 211, 238, 273, 284, 312, 409, 557
 Higgins, G. E., 49, 517, 524
 Hilbig, B. E., 45
 Hill, A. V., 139
 Hill, P., 383
 Hillier, A., 420
 Hillman, C. H., 140
 Hill-Soderlund, A. L., 462, 466
 Hilmert, C. J., 259
 Hinson, J. M., 186, 191
 Hinson, R. E., 584
 Hira, N. S., 288
 Hiraoka, R., 84
 Hirsch, J., 189
 Hirschi, T., 42, 49, 397, 398, 401, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526
 Hirsh, J. B., 166, 355
 Hirst, A., 86
 Hirt, E. R., 171, 307
 Hisler, G., 187
 Hitch, G. J., 500
 Hochschild, A. R., 323, 324, 325, 326, 327, 328, 329, 330, 333, 335
 Hochstetler, A., 49, 517
 Hockey, G. R. J., 170, 172, 174, 175, 191, 193, 195
 Hodapp, V., 328
 Hoeksema-van Orden, C. Y., 190, 195
 Hoerger, M., 366, 408
 Hof, P. R., 422
 Hofer, C., 465, 468
 Hoffman, K. L., 55, 184, 192
 Hofmann, W., 14, 17, 43, 46, 47, 55, 62, 65, 77, 78, 79, 80, 81, 82, 83, 84, 86, 87, 89, 101, 102, 119, 121, 159, 160, 166, 184, 273, 346, 406, 441
 Hofstee, W. K., 351
 Hogarth, L., 97
 Holland, R. W., 204
 Holman, D., 333
 Holmes, A. J., 249, 250, 257,
 Holmes, J. G., 274, 287, 317
 Holtfreter, K., 520
 Holt-Lunstad, J., 247
 Hommel, B., 96, 205, 207, 316
 Hönig, G., 557
 Hope, N., 82
 Hope, T. L., 48
 Hopfinger, J. B., 117
 Hopkins, J., 85
 Hopp, H., 328
 Horne, J. A., 185, 186, 190
 Hosey, C., 82
 Hosseinkhanzadeh, A. A., 307, 311
 Hostinar, C. E., 425, 426
 Houben, K., 62, 86, 89, 578
 Houck, P. R., 572
 Houghton, S., 497
 Houssais, S., 563
 House, J. S., 489
 Houser-Marko, L., 443
 Houston, A. I., 540
 Howard, M. O., 135
 Howell, J. L., 152
 Howerter, A., 86
 Hox, J. J., 224
 Hoyle, A., 558
 Hoyle, R. H., 355, 409
 Hoyt, W. T., 309
 Hoza, B., 506
 Hsieh, K. H., 465
 Hu, L., 50
 Hu, P., 117, 189
 Hu, S., 353
 Huang, K. Y., 460
 Huang, L., 517
 Huang, Z., 50
 Hudson, N. W., 228
 Huettel, S. A., 119, 191
 Huffcutt, A. I., 189
 Hufford, M. R., 574, 581
 Hugenberg, K., 66, 211, 481
 Hughes, C., 419, 425
 Hughes, J. R., 571, 577
 Hughes, L. A., 520
 Hülshager, U. R., 325, 326, 327, 328, 335, 338
 Hulin, C. L., 332
 Hull, J. G., 571, 576, 578
 Hulleman, C. S., 387, 388
 Hulme, C., 449
 Hultman, E., 139
 Hummer, T. A., 498
 Humphrey, R. H., 324, 325, 328, 329, 336
 Hund, A. M., 497
 Hung, I. W., 258
 Hunt, J. G., 328
 Hunter, E. M., 332
 Hurst, C., 327
 Hurwitz, B. E., 131
 Hussain, M., 384
 Hutcherson, C., 173

- Huth, M., 188, 191
 Hyde, J. S., 387
- Ignarri, C., 206
 IJames, S. G., 119
 IJzerman, H., 265
 Imperato, A., 119
 Ingvar, D. H., 500
 Inzlicht, M., 46, 82, 86, 121, 165, 166, 167, 168, 170, 171, 172, 173, 174, 175, 176, 177, 194, 204, 312, 316, 432, 441, 447, 451, 452
 Ireland, M., 553
 Isen, A. M., 10, 13, 365
 Itti, L., 194
 Iyengar, S. S., 45
 Iyer, R. V., 465
 Izard, C. E., 10
- Jackson, J., 351
 Jackson, J. J., 307
 Jackson, J. R., 63
 Jackson, M. L., 191
 Jacobson, J. A., 51, 309
 Jacobson, L., 115
 Jacoby, L. L., 481
 James, W., 101, 184, 203, 205, 209, 549, 551
 Janczyk, M., 236
 Janes, A. C., 119, 578
 Janetzke, H., 557
 Janiszewski, C., 171, 172
 Janoff-Bulman, R., 310
 Jansen, A., 86, 89
 Jansen, C., 5
 Janssen, L., 45
 Janssen, W. G., 168
 Jarvie, H. F., 112, 114
 Jaudas, A., 229, 237
 Javitt, D. C., 115
 Jazaieri, H., 365
 Jeannerod, M., 205, 207, 209, 212, 213
 Jelinek, H. F., 136
 Jenkins, D. D., 307
 Jenkins, K. T., 85
 Jenkins, M. A., 116
 Jennings, J. R., 134
 Jennings, W. G., 516
 Jeong, Y.-J., 307
 Jessop, D. C., 231, 234
 Ji, L.-J., 51, 309
 Jia, L., 171, 307
 Jiang, Y., 120
 Jó, P. S. B., 465
 Job, V., 52, 171, 173, 225, 307, 432, 450
 Johannessen, K. B., 562
 Johansen, E. B., 498
 John, O. P., 30, 345, 369, 370, 371, 402
 Johnsen, B. H., 134
 Johnson, H.-A. M., 328
 Johnson, J. A., 352
 Johnson, K. A., 305, 306
 Johnson, L. M., 462
 Johnson, P., 229
 Johnson, R. D., 389
 Johnson, R. E., 332
 Johnson, S. L., 11, 14, 17, 346, 366, 368, 369
- Johnson, S. M., 258
 Johnson-Laird, P. N., 17
 Johnston, L., 85
 Johnstone, T., 117, 122
 Joiner, T., 365
 Joireman, J., 252, 353
 Jolesz, F. A., 117, 189
 Jones, A., 120
 Jones, B. T., 578
 Jones, D. A., 139
 Jones, D. L., 79
 Jones, G. E., 28
 Jones, L. B., 461
 Jones, S., 516
 Jones, S. R., 213
 Jones-Gotman, M., 115
 Jonides, J., 418
 Joormann, J., 14, 147, 346
 Jordan, J., 176
 Joseph, A. M., 577
 Josephs, R. A., 576, 577
 Joshi, P. D., 151
 Jostmann, N. B., 33, 213
 Judd, C. M., 64
 Judge, T. A., 327
 Julia, H. L., 47
 Junger, M., 516, 519
 Junger-Tas, J., 519
 Just, D. R., 84
 Just, M. A., 422
- Kable, J. W., 171, 195, 314, 452, 534, 536, 537, 539, 540, 541, 543
 Kahn, B. E., 13
 Kahn, L. E., 443, 454
 Kahneman, D., 157, 184, 193, 549, 596
 Kahn-Green, E. T., 189
 Kaikati, A. M., 149
 Kalarchian, M. A., 572
 Kalin, N. H., 117
 Kalisch, R., 30
 Kalvelage, J., 553
 Kamimori, G. H., 189, 191
 Kammeyer-Mueller, J. D., 325, 326, 327, 338
 Kammrath, L. K., 256, 257
 Kamp-Becker, I., 497
 Kamphuis, J., 187
 Kanacri, B. P. L., 464
 Kanfer, F. H., 305, 409, 499
 Kang, H., 46
 Kang, O. S., 578
 Kang, S. K., 46, 168
 Kao, C. F., 560
 Kaplan, R. F., 116
 Kaplan, S., 184
 Kapogiannis, D., 351
 Kappes, A., 230, 557, 558, 559, 562
 Kappes, H. B., 453, 550, 551, 553, 554, 555, 559, 564
 Karbon, M., 463
 Kardes, F. R., 205, 553
 Karlan, D., 600
 Karney, B. R., 289, 293
 Karniol, R., 389
 Karoly, P., 305, 499
 Karreman, A., 468

- Karremans, J. C., 86, 211, 252, 266
 Karyadi, K. A., 17, 349
 Kaschel, R., 25
 Kashdan, T. B., 32, 34, 383
 Kashy, D. A., 105, 255, 287
 Kast, F., 599
 Katz, L. F., 469
 Kaufman, S. B., 357
 Kauschke, C., 497
 Kavanagh, D. J., 77, 78, 79, 85, 581
 Kay, A. C., 312, 313, 314, 315, 318
 Keane, C., 516, 519, 522
 Keane, S. P., 466, 469
 Keel, P. K., 120
 Keesman, M., 204, 206
 Keil, A., 30, 228
 Keller, P. E., 16
 Kelley, H. H., 247, 285
 Kelley, W. M., 84, 117, 118, 119, 122
 Kelly, D. R., 381, 382, 408
 Keltner, D., 369, 371, 487
 Kemeny, M. E., 428
 Kemp, A. H., 136
 Kempes, E., 79, 84
 Kennedy, D. O., 140
 Kennedy, K. A., 151
 Kenny, D. A., 255
 Kensinger, E. A., 487
 Keren, G., 15
 Kerkhof, P., 253
 Kern, M. L., 49, 349, 397, 410
 Kerns, J. G., 116, 422
 Kerr, D. C. R., 466
 Kerr, M., 254
 Kesebir, P., 390
 Kessler, R. C., 188, 485
 Ketelaar, T., 371
 Keyes, A., 193
 Kidd, C., 535
 Kiehl, K. A., 117
 Kiesel, A., 558
 Killgore, D. B., 189, 190
 Killgore, W. D. S., 120, 186, 189, 190, 191
 Killingsworth, M. A., 549, 581
 Kilts, C., 31
 Kim, D.-Y., 466
 Kim, K., 367
 Kim, P., 426
 Kim, S., 463, 465
 Kim-Spoon, J., 306, 307, 308, 316, 467
 King, K. M., 17, 465
 King Elbaz, Z., 349
 Kinsella, G. J., 505
 Kirby, K. N., 348, 349
 Kirby, T., 383
 Kirby, T. A., 321, 408, 562, 564
 Kirchner, T. R., 574, 577
 Kirk, D., 228, 231, 561, 563
 Kirkham, N. Z., 424
 Kirsch, I., 449
 Klanjšek, R., 307, 311, 315
 Klauer, K. C., 63, 64, 68, 70, 72, 481
 Kleiman, E. M., 383
 Kleiman, T., 170, 210
 Klein, D. J., 25
 Klein, H. J., 595
 Klein, K., 33
 Klein, K. M.
 Klein, L. C., 577
 Klein, O., 203
 Klein, W. M. P., 231
 Kleist, K., 111, 114
 Klinger, E., 13, 14, 333, 550
 Klinger, R., 564
 Klock, S., 133
 Klonsky, E. D., 136
 Kloof, D., 424
 Kluck, A., 310
 Kluge, L., 560
 Knaack, A., 14, 461, 462, 463, 465, 468, 470
 Knäuper, B., 229
 Knight, R. T., 113, 115, 116, 487
 Knoch, D., 115
 Knowles, E. D., 65
 Knowlton, B. J., 99
 Kober, H., 85, 119, 122
 Koch, C., 212
 Kochanska, G., 14, 259, 461, 462, 463, 465, 467, 468, 469, 470
 Kochenderfer-Ladd, B., 465
 Kocher, M. G., 255
 Koestner, R., 82, 234, 235
 Kofler, L. M., 99
 Kofos, M. N., 52
 Kogan, A., 369
 Kok, B. E., 136
 Kokko, K., 465
 Kokkonen, M., 371
 Kolts, R. L., 374
 Komaroff, E., 584
 Komsí, N., 462
 Koo, M., 275
 Koob, G. F., 119
 Kool, W., 171, 172, 194
 Koole, S. L., 25, 26, 27, 30, 31, 32, 33, 316, 337, 338
 Kopp, C. B., 31, 468
 Kosinski, M., 307, 308
 Kosovich, J. J., 387
 Koster, E. H. W., 33
 Kotabe, H. P., 77, 78, 82, 83, 84, 86
 Koval, C. Z., 174, 255, 256
 Kozak, R., 184
 Krabbendam, L., 254
 Kraft, M., 353
 Kraft-Todd, G., 365
 Kramer, A. F., 140
 Kramer, M. D., 349
 Krampe, R. T., 383
 Kranton, R. E., 388
 Krantz, L., 229
 Kraus, M. W., 206
 Krendl, A. C., 118, 487, 488
 Krieglmeyer, R., 63, 70, 71
 Krietemeyer, J., 85
 Krimmel, K. R., 324
 Krischer, M. M., 332
 Krizan, Z., 187, 192
 Kroese, F. M., 101, 228, 233
 Krokoff, L. J., 289, 290
 Kross, E. F.,

- Krueger, J. M., 186
 Krueger, R. F., 349, 350, 356
 Kruesi, M., 356
 Kruger, J., 157
 Kruglanski, A. W., 11, 87, 155, 175, 176, 207, 208, 211, 212, 273, 384, 385, 386, 409, 444, 551, 592, 595
 Krysan, M., 480
 Kryski, K. R., 469, 480
 Kubacka, K. E., 277, 285
 Kubiak, T., 136
 Kuehl, K., 385
 Kuhl, J., 25, 28, 32, 53, 409
 Kuhlman, D. M., 353
 Kumar, A., 581
 Kumar, R., 266
 Kumashiro, M., 252, 273, 276, 277, 285
 Kunda, Z., 31, 275, 573, 574
 Kunishio, K., 113
 Kuntsche, E., 579
 Kuntsi, J., 348, 359, 504
 Kunzmann, U., 486
 Kuo, S. I., 298
 Kupor, D., 314, 315
 Kurlander, D., 97
 Kurzban, R., 139, 140, 169, 170, 171, 172, 173, 175, 176, 177, 194, 195, 313
 Kusche, A., 287
 Kwok, D., 383
- Labrecque, J. S., 96, 97, 208
 Labroo, A. A., 258
 Lacaille, J., 85
 LaGrange, T. C., 517, 519
 Laibson, D., 600, 601
 Laird, D. A., 195
 Laird, R. D., 307, 315
 Lakin, J., L., 206
 Lalande, K., 30, 336
 Lally, P., 96, 208
 Lam, V., 593
 Lamarche, V. M., 257
 Lambert, E. V., 138
 Lamme, V. A. F., 203, 212
 Lampman-Petratis, C., 371
 Lancaster, K., 85
 Lancel, M., 187
 Landau, M. J., 315
 Landau, S., 497
 Landis, K. R., 326
 Landis, R. S., 489
 Lando, H. A., 577
 Lane, A. M., 139, 194
 Lane, R. D., 134
 Lanfranchi, G., 112
 Lang, A. R., 575
 Lang, I. A., 490
 Lang, J. W. B., 327
 Lang, P. J., 8
 Langendam, D., 204
 Langston, C. A., 558
 Langton, L., 516
 Laplane, D., 116
 Laran, J., 171, 172
 Larkin, G. R., 365
 LaRose, R., 253
- Larrick, R. P., 592
 Larsen, R. J., 28, 31, 337, 371
 Larson, C. L., 117
 Larson, R., 371
 Larsson, A., 121, 168
 Latané, B., 317
 Latham, G. P., 223, 238, 384, 548, 592, 595, 596
 Lau, H. C., 212
 Laub, J. H., 521, 524, 526
 Laurin, K., 307, 313, 314, 315
 Lavidor, M., 115
 Lavie, N., 86
 Lawrence, C., 172, 174
 Layne, C., 289
 Layton, J. B., 247
 Lazarus, R. S., 25, 582
 Lazowski, R., 387
 Leahey, T. M., 266
 Leary, M. R., 285, 317, 551, 556
 Le Blanc, M., 519
 LeBourgeois, M. K., 189
 Ledgerwood, A., 149
 LeDoux, J. E., 26
 Lee, A., 51, 309
 Lee, A. Y., 65
 Lee, E. H., 468
 Lee, K., 258, 367, 449
 Lee-Chai, A., 206
 Leed-Kelly, A., 577
 Leerkes, E. M., 465
 Legault, L., 452
 Leggett, E. L., 238, 273, 430, 548, 560
 Leigh Gibson, E., 337
 Lejuez, C. W., 369
 Lokes, N., 235
 Lemay, E. P., Jr., 294, 296, 298, 299, 300
 Lemery, K. S., 467
 Lemery-Chalfant, K., 469
 Lempert, K. M., 543
 Le Moal, M., 119
 Lengfelder, A., 226, 234
 Lengua, L. J., 465, 466, 467, 470
 Lensvelt-Mulders, G., 23, 102, 165, 257, 384, 401
 Lenzenweger, M. F., 17
 Leonard, K. E., 465
 Leonards, U., 578
 Leon-Carrion, J., 460
 Leong, D. J., 429
 Leproult, R., 133
 Lerner, J. S., 120
 Leskovec, J., 307
 Lessels, C. M., 138
 Leth-Steensen, C., 349
 Leukefeld, C., 352
 Levav, J., 45, 314
 Leve, C., 469
 Levenson, R. W., 25, 328, 372, 480
 Levesque, C., 119
 Levesque, J., 29
 Levin, Z., 30, 34
 Levine, B., 480
 Levine, M. D., 572
 Levin-Sagi, M., 52, 150, 273
 Levitt, K., 31, 43
 Lewis, M., 13

- Li, B. M., 421
 Li, C. S. R.
 Li, N. P., 252
 Li, R., 353
 Li, Y., 120, 305
 Libby, D. J., 135
 Libedinsky, C., 191
 Liberman, A., 31
 Liberman, N., 52, 147, 148, 149, 150, 151, 152, 159, 205, 273, 557
 Lichtenstein, E., 573
 Lichtman, D., 554
 Liddle, P. F., 117
 Lieberman, M. D., 16, 86, 114, 167, 211, 259, 453
 Liebke, A. W., 500
 Liebke, L., 45
 Liepert, J., 564
 Liew, J., 423, 462, 465
 Li-Grining, C. P., 460, 461, 468
 Lijffijt, M., 17
 Lim, J., 188
 Lim, S. I., 371
 Lin, C. A., 253
 Lin, P. Y., 97, 102
 Lin, Y., 382
 Lindenberger, U., 372
 Linebarger, D. L., 527
 Linehan, M. M., 34, 373
 Lipizzi, E. L., 189
 Liston, C., 426
 Litt, M. D., 133
 Liu, D., 427
 Liu, K. S.,
 Liu, S., 591, 593
 Livesay, J. R., 500
 Livi, S., 255
 Livingston, J. L., 443
 Livingstone, V., 485
 Llabre, M. M., 11
 Llewellyn, D. J., 490
 Lloyd, S. A., 308
 Lobel, M., 31
 Locke, E. A., 206, 223, 238, 384, 548, 558, 592, 595, 596
 Lockwood, P., 275
 Loehlin, J. C., 308
 Loew, B., 231
 Loewenstein, G., 151, 537, 554, 577, 579, 581, 596
 Logue, A. W., 499
 Lomax, L. E., 462
 Lombardi, W. J., 211
 Long, C. N. H., 139
 Longo, G. S., 306
 Longshore, D., 517, 518
 Lopez, D. F., 152
 Lopez, N. L., 466
 Lopez, R. B., 119, 123
 Lorenz, S., 557
 Lorist, M. M., 449
 Louro, M. J., 11
 Loxton, N. J., 49
 Love, B. C., 540
 Lowenstein, A. E., 429
 Ludden, A. B., 195
 Luebke, A., 372
 Luechinger, R., 121
 Lugtig, P., 398
 Luhmann, M., 55, 82, 560
 Lukon, J. L., 462
 Luminet, O., 374
 Luna, B., 372
 Lupien, S. J., 420
 Lupton, H., 139
 Luszczyńska, A., 229
 Luu, P., 417, 420, 422
 Lykken, D. T., 308
 Lynam, D. R., 17, 351, 352, 355, 406, 520
 Lynam, R. W., 345, 346, 348, 352, 353, 354, 357, 359
 Lynch, J. G., Jr., 234
 Lynch, M. E., 69, 480
 Lynchard, N. A., 491
 Lynd-Balta, E., 113
 Lyons, D. M., 428
 Lyyra, A., 465
 Ma, Y., 328, 462, 466, 467, 468
 Maas, L. C., 119
 Maas, M., 206
 Mao, L., 172
 MacAndrew, C., 580
 MacDonald, A. W. III, 116, 422
 MacDonald, J., 520
 MacDonald, T., 576
 MacIntosh, R., 397, 522
 Mack, D., 119, 120
 MacKay, D. M., 4
 Mackintosh, B., 578
 MacLachlan, M., 42
 MacLeod, C., 33
 Macrae, C. N., 117, 118, 167, 194, 306, 432
 Maddox, W. T., 194
 Maddux, J. E., 549
 Madlon-Kay, S., 99
 Madrian, B. C., 600, 601, 602
 Maestripieri, D., 428
 Magee, J. C., 206
 Maglio, S., 151, 236, 559
 Magliozzi, T., 228
 Mahoney, M. J., 83
 Mahrer, A. R., 535
 Maier, G. W., 338
 Main, A., 423, 458
 Majeskie, M. R., 573
 Major, B., 443
 Malamuth, N. M., 290
 Malkoc, S. A., 151
 Malofeeva, L., 429
 Maloney, P. W., 398
 Manchanda, R. V., 317
 Mancini, F., 17
 Mancuso, R. A., 365
 Maner, J. K., 140, 211, 256
 Mann, T., 85, 146, 192, 444, 544
 Manning, R. D., 591
 Manning, V., 46
 Manolis, C., 49
 Mäntylä, T., 212
 Manuck, S. B., 356
 Maranges, H. M., 44, 46, 47, 76, 193
 March, J. G., 387, 388

- Marchette S. A., 99
 Marcora, S. M., 46
 Marcus, B., 522, 523
 Marcus, M. D., 572
 Maree, J., 136
 Maresh, E. L., 264
 Margaryan, S., 519
 Marien, H., 207, 212
 Markland, D., 448
 Markman, A. B., 15, 99, 194, 540
 Markman, K. D., 549
 Markon, K. E., 349, 350, 355, 356
 Marks, L. D., 307
 Marlatt, G. A., 573, 574, 579, 583, 584
 Marquardt, M. K., 561, 564
 Marrero, M. D., 307
 Marshall, I. H., 519, 520
 Martel, M. M., 465, 466, 498
 Martijn, C., 51, 52
 Martin, C. S., 574, 575, 577, 578
 Martin, J. E., 48
 Martin, L. L., 140, 549
 Martin, L. R., 366
 Martin, S. R., 172
 Martineau, A. M., 576
 Martins, S. S., 49
 Mascagni, F., 114
 Masicampo, E. J., 82, 140, 151, 172, 177, 204, 212, 236, 557
 Maslow, A. H., 32, 550
 Masters, K. S., 311
 Matarazzo, J. D., 131
 Mather, M., 372, 488
 Mathews, A., 33
 Mathias, C. J., 134
 Mathy, A., 549
 Matovic, D., 488
 Matta, F. K., 332
 Mattay, V. S., 117
 Matthews, G., 353
 Matthews, M. D., 381, 408
 Matthews, S., 136
 Matteucci, A. J., 381, 382
 Maule, J., 191
 Mauss, I. B., 25, 189, 366, 367, 379, 370, 371, 374
 Maxim, P. S., 516
 Maxim, R., 187
 May, C. P., 479, 482
 May, J., 77, 78, 84, 581
 May, M. A., 381
 Mayberg, H. S., 419
 Mayer, D., 314, 548, 549, 552, 553, 554, 557, 559, 561, 562, 563
 Mayer, R. C., 250
 McAdams, D. P., 32
 McCabe, D. P., 184, 186
 McCance, A. S., 335
 McCandliss, B. D., 426
 McCarter, L., 25
 McCarthy, D. E., 573, 575
 McCarthy, E. M., 504
 McChargue, D., 576
 McClain, T. M., 337
 McClelland, D. C., 550, 551
 McClelland, M. M., 430
 McClure, S. M., 29, 119, 173
 McConaghy, N., 49
 McConnell, A. R., 63
 McConnell, M., 600
 McCoy, D. C., 429
 McCrae, R. R., 348, 350, 352, 353, 354, 355, 370, 371, 402, 404
 McCrae, V., 116
 McCraty, R., 134
 McCrea, S. M., 225
 McCuller, W. J., 48
 McCulloch, K. C., 212, 224, 228, 236, 557
 McCullough, M. E., 30, 32, 99, 168, 306, 307, 308, 309, 316, 317, 431
 McDaniel, M. A., 184
 McDermott, K. B., 157
 McDevitt, A. A., 187
 McDonald, A. J., 114
 McEwen, B. S., 428
 McFarland, C. P., 230, 234
 McFarlin, D. B., 541
 McGaugh, J. L., 425
 McGhee, D. E., 62, 118, 481
 McGee, R. O., 464
 McGue, M., 308
 McGuinn, M., 187
 McGuire, J. T., 172, 194, 534, 536, 537, 539, 540, 541, 543
 McIlvain, H. E., 577
 McKay, L., 86
 McKay, R., 313, 318
 McKenna, B. S., 191
 McLeod, K. A., 317
 McLoyd, V. C., 427
 McMullen, M., 549
 McNamara, J., 541
 McNamara, J. M., 540
 McNamara, P., 311
 McNaughton, N., 192, 356, 358, 548
 McNulty, J. K., 292, 293
 McQuade, A., 49
 McQuade, J. D., 505
 McRae, K., 25, 367
 Mead, N. L., 46, 49, 51, 52, 168
 Meaney, M. J., 427
 Medeiros, M., 187
 Medeiros, R., 519
 Medin, D. L., 148
 Mednick, S. A., 165
 Mednick, S. C., 187
 Meerkerk, G. J., 253
 Megías, A., 212
 Mehl, M. R., 373
 Meier, B. P., 312, 316, 357
 Meier, M. H., 520
 Meier, S., 599
 Meijman, T. F., 449
 Meins, E., 213
 Meints, J., 307
 Meiran, N., 174
 Melamed, L., 49
 Melby-Lervåg, M., 449
 Mele, A., 78
 Melzer, D., 490
 Mendes, W. B., 318, 373

- Mendoza, S. A., 228
 Mendoza-Denton, R., 534
 Menec, V. H., 387
 Mennin, D. S., 34, 369, 373
 Mens, M. G., 14
 Mento, A. J., 595
 Merchant, J. S., 454
 Merckelbach, H., 52
 Mervis, C. B., 148
 Mesmer-Magnus, J. R., 326, 327
 Mesulam, M. M., 184, 419
 Metcalfe, J., 98, 121, 146, 160, 203, 535, 542
 Meulenbroek, R. G. J., 5
 Meyer, K., 115
 Meyer, M. L., 211, 212
 Mezzacappa, E., 467
 Mezo, P., 409
 Michalik, N., 463
 Michalski, V., 266
 Mickelsen, O., 193
 Midden, C., 227
 Midgley, C., 387
 Miketta, S., 173
 Mikolajczak, M., 374
 Mikulincer, M., 13, 249, 257, 258, 274, 294
 Miles, E., 24, 27, 29, 338
 Miles, J. D., 229
 Milham, M., 498
 Milkman, K. L., 173, 600
 Millar, M., 485
 Miller, C. J., 17
 Miller, D. T., 549
 Miller, E. K., 29, 112, 114, 210, 353, 419, 420, 422
 Miller, G. A., 4, 193
 Miller, G. E., 14, 312, 425
 Miller, J. D., 352, 354, 355
 Miller, R. S., 211
 Miller, S. L., 211
 Miller-Johnson, S., 429
 Miller-Ziegler, J. S., 450
 Milne, A. G., 306
 Milner, B., 115
 Milner, C. E.,
 Milyavskaya, M., 82, 166
 Minda, J. P., 168
 Mintun, M. A., 170
 Miranda, A., 348
 Mischel, W., 4, 42, 85, 98, 119, 121, 146, 159, 160,
 166, 203, 278, 397, 407, 408, 462, 465, 499, 534,
 535, 542, 549, 550
 Mitchell, C., 368
 Mitchell, J. P., 118
 Miyake, A., 86, 184, 210, 418, 432, 461
 Mizobuchi, M., 113
 Mizruchi, M. S., 10
 Moberly, N. J., 157, 549
 Moeller, F. G., 17, 348
 Moffitt, T. E., 42, 165, 252, 384, 464, 524, 526
 Moffitt, R., 85
 Mogenson, G. J., 79
 Mogg, K., 485
 Mohr, C. D., 32
 Mohr, P., 85
 Mojallal, M., 307
 Molden, D. C., 140, 170, 172, 174, 313, 444, 450
 Moller, A. C., 169, 171
 Monahan, K. C., 465
 Moneta, G., 371
 Monin, B., 450
 Montague, P. R., 119
 Monteith, M. J., 64
 Monterosso, J. R., 102
 Montgomery, G. H., 577
 Monti, P. M., 579, 584
 Moonen, A., 208
 Moore, E., 523
 Moore, J. W., 213
 Moore, W. E., 120
 Moors, A., 63, 203
 Moos, R. H., 368
 Mor, N., 579
 Moran, L., 466
 Morecraft, R. J., 184
 Morehart, J., 337
 Moretti, M. M., 284
 Morewedge, C. K., 549, 550
 Morgan, L. M., 327, 336
 Morgenroth, K., 235, 564
 Morizot, J., 519
 Morris, A. S., 467
 Morris, J., 324
 Morton, J. B., 188
 Moser, D. J., 116
 Moskowitz, G. B., 64, 65, 206, 211, 226
 Moskowitz, J. T., 369
 Mossholder, K. W., 595
 Moulds, M. L., 157
 Mowat, T., 485
 Moylan, C. A., 259
 Mrazek, M. D., 550
 Msall, M., 187
 Mukhopadhyay, A., 593
 Mulkens, S., 85
 Mullainathan, S., 600
 Müller, U., 419, 424
 Munafò, M. R., 578
 Muraven, M.,
 Muraven, M. R., 42, 43, 44, 47, 49, 50, 51, 54, 76, 89,
 99, 121, 153, 160, 166, 167, 169, 171, 172, 176, 177,
 193, 194, 203, 251, 278, 305, 307, 326, 432, 445,
 446, 451, 517, 522, 541, 576
 Muris, P., 465, 466
 Murphy, B. C., 460, 461, 463, 465
 Murphy, D. S., 517
 Murphy, K. R., 497, 498
 Murray, H. A., 550, 551
 Murray, J., 485
 Murray, K., 463
 Murray, K. B., 104
 Murray, K. L., 459, 463
 Murray, K. T., 467
 Murray, S. L., 249, 257, 258, 274, 287
 Musket, S., 206
 Musseler, J., 205
 Muusses, L. D., 253, 257
 Myers, J., 171, 195, 313
 Myerson, J., 255, 554
 Myrick, H., 119
 Nagin, D. S., 521
 Nair, U. S., 584
 Nam, C. S., 371

- Nambu, A., 114
 Napier, J. L., 313
 Nath, R., 307
 Naufel, K. Z., 152
 Naumann, L. P., 245
 Navalpakkam, V., 194
 Navarick, D. J., 499
 Navarro, A. D., 538
 Navon, D., 170, 174
 Neal, D. T., 43, 54, 95, 96, 97, 98, 100, 101, 104, 105, 208, 209
 Neale, M. A., 228
 Nederkoorn, C., 86, 89
 Neely, J. H., 156, 557
 Neinhaus, K., 99
 Neisser, U., 165, 387
 Nelligan, J. S., 294
 Nelson, D. B., 577
 Nelson, L. D., 152
 Nesse, R. M., 14
 Netemeyer, R., 234
 Neter, E., 12, 152
 Nettle, D., 317
 Neufeld, S. J., 468
 Neumann, R., 31
 Newcomb, A., 50
 Newell, B. R., 203
 Newman, D. L., 464
 Newman, J. R., 337
 Newman, L. S., 31
 Ng, M., 236
 Nguyen, D., 49
 Niaura, R. S., 572, 579
 Niedenthal, P. M., 558
 Nielsen, M. E., 206
 Nieuwenhuis, S., 116, 422
 Nigg, J. T., 14, 86, 497, 498, 504
 Nimchinsky, E., 422
 Nisbett, R., 581
 Nisbett, R. E., 68
 Nishimura, K., 541
 Niv, Y., 15
 Niven, K., 333
 Noakes, M., 85
 Noakes, T. D., 138, 139
 Nobile, C., 187
 Noble, K. G., 426
 Nocera, C. C., 373
 Nohlen, H., 78
 Nolen, W. A., 368
 Nolen-Hoeksema, S., 24, 34, 549
 Noor, M., 230
 Nordgren, L., 591
 Nordgren, L. F., 77, 78, 310, 314
 Nordling, J. K., 465
 Norem, J. K., 558
 Norenzayan, A., 305, 306, 308, 314, 315
 Norman, D. A., 86
 Norman, P., 208, 230, 233
 Normandeau, S., 430
 Norton, E., 553
 Nosek, B. A., 69
 Notarius, C. I., 289
 Novemsky, N., 44
 Nowlis, S. M., 88
 Nozaki, D., 207
 Nugent, S. M., 577
 Nuñez-Villegas, M., 264
 Nussbaum, A., 558
 Nyland, B., 139
 Nyman, M., 462
 Oakman, J. M., 406
 Oaten, M., 33, 42, 47, 54, 89, 120, 252, 258, 446, 447
 O'Boyle, C., 31
 Obremski, K. M., 579
 O'Brien, J. L., 211
 O'Brien, M., 469
 Ochsner, K., 25, 27, 29, 31, 117, 189, 373, 420, 583
 O'Connell, K. A., 577
 O'Connor, J., 49
 O'Curry, S., 597
 Odenthal, G., 234
 O'Doherty, J. P., 97, 119
 O'Donoghue, T., 537
 Oettingen, G., 223, 224, 225, 226, 227, 230, 231, 233, 234, 235, 236, 314, 449, 453, 454, 548, 549, 550, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564
 Ogedegbe, G. O., 448
 O'Gorman, J. G., 404
 Oikawa, M., 213
 Oikawa, H., 213
 Oldehinkel, A. J., 465, 466
 Oliver, E. J., 390
 Olivola, C. Y., 151
 Olson, J. M., 31, 550
 Olson, K. R., 355
 Olson, S. L., 465, 466
 O'Mara, E. M., 293
 Ongur, D., 113, 115
 Oosterlaan, J., 504
 Opitz, P. C., 372
 Oppenheim, H., 112, 113
 Orehek, E., 11, 211
 Orff, H. J., 191
 Oriña, M. M., 294, 297
 Ormel, J., 465
 Orom, H., 579
 Orsillo, S. M., 34
 Ortengren, A., 348
 Orth, U., 487
 Ortony, A., 5, 148
 Osnes, J. B., 139
 O'Sullivan, H., 578
 O'Sullivan, T. L., 448
 Otto, A. R., 15, 97, 99, 100, 540
 Ouellette, J. A., 101, 208
 Oveis, C., 136, 379
 Overall, N. C., 271, 285, 286, 290, 292, 294, 295, 297
 Overbeek, G., 252
 Overeem, S., 187
 Overman, H. G., 103
 Owen, A. M., 449
 Owens, J., 187
 Oyserman, D., 388
 Ozcan, T., 601
 Ozelik, H., 328
 Ozonoff, S., 419
 Padmanabhan, A., 372
 Pagnoni, G., 119

- Packer, D. J., 153
 Pak, H., 230, 556, 559
 Palisin, H., 430
 Paliwal, P., 48
 Palmeri, H., 535
 Pals, J. L., 32
 Pandya, D. N., 114, 115
 Pankiewicz, J., 125
 Panno, A., 176
 Papa, A., 30, 336
 Papachristos, A. V., 429
 Pape, C. L., 485
 Papias, E. K., 84, 155, 204, 206, 207, 208, 210, 211, 212, 214, 226, 233, 431
 Parcet, M. A., 348
 Pargament, K. I., 311
 Parizel, P. M., 397
 Park, B., 64
 Park, C., 383
 Park, C. L., 307, 311
 Park, C. R., 420, 421
 Park, D., 383
 Park, J. K., 448
 Park, S., 408
 Parker, J. D. A., 346, 351
 Parker, K. J., 428
 Parkinson, B., 337
 Parks, A. C., 374
 Parks-Stamm, E. J., 226, 233, 236, 237
 Parrott, A. C., 367
 Parrott, D. J., 581
 Pascoe, A., 98, 105
 Pascual-Leone, A., 115
 Pashler, H., 226
 Passingham, R. E., 212
 Pastorelli, C., 464
 Paternoster, R., 516, 521, 525
 Patrick, C. J., 349
 Patten, C. A., 48
 Pattison, K. F., 140
 Patton, J. H., 348, 406
 Paty, J. A., 576
 Paulhus, D. L., 31, 43, 277
 Paulsen, D. J., 372
 Paultzki, J., 236
 Paus, T., 115, 116
 Pawlow, L. A., 28
 Payne, B. K., 70, 72, 86, 118, 228
 Payne, C. R., 103, 171
 Payton, D. W., 12
 Peake, P. K., 42, 397, 408, 462
 Peake, S. J., 120
 Pearson, J. M., 541
 Pearson, P. R., 348, 406
 Peetz, J., 157, 256, 257,
 Pek, J., 367, 418
 Peluso, M. A. M., 17
 Penfield, W., 114
 Pennebaker, J. W., 33, 553
 Penney, L. M., 332
 Penney, S. J., 463
 Pennington, B. F., 419, 498
 Perez, L. A., 337
 Pérez-Santamaría, F. J., 460
 Pergadia, M., 576
 Perkins, A. W., 62
 Perkins, K. A., 572
 Perner, J., 424
 Perret, E., 115
 Perrone, D., 519
 Perrott, M. A., 574, 575, 578, 581
 Perry, R., 387
 Persson, J., 121, 168
 Peruche, M., 140
 Pess, R., 429
 Peters, A. R., 575
 Petersen, S. E., 421
 Peterson, B. S., 116
 Peterson, C., 352, 381, 383, 408
 Peterson, J. B., 355
 Peterson, R. A., 597
 Petrides, M., 114
 Petry, N. M., 490
 Pettijohn, L., 120
 Petty, R. E., 560
 Pevernagie, D., 187
 Pfau, F., 226
 Pfaus, J. G., 119
 Pfeifer, J. H., 120
 Pham, L. B., 157, 548
 Phelan, J. E., 15
 Phelps, E. A., 97, 118, 119, 543
 Philibert, R. A., 469
 Philippot, P., 27, 28, 33
 Phillips, A. J. K., 186
 Phillips, D., 294
 Phillips, D. T., 550
 Phillips, K., 116
 Phillips, L. H., 485, 486
 Piasecki, T. M., 575
 Piche, C., 259
 Pichon, C.-L., 203
 Pick-Alony, R., 151, 152
 Pickering, A., 578
 Pickering, A. D., 459
 Pickering, L. E., 516
 Pidada, S. U., 462
 Pigeau, R. A., 188
 Pilcher, J. J., 189
 Pilver, C. E., 135
 Pine, D. S., 372
 Pinel, E. C., 550
 Pinker, S., 519
 Pintar, A., 423
 Pinto, R., 429
 Pinuelas, A., 462
 Piper, M. E., 573
 Piquero, A. R., 397, 515, 516, 517, 518, 519, 520, 521, 524, 525
 Piquero, N. L., 521
 Pirutinsky, S., 307, 308, 315
 Pittinsky, T. L., 388
 Pitts, S., 211
 Pizzagalli, D. A., 364
 Plant, A., 140
 Plant, E. A., 54, 114, 445
 Plantinga, A. J., 103
 Platt, M. L., 541
 Plumm, K. M., 316
 Pierro, A., 273, 386

- Pieters, R., 11
 Pietromonaco, P. R., 249, 294
 Pocheptsova, A., 44
 Poddar, A., 601
 Podus, D., 449
 Pogarsky, G., 49, 517
 Pohl, R. F., 45
 Poldrack, R. A., 99, 114
 Polich, J., 32, 311
 Polivy, J., 119, 157, 576
 Pollak, S. D., 459, 485
 Pomerantz, E. M., 13
 Pomeranz, D., 599
 Pontius, A. A., 498
 Posick, C., 397, 517, 519, 520, 524
 Posner, M. I., 14, 16, 28, 29, 32, 33, 184, 186, 421, 422, 423, 458, 459, 460, 461
 Poster, W. R., 332
 Potenza, M. N., 356
 Pothos, E. M., 578
 Potjes, I., 206
 Potts, M. K., 497, 504
 Poulos, C. X., 583
 Poulton, R., 464
 Powell, J., 578
 Powell, M. C., 205, 553
 Power, T., 461
 Powers, R. B., 499
 Powers, T. A., 234, 235
 Powers, W. T., 4, 5, 210
 Prabhakaran, V., 422
 Prado, G. F., 187
 Prado, L. B. F., 187
 Pratt, T. C., 306, 516, 517, 518, 519, 520, 524, 525
 Prelec, D., 151, 554, 591, 596
 Prendergast, M., 449
 Presaghi, F., 273
 Pressman, S. D., 365
 Preston, J., 213, 313
 Preuss, D., 87
 Pribram, K. H., 4
 Price, J. L., 113, 115
 Prinz, W., 205, 213
 Prior, M., 505
 Prisco, T. R., 468
 Prochaska, J. J., 48, 50
 Proctor, R. W., 229
 Proffitt, D. R., 211, 259
 Pronin, E., 151
 Pronk, T. M., 86, 204, 211, 251, 252, 256, 266
 Przybylinski, E., 232
 Pu, J., 46
 Puga, D., 103
 Pugh, S. D., 327
 Pulkkinen, L., 371, 465
 Pungello, E. P., 429
 Purcell, J., 368
 Purdie-Vaughns, V., 448
 Pushkar, D., 482, 485
 Putnam, K. M., 117
 Putnam, S. P., 461, 462
 Pyszczynski, T., 31
 Quay, H. C., 504
 Quevedo, K. M., 371, 425
 Quigley, C., 208
 Quigley, K. S., 134
 Quilty, L. C., 352, 406
 Quinn, J. M., 98, 105
 Quinn, P. D., 381, 382, 384
 Quintana, D. S., 136
 Quirk, G. J., 113
 Quirk, S. W., 408
 Quoidbach, J., 369
 Rabi, R., 168
 Rabin, M., 596
 Rachlin, H., 146, 537, 554
 Radenbach, C., 100
 Radley, J. J., 426
 Radvansky, G. A., 481, 491
 Raes, F., 372
 Rafaeli, A., 324, 337
 Rafaeli-Mor, E., 33
 Raichle, M. E., 170, 196
 Raila, H., 364
 Raineri, A., 554
 Raio, C. M., 100
 Ramanathan, S., 46
 Ramey, C. T., 429
 Ramos, B. P., 420
 Ramsay, D. S., 13
 Ranby, K. W., 255
 Rand, D. G., 365
 Randolph-Seng, B., 206
 Rangel, A., 113, 173
 Rankin, C. H., 26
 Rao, A. R., 121
 Rao, H., 186
 Raphel, C., 188
 Rapson, R. L., 373
 Rasch, B., 121
 Rashid, T., 374
 Raskoff Zeiss, A., 166
 Rau, H. K., 135, 189
 Rau, P., 191
 Rauch, L. C., 372
 Rauch, W., 46
 Rausch, S. M., 33
 Raver, C. C., 418, 425, 429, 430
 Ravid, S., 337
 Raviv, A., 188
 Raviv, M., 120
 Rawn, C. D., 148, 572
 Rayburn-Reeves, R., 140
 Raymond, P., 266
 Raymond, J. E., 211
 Razza, R. P., 419, 430
 Read, D., 596
 Reading, S., 418
 Rebellon, C. J., 519
 Reber, R., 104
 Reck, S. G., 497
 Redden, J. P., 80
 Redick, T. S., 451
 Redish, A. D., 542
 Reeb, B. C., 428
 Regnerus, M. D., 308
 Reichardt, R., 72
 Reichle, E. D., 576

- Reid, G. J., 188
 Reinelt, T., 558
 Reis, H. T., 274, 287
 Reiser, M., 462, 465, 469
 Reisig, M. D., 306, 307, 310, 315, 524
 Reiter, A. M. F., 100
 Reitsma, M., 266
 Rempel, J. K., 247, 249, 250, 257
 Rempel-Clower, N., 113
 Ren, J., 50
 Renz, G. L., 324
 Rescorla, R. A., 549
 Resnick, S., 351
 Reuter-Lorenz, P. A., 121, 168
 Reyna, V. F., 148
 Reynard, A., 136
 Reynolds, A. J., 429
 Reynolds, B., 191, 348, 349
 Reynolds, S. K., 352
 Rhodes, R., 236
 Rholes, W. S., 294, 297
 Riccio, C. A., 497
 Richard, E. M., 327, 329
 Richards, J. B., 348
 Richards, J. M., 27
 Richards, M., 371
 Richards, P. S., 311
 Richeson, J. A., 86, 118, 168, 266
 Richmond, M., 576
 Richter, D., 486
 Richter, M., 306
 Ridderinkhof, K. R., 99, 116
 Riediger, M., 372
 Riefer, D. M., 66
 Riela, S., 190
 Righetti, F., 251, 252, 253, 256, 257, 258
 Rise, J., 541
 Risen, J. L., 82, 550
 Riskind, J. H., 383
 Ritter, M., 373
 Ritter, S. M., 211, 212, 252, 256
 Rivers, A. M., 72
 Rivkin, I. D., 548
 Roach, A. R., 136
 Robbins, M. L., 373
 Robbins, T. W., 104, 114, 345, 357, 419, 421
 Roberts, B. W., 307, 349, 352
 Roberts, G., 317
 Roberts, J. A., 49
 Roberts, J. C., 154
 Roberts, P., 591
 Robertson-Kraft, C., 381, 382
 Robins, R. W., 402, 487, 489
 Robinson, J. L., 461
 Robinson, M. D., 165, 357
 Robinson, P. A., 186
 Robinson, S. L., 248
 Robinson, T. E., 578
 Roby, T. B., 550
 RoCHAT, L., 234
 RoCHAT, S., 328
 Rockstroh, B., 30, 228, 560
 Rocque, M., 397, 517, 519, 520
 Rodgers, C. D., 192
 Rodriguez, M. I., 119, 499
 Rodriguez, M. L., 146, 534, 535
 Roediger, H. L., 157, 184
 Roefs, A., 86, 441
 Roelofsma, P., 32, 316
 Roemer, L., 34
 Reese, N. J., 31, 549, 550
 Roeyers, H., 497
 Rogers, R. D., 212
 Rogers, T., 154, 173, 450
 Rogosch, F. A., 467
 Rohrmann, S., 328
 Roll, J., 449
 Rollnick, S., 448
 Rollo, I., 139
 Rolls, E. T., 9
 Romeo, R. D., 428
 Romer, D., 408
 Ronan, K. R., 397
 Rosales-Lagarde, A., 189
 Rosay, A. B., 517, 519
 Rosch, E., 148
 Rose, P., 249, 287
 Roseman, M., 229
 Rosen, S., 554
 Rosen, Z. B., 172, 194
 Rosenbaum, D. A., 5, 11
 Rosenberg, E. L., 581
 Rosenthal, M. Z., 369
 Rosman, H., 51, 172
 Rosolack, T. K., 350
 Ross, J. M., 311
 Ross, L., 148, 158,
 Rotenberg, K. J., 254
 Roth, J., 515
 Rothbart, M. K., 14, 15, 31, 421, 423, 458, 459, 460,
 461, 463,
 Rothemund, Y., 119
 Rothermund, K., 32, 33
 Rothman, A. J., 576
 Rottenberg, J., 32, 34, 365
 Rounding, K., 51, 309, 313
 Rousseau, D. M., 248, 249
 Roussel, C., 213
 Rowe, R., 231
 Rozek, C. S., 387
 Rubel, T., 5
 Rubin, D. C., 119
 Rudman, L. A., 15
 Rueda, M. R., 14, 423, 460
 Ruff, H. A., 460
 Ruffman, T., 485, 486
 Rugle, L., 49
 Rumpf, A. L., 497
 R  nger, D., 95, 97, 103, 105
 Rupp, D. E., 323, 325, 335,
 Rusbult, C. E., 247, 250, 251, 273, 274, 276, 277, 285,
 287, 292
 Rush, C. R., 48
 Russell, V. A., 498
 Russell, V. M., 292
 Rusting, C. L., 371
 Ruys, K. I., 213
 Ryan, M., 485
 Ryan, R. M., 31, 82, 169, 192, 213, 443, 448, 551
 Ryans, D. G., 381

- Rydell, A., 254, 466
 Rydell, R. J., 63
 Ryding, E., 500
 Rylander, G., 114
- Sadeh, A., 188
 Sadosky, A., 465, 466, 467
 Saelens, B. E., 103
 Sagristano, M., 149
 Sagvolden, T., 498
 Saha, S., 113
 Sahlin, K., 139
 Sallquist, J. V., 462
 Salminen, S., 188
 Salmon, S. J., 47
 Salo, P., 188
 Salovey, P., 152
 Salters-Pedneault, K., 34
 Saltzman, H., 459
 Salvatore, J. E., 298
 Samaras, M. R., 500
 Sameroff, A. J., 465, 466
 Sampson, R. J., 521, 524
 Samson, A. C., 367
 Sanbonmatsu, D. M., 205, 553
 Sanders, M. A., 140
 Sanders, M. R., 288
 Sandler, I. N., 467
 Sandy, J. M., 407
 Sanfey, A. G., 114
 Sapolsky, R. M., 32, 141
 Sargent, J. D., 119
 Saroglou, V., 305, 306, 307
 Sarter, M., 184
 Sasota, J. A., 156
 Sassenberg, K., 227
 Sato, A., 213
 Saucier, G., 350
 Sauer, J., 193
 Saunders, B., 166
 Saus-Rose, E., 134
 Savelyev, P. A., 429
 Saver, J. L., 114
 Savino, N. S., 370
 Sawyer, D. A., 47
 Sayers, W. M., 578
 Sayette, M. A., 571, 572, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583
 Scabini, D., 487
 Scahill, R. I., 479
 Schaal, B., 64, 206, 228, 233
 Schacter, D. L., 549
 Schaller, M., 176
 Schamberg, M. A., 426, 427
 Scharf, C., 103
 Schatzberg, A. F., 428
 Schaubroeck, J., 188, 191
 Schechter, A., 189
 Scheibe, S., 30
 Scheier, M. F., 3, 4, 5, 6, 7, 10, 11, 13, 14, 16, 28, 29, 30, 35, 146, 166, 183, 191, 213, 223, 269, 275, 284, 305, 306, 312, 384, 385, 440, 549, 592, 593, 599, 602
 Schelling, T. C., 88, 542
 Scher, S. J., 542
- Scheres, A., 497
 Schewe, A. F., 325, 326, 327
 Schiffbauer, R., 191
 Schilling, E. A., 133
 Schimmack, U., 169
 Schlam, T. R., 408
 Schmeichel, B. J., 24, 29, 30, 43, 44, 46, 51, 65, 77, 79, 86, 87, 121, 153, 157, 165, 167, 168, 172, 173, 174, 176, 183, 184, 194, 204, 399, 400, 431, 432, 441, 446, 448, 451, 577
 Schmiedek, F., 372
 Schmitt, M., 273
 Schnall, S., 211, 259
 Schneider, I. K., 78
 Schnetter, K., 230, 556
 Schoenmakers, T. M., 578
 Schoepfer, A., 516
 Scholer, A. A., 409
 Scholey, A. B., 140
 Scholz, U., 47
 Schonberg, M. A., 462
 Schoofs, D., 87
 Schooler, J. W., 549, 550, 576
 Schooler, L. J., 539
 Schoorman, F. D., 250
 Schrage, J., 557
 Schreck, C. J., 520
 Schroeder, S. A., 76, 89, 264
 Schul, Y., 15
 Schulsinger, F., 165
 Schultheiss, O. C., 277
 Schultz, R., 235, 564
 Schulz, R., 14, 312
 Schuman, H., 480
 Schwabe, L., 100, 101
 Schwader, K. L., 423
 Schwartz, B., 390
 Schwartz, J., 449
 Schwartz, J. E., 577
 Schwartz, J. L., 118
 Schwartz, J. K. L.
 Schwartz, M., 365
 Schwartz, S. H., 5
 Schwarz, N., 10, 62, 104, 481
 Schwarzer, R., 47
 Schweiger-Gallo, I., 29, 30, 224, 226, 228
 Schweighofer, N., 540
 Schweickert, R., 226
 Schweinhart, L. J., 429
 Schweitzer, M. E., 49, 168
 Schweizer, L., 309
 Schweizer, S., 24
 Schwinghammer, S., 206
 Schwörer, B., 550
 Sciarappo, J., 553, 554
 Scott, B. A., 326, 328
 Scott, C., 485
 Scott, W. D., 579
 Sedikides, C., 31, 559
 Seery, M. D., 318
 Seeyave, D. M., 408
 Segal, N. L., 308
 Segal, Z. V., 374
 Segerstrom, S. C., 131, 132, 133, 135, 136, 137, 138, 140, 141

- Séguin, J. R., 355
 Seifer, R., 188
 Seifert, A. E., 266
 Selby, E. A., 390
 Self, E. A., 554
 Seligman, M. E. P., 157, 165, 252, 374, 382, 383, 430, 549,
 Sellers, C. S., 517
 Sephton, S. E., 133
 Sestir, M. A., 70
 Settles, R. E., 354, 355
 Settles, R. F., 354
 Sevincer, A. T., 553, 558, 559, 560
 Sezer, L. A., 236
 Shackelford, T. K., 317
 Shackman, A. J., 377
 Shadel, W. G., 579
 Shaffer, F., 134
 Shah, J. Y., 8, 206, 210, 211, 212, 266, 285, 385, 551, 592
 Shahab, L., 574
 Shallcross, S. L., 249, 297, 366, 370
 Shallice, T., 11, 86, 115, 207, 209
 Shamosh, N. A., 168
 Shanks, D. R., 203
 Shannis, D., 426
 Shariff, A. F., 314
 Sharkey, P. T., 429
 Sharma, E., 555
 Shaver, P. R., 274, 294
 Shaw, D. S., 462
 Shaw, P. J., 185
 Shea, C. T., 174
 Shea, D. F., 601, 602
 Sheeran, P., 24, 25, 29, 52, 88, 97, 204, 207, 208, 209, 214, 224, 225, 226, 227, 229, 230, 232, 235, 237, 266, 312, 449, 550, 551, 562, 563, 564
 Sheese, B. E., 460
 Shefrin, H. M., 146, 154, 159, 591, 596, 600, 601
 Sheikh, S., 310
 Sheldon K. M., 390, 443
 Shell, P., 422
 Shelton, A. L., 99
 Shelton, J., 266
 Shelton, J. N., 168
 Shelton, N., 387
 Shepard, S. A., 460, 463, 465,
 Shepperd, J. A., 152
 Sheppes, G., 28, 30, 34
 Sherman, D. A., 152
 Sherman, D. K., 448, 452
 Sherman, J. E., 120
 Sherman, J. W., 62, 63, 64, 65, 66, 67, 68, 70, 71, 72, 481
 Sheveland, A., 386
 Shi, Y., 172
 Shih, M., 388
 Shiffman, S., 573, 574, 575, 576, 577, 578, 579, 580
 Shinar, O., 407
 Shiota, M. N., 371, 372, 373
 Shimamura, A. P., 113
 Shimokawa, A., 485
 Shin, J. C., 11
 Shipstead, Z., 451
 Shirk, S. D., 140
 Shiv, B., 84, 88, 453
 Shmueli, D., 47, 48, 49, 50, 169, 172, 231, 517
 Shoda, Y., 4, 42, 119, 146, 397408, 462, 499, 534, 535
 Shull, A., 327
 Shulman, E., 382, 387, 389
 Shultz, S., 480
 Sibley, C. G., 290, 292
 Sieber, F. E., 132, 133, 139
 Sieber, W. J., 132, 133
 Siegel, S., 584
 Siersema, M., 254
 Siewert, K., 136
 Sigelman, J. D., 9
 Sijtsma, S. J., 208
 Silbersweig, D., 117
 Silk, J. S., 467
 Silva, P. A., 464, 524
 Silva, T. A., 187
 Silvanto, J., 212
 Silver, L. A., 69, 480
 Silverman, K., 449
 Silverman, R. A., 517, 519
 Silvia, P., 306
 Simen, P., 540
 Simon, H. A., 11
 Simons, L. G., 518
 Simons, R. L., 518
 Simpson, J. A., 247, 249, 259, 271, 285, 286, 287, 290, 291, 293, 294, 295, 296, 297, 298, 299
 Simpson, L. E.
 Simpson, S., 523, 526
 Simpson, S. S., 516, 524
 Sin, H. P., 337
 Singer, J. L., 549, 550
 Singmann, H., 230, 558, 562
 Sinha, R., 48
 Sitkin, S. B., 248
 Sjoerds, Z., 100
 Skatova, A., 99
 Skinner, B. F., 499
 Skinner, E. A., 430
 Skitka, L. J., 80
 Skorka-Brown, J., 84
 Sleeper, J., 48
 Slepian, M. L., 151
 Slessareva, E., 169, 171, 177, 194, 432
 Sloan, M. M., 328
 Slone, L., 571, 576
 Slotter, E. B., 42, 252
 Slutske, W. S., 464, 520
 Smallman, R., 236, 549, 550
 Smallwood, J., 549, 550
 Smeets, M., 85
 Smith, A. M., 117
 Smith, C., 308
 Smith, D. G., 345
 Smith, F. V., 138
 Smith, G. A., 349, 352, 353, 354, 355, 356
 Smith, G. T., 17, 85, 351, 354
 Smith, I. M., 432
 Smith, J., 277
 Smith, J. K., 189
 Smith, L. E., 84
 Smith, M. T., 190
 Smith, R. M., 420

- Smith, T. B., 247
 Smith, T. W., 135, 136, 140
 Smulders, F. T. Y., 578
 Snider, N. A., 467
 Sniehotta, F. F., 47
 Snowdon, D. A., 365
 Snyder, C. R., 28, 29
 Sokol-Hessner, P., 543
 Sokoloff, L., 139
 Solberg Nes, L., 133, 135, 136, 141
 Soll, J. B., 596, 597, 600
 Soman, D., 591, 593, 595, 596, 597, 598, 599, 600, 601
 Somerville, L. H., 117, 122, 397
 Sommers, S. R., 168, 488
 Sonntag, K., 335
 Sonuga-Barke, E., 497, 498
 Soto, C. J., 345, 487
 Soto, D., 212
 Sousa, C., 259
 Sowell, E. R., 426
 Sozou, P. D., 539
 Sparks, P., 231
 Sparrow, B., 213
 Spector, P. E., 328
 Spencer, J. P., 424, 425
 Spencer, S., 335
 Spencer, T. E., 133
 Spiegelhalter, K., 478
 Spijker, J., 368
 Spiller, S. A., 234, 235
 Spinrad, T. L., 459, 460, 461, 463, 464, 465, 466, 467, 468, 469, 470
 Spont, M. R., 356
 Spreen, M., 187
 Spreng, R. N., 549
 Spring, B., 576
 Srivastava, S., 30, 369
 Srull, T. K., 211
 Stacy, A. W., 582
 Stadler, G., 231, 564
 Stahl, D., 464
 Stahlberg, D., 45
 Staiano, W., 46
 Stairs, A. M., 354
 Stajkovic, A. D., 206
 Stanford, M. S., 348, 406
 Stanley, S. A., 500
 Stanovich, K. E., 15, 417, 498
 Stark, L. J., 103
 Stark, S., 352
 Stattin, H., 254
 Steeh, C., 480
 Steel, P., 403
 Steel, Z., 49
 Steele, C. M., 152, 443, 576, 577
 Steele, R. D., 298
 Stefano, G. B., 33
 Stefanucci, J. K., 259
 Stein, J. A., 517
 Stein, R., 372
 Steinberg, J., 33
 Steinberg, J. L., 17
 Steinberg, L., 346, 354, 372, 460, 467
 Steinberg, L. B., 254
 Steiner, D. D., 337
 Steketee, M., 519
 Steller, B., 595
 Stenger, V. A., 116, 422
 Stephan, E., 149
 Stephens, D. W., 542
 Stephens, E. J., 557
 Stern, C., 224, 232
 Stern, T., 483
 Sternthal, B., 51
 Stevenson, J., 504
 Stewart, B. D., 70, 228, 481, 482
 Stewart, E. A., 520
 Stiff, C., 43, 76, 99, 121, 140, 167, 194, 446
 Stifter, C., 462
 Stifter, C. A., 421, 426
 Stillman, T. F., 46
 Stillwell, D., 307
 Stine, M. M., 577
 Stocker, S. L., 273
 Stoekel, L. E., 119
 Stok, F. M., 43, 102, 165, 257, 384, 401
 Stokes, T. F., 497
 Stone, T., 374
 St-Onge, M. P., 189
 Stoolmiller, M., 48
 Stormshak, E. A., 120
 Stough, C., 334
 Strack, F., 14, 31, 79, 86, 159, 203, 346
 Strain, A., 389
 Straus, M. A., 519
 Striano, T., 464
 Striepe, M., 120
 Stritzke, W. G. K., 575
 Stroebe, W., 89, 155, 208, 211, 233, 431
 Stroop, J. R., 442, 446, 447, 460, 482, 483, 578, 582, 43, 49, 50, 52, 53, 66, 97, 115, 118, 121, 166, 170, 172, 309, 312, 348, 421
 Strotz, R. H., 542
 Struthers, H., 297
 Stucke, T. S., 120
 Stupnisky, R., 387
 Sturge-Apple, M. L., 254
 Stuss, D. T., 114, 418, 480
 Suchan, B., 486
 Suh, S., 367
 Sullivan, C. J., 516, 519
 Sullivan, J. R., 497
 Sullivan, M. W., 13
 Sullivan, N., 173
 Sullivan, R. M., 425
 Sullivan, S., 485
 Sulik, M., 423
 Sunstein, C. R., 82, 84, 88
 Suri, G., 30
 Sussman, S., 48
 Sutin, A., 351
 Sutter, F., 309
 Sutter, M., 255
 Sutton, R. I., 324, 335
 Svensson, R., 521
 Swann, A. C., 17, 348, 349
 Swann, W. B., Jr., 258
 Swanson, J., 462
 Swanson, L. M., 188
 Sweeny, K., 8

- Sweeney, A. M., 152
 Sweet, S. N., 448
 Sweldens, S., 135, 170
 Sy, M., 189
 Sznitman, S., 408
 Szpunar, K. K., 549

 Tabibnia, G., 396
 Tajima, E. A., 259
 Takarada, Y., 207
 Tam, L., 208
 Tamir, M., 29, 30, 367, 368, 369, 370
 Tan, Y. L., 315
 Tang, A. C., 428
 Tangney, J. P., 42, 43, 251, 252, 256, 273, 307, 355, 398, 403, 560
 Tannock, R., 498
 Tantleff-Dunn, S., 85
 Tao, T., 391
 Tapper, K., 85
 Taumoepeau, M., 485
 Tavares, H., 49
 Taylor, C., 521
 Taylor, H. L., 193
 Taylor, J. R., 356
 Taylor, M. F., 497
 Taylor, S. E., 31, 157, 214, 259, 548, 549, 550, 551
 Taylor, Z. E., 463, 464, 468, 470
 Teachman, B. A., 62
 Teasdale, J. D., 157, 374
 Teevan, J. J., 516
 Tellegen, A., 8, 308, 348, 370
 Tempesta, D., 189
 Temple, J. A., 429
 Tenbült, P., 52
 Tenenbaum, J. B., 535, 536, 537, 539
 Tennen, H., 32, 133
 Teper, R., 204, 452
 Terrell, H. K., 316
 Terry, D. P., 372
 Tesch-Römer, C., 383
 Tesher, H., 426
 Tesser, A., 13, 27, 31, 32, 157, 277, 549, 595
 Tessitore, A., 117
 Teta, P., 353
 Thaler, R. H., 82, 84, 88, 146, 154, 159, 591, 596, 600, 601, 602
 Thayer, J. F., 134, 367
 Thayer, R. E., 337
 Thewissen, R., 85
 Thibaut, J. W., 285
 Thoeny, A. L., 497
 Thoits, P. A., 277
 Thoma, P., 486
 Thomas, G., 286
 Thomas, M., 185
 Thomasi, D., 196
 Thompson A. S., 390
 Thompson, M., 465
 Thompson, P. M., 426
 Thompson, R. A., 28, 332, 333, 336, 365, 508
 Thompson, T., 206
 Thompson-Schill, S. L., 114
 Thorell, L. B., 254
 Thoresen, C. E., 84
 Thoresen, C. J., 326
 Thorpe, J., 557
 Thorson, K. R., 563
 Thürmer, J. L., 225, 231
 Tibbetts, S., 517
 Tice, D. M., 16, 28, 32, 42, 43, 50, 54, 70, 76, 88, 89, 120, 153, 165, 166, 167, 172, 193, 225, 251, 273, 278, 326, 384, 398, 431, 443, 517, 522, 541, 571, 572, 573, 576, 592
 Tiffany, S. T., 84, 572, 573, 576, 577, 579, 580, 581, 584
 Tiggemann, M., 79, 84
 Ting, A., 426
 Titova, O. E., 188
 Tirado-Strayer, N., 429
 Tittle, C. R., 49, 397, 516, 517, 518, 519, 522, 523
 Tivarus, M. E., 420
 Tobin, V. J., 448
 Toburen, T. M., 312, 316
 Toga, A. W., 426
 Tolley-Schell, S. A., 485
 Tolman, E. C., 549
 Tombor, I., 574
 Tomiyama, A. J., 85
 Tomporowski, P. D., 140
 Toney, L., 85
 Tong, E. M. W., 315
 Tononi, G., 185
 Tontsch, C., 497
 Tooby, J., 173, 176, 184
 Topciu, R. A., 234
 Toplak, M. E., 498
 Torelli, C. J., 149
 Tottenham, N., 16
 Totterdell, P., 333, 337
 Touré-Tillery, M., 173
 Tow, P. M., 116
 Towse, A., 558
 Trace, S. E., 189
 Tracy, A., 308
 Tracy, J. L., 489
 Trainor, R. J., 124
 Trampe, D., 170
 Tran, S., 296
 Tranel, D., 114
 Travaglia, L. K., 292
 Travis, T., 577
 Traystman, R. J., 139
 Treadway, D. C., 325
 Treanor, J. J., 365
 Trejos-Castillo, E., 307
 Tremblay, C., 259
 Tremblay, R. E., 355
 Treyer, V., 115
 Triandis, H. C., 560
 Tricomi, E., 97
 Troetschel, R., 206
 Trommsdorff, G., 468
 Trost, K., 254
 Trötschel, R., 228, 229
 Trope, Y., 12, 13, 16, 52, 63, 147, 148, 149, 150, 151, 152, 154, 156, 158, 159, 170, 273
 Trougakos, J. P., 327, 328, 332
 Troy, A. S., 189, 366
 Tsang, J.-A., 308, 309

- Tschan, F., 328, 337
 Tsuchiya, N., 212
 Tsukayama, E., 383, 387, 408
 Tucker, A. M., 186
 Tucker, D. M., 417, 420
 Tucker-Drob, E. M., 354
 Tugade, M. M., 32, 365, 369
 Tuk, M. A., 135, 170, 177
 Tull, M. T., 34, 369
 Tullett, A. M., 312, 316
 Turanovic, J. J., 516
 Turin, A. C., 47
 Turk, C. L., 369
 Turnbull, K., 188
 Turner, M. A., 103
 Turner, M. G., 516, 525
 Turner, R. B., 365
 Turner, S., 517, 518
 Tversky, A., 157, 549, 596
 Twenge, J. M., 120, 266
 Tyler, J. M., 53

 Uchino, B. N., 277
 Ullsperger, M., 116, 422
 Ulmer, J. T., 306
 Umberson, D., 489
 Unrod, M., 584
 Urry, H. L., 28, 117, 372
 Ursache, A., 426, 462

 Vaidya, J., 8
 Valiente, C., 460, 461, 462, 464, 465, 466, 467, 469, 470
 Vallacher, R. R., 5, 159, 205
 Vallerand, R. J., 390
 van Aken, M., 468
 Van Cauter, E., 133
 Vance, S. L., 118
 Vancouver, J. B., 35, 207
 Van de Laar, M., 187
 vanDellen, M. R., 174, 252, 255, 266, 267, 284
 van den Eijnden, R. J. J. M., 253
 Van der Helm, E., 189
 Vander Heyden, K., 254
 Van der Linden, M., 17, 213, 234
 van der Pligt, J., 310
 Van Der Veen, F. M., 134
 van der Weiden, A., 213
 Van der Wulp, N., 33
 van de Vijver, I., 99
 Van Dillen, L. F., 27, 31, 77, 78, 79, 80, 84, 204
 Van Dongen, H. P. A., 185, 186
 van Dulmen, M., 259
 Van Egeren, L. F., 350, 351, 353, 402
 van Gaal, S., 203
 van Gelder, J.-L., 403, 404, 591
 van Harreveld, F., 78, 310
 Van Hecke, W., 397
 van Hooft, E. A. J., 398
 Van Jaarsveld, D. D., 332
 van Knippenberg, A., 208
 van Koningsbruggen, G. M., 206, 211, 233
 Van Lange, P. A. M., 247, 250, 252, 259, 272,
 Van Loh, T. D., 516
 van Oosten, J. M. F., 233

 van Reekum, C. M., 117
 van Schie, H. T., 211, 252
 van't Riet, J., 208
 van Tuijl, C., 468
 Van Veen, V., 421
 Van Zundert, R. M. P., 579
 Vasey, M. W., 372, 483
 Vater, T., 485
 Vaughan, J., 5, 562
 Vaughan, W., 151
 Vaughn, M. G., 516
 Vazsonyi, A. T., 307, 516, 517, 519, 520
 Veenstra, L., 30
 Veling, H., 89, 206
 Veltkamp, M., 211
 Vendrell, P., 115
 Venkatraman, V., 186, 191
 Vennewald, N., 136
 Verbeek, I., 187
 Verhoeven, A. A. C., 234
 Verhofstadt, L. L., 374
 Verhulst, F. C., 465
 Vermulst, A. A., 252, 253
 Verplanken, B., 208
 Verwijmeren, T., 266
 Vey, M. A., 324, 327
 Viding, E., 86
 Vidmar, M., 470
 Villarroel, N. A., 120
 Villringer, A., 100
 Vinkers, C. D. W., 224
 Visher, C., 515
 Vishwanath, A., 102
 Visserman, M., 252, 256
 Voegtline, K., 426, 462
 Voelkle, M. C., 372
 Vogt, B. A., 115
 Vohs, K. D., 8, 24, 43, 44, 45, 47, 51, 52, 55, 62, 70, 77, 81, 82, 83, 86, 99, 101, 121, 148, 153, 157, 165, 166, 167, 168, 169, 172, 174, 183, 194, 204, 225, 251, 256, 266, 273, 431, 432, 443, 448, 519, 522, 560, 572, 576, 592
 Voils, C. I., 64
 Volkow, N. D., 196
 Vollstädt-Klein, S., 79
 Volokhov, R. N., 30, 441
 Volpp, K. G., 449
 Vonasch, A. J., 44, 47
 von Bertalanffy, L., 4
 Von Culin, K. R., 383
 von Hippel, W., 62, 69, 86, 480, 481, 482, 483, 484, 486, 488, 489, 491
 von Suchodoletz, A., 468
 Voorneman, I., 562
 Vosgerau, J., 550
 Voss, A., 32
 Vroom, V. H., 305, 313

 Wadhwa, M., 88
 Waegeman, A., 397
 Wakslak, C. J., 156, 158
 Wallace, J. C., 327, 334
 Walton, G. M., 52, 171, 225, 266, 307, 432, 450
 Waltz, J. A., 419
 Wager, T. D., 418

- Wagner, D. D., 79, 80, 84, 116, 119, 120, 122, 134, 140, 168
Wagner, D. T., 188, 326, 327, 328
Wagner, G., 353
Wagner, G. G., 372
Wakslak, C., 156, 158
Walker, M. P., 117, 185, 189
Walker, R. D., 577
Wall, S., 298
Waller, N. G., 348
Walsh, D., 174
Wan, E. W., 51, 120, 152, 153
Wan, H. C., 334
Wang, C., 593
Wang, G. J., 196
Wang, J., 44
Wang, Y., 462, 467, 468
Wänke, M., 50, 84, 172, 309
Wansink, B., 84, 103, 171
Ward, A., 85, 192, 444
Ward, D. A., 517, 522
Warlop, L., 45, 170
Warren, C. R., 326
Wasel, W., 64, 206
Wastell, D. G., 193
Waszak, F., 213
Waters, A. J., 578
Waters, E., 298
Watkins, E., 157
Watkins, P. C., 374
Watson, A., 390
Watson, D., 8, 9, 187, 350
Watson, T. L., 372
Watson, T. W., 324
Watt, A., 209
Watterson, K., 306, 309, 310
Waugh, C. E., 365
Wax, A., 326
Weafer, J., 348, 349
Weatherly, J. N., 316
Webb, T. L., 24, 25, 27, 29, 30, 33, 52, 88, 97, 209, 225, 226, 227, 229, 230, 234, 237, 329, 333, 334, 335, 336, 563
Weber, E. U., 120
Weber, H., 136
Webster, C. D., 346
Weed, N. C., 408
Wegner, D. M., 5, 85, 86, 159, 205, 213, 266, 310, 313
Weinberg, A., 136
Weinberg, B. M., 266
Weinberg, L. E., 387
Weinberger, D. R., 117
Weiner, B., 251
Weisbuch-Remington, M., 318
Weisburd, D., 524
Weiss, A., 42
Weiss, H. M., 327
Weiss, N. H., 34
Weiss, F., 581
Weiss, R. L., 289
Wellford, C. F., 521
Wellman, H. M., 466
Welsh, M. C., 498
Welt, L., 111, 113
Wendt, M., 558
Wentura, D., 32
Werle, C. O. C., 171, 174, 177
Wertz, J. M., 574, 575, 578, 580, 581
Wesensten, N. J., 191
West, R., 574, 578
West, R., F., 498
West, R. L., 419, 479
West, S. G., 467
West, T. V., 232
Westbrook, C., 85, 575
Westen, D., 31
West-Eberhard, M. J., 425
Westphal, M., 30, 336
Wexler, B. E., 119
Weytens, F., 374
Whalen, P. J., 119
Wharton, A. S., 324, 326
Wheatley, T., 213, 550
Wheeler, W., 195
Wheelwright, S., 486
White, L. K., 460
White, T. L., 407
Whiteford, S. W., 48
Whiteside, S. P., 17, 345, 346, 348, 351, 352, 353, 354, 357, 359, 406
Whitney, G. A., 292
Whitney, P., 186, 191
Whitson, J., 315
Whitton, S., 276
Whitty, C. W., 116
Widaman, K. F., 463
Wiebe, R. P., 520
Wiebe, S., 188, 418
Wieber, F., 225, 227, 231, 232, 234, 236, 237
Wiener, N., 4
Wientjes, C. J. E., 33
Wiers, R. W., 62, 86, 89, 273, 578, 582
Wiese, D., 8
Wieselquist, J., 250, 251, 259, 276
Wigboldus, D. H. J., 86, 211, 252
Wigfield, A., 430
Wikenheiser, A. M., 542
Wikler, A., 573
Wikström, P. O., 521
Wilbarger, J. L., 79
Wildenbeest, M., 206
Wilhelm, F., 25
Wilhelm, F. H., 135
Wilhelm, H., 560
Wilkerson, W., 517
Wilkinson, A., 380
Wilkinson, H., 116
Wilkowski, B. M., 357
Willcutt, E. G., 497, 498, 504, 505
Willenbring, M. L., 577
Williams, C., 139
Williams, C. J., 63
Williams, G. C., 448
Williams, J. M. G., 374
Williams, K. D., 120
Williams, L. A., 367
Williams, L. E., 373
Williams, L. M., 259
Williams, M. W. M., 397
Williams, P. G., 135, 189

- Willingham, W. W., 382
 Willoughby, B. L. B., 307, 316
 Willoughby, M., 418
 Willoughby, M. T., 460
 Wills, T. A., 48, 407
 Wilson, D. H., 116
 Wilson, G. T., 573, 581
 Wilson, J. P., 211
 Wilson, N. L., 408
 Wilson, S., 371, 429
 Wilson, S. J., 580, 581
 Wilson, T. D., 68, 387, 550, 581
 Wing, R. R., 32, 366
 Wink, P., 308
 Winkielman, P., 79, 104
 Winsler, A., 311, 504
 Winter, M. A., 254
 Winterheld, H. A., 297
 Winters, N. F., 131
 Wirth, R. J., 418, 460
 Wirtz, J., 337
 Wisneski, D. C., 80
 Witkiewitz, K., 120
 Wittchen, M., 230
 Wittekind, J. E. C., 516
 Wittenberg, L., 120
 Wittenbrink, B., 63, 64
 Witt Huberts, J. C., 196
 Witzki, A. H., 86
 Wolf, O. T., 87, 100, 101
 Wolfe, C. T., 443
 Wolfe, S., 189
 Wolfe, S. E., 306
 Wolff, J. M., 464
 Wolfson, A. R., 188, 195
 Wolpert, D. M., 209, 213
 Wolters, C., 384
 Woo, J. C., 371
 Wood, C., 43, 76, 99, 105, 121, 140, 167, 194, 446
 Wood, P. B., 517
 Wood, W., 43, 95, 96, 97, 98, 101, 102, 103, 104, 105, 208, 209
 Woodward, K., 374
 Woodward, N. D.,
 Woody, S. R., 62
 Woolf, E. F., 327
 Worhunsky, P. D., 135
 Wortman, C. B., 13
 Wrase, J., 119
 Wright, B. R. E., 524
 Wright, J. P., 516
 Wright, K. A., 516
 Wright, R., 499
 Wright, R. A., 187, 554, 558
 Wrosch, C., 14, 312
 Wu, G., 592
 Wu, J. C., 185
 Wu, M., 97
 Wu, W. H., 152
 Wyer, R. S. J., 211
 Wyland, C. L., 117
 Yamagishi, T., 249
 Yang, J., 329
 Yang, T., 335
 Yap, M. B. H., 469
 Yasuda, A., 213
 Yates, T., 259
 Yatomi, N., 494
 Yeager, D. S., 387
 Yeganeh, T., 307
 Yerkes, R. M., 420, 427, 431
 Yeung, N., 29
 Yim, C. Y., 79
 Yoo, S. S., 117, 189
 Yook, K., 367
 Yoon, C., 482
 Yoon, J. E., 465
 Young, B. N., 461
 Young, K. S., 253
 Young, V., 382, 387
 Youngstrom, E. A., 504
 Youyou, W., 307
 Yu, A. J., 173
 Yurgelun-Todd, D. A., 120
 Yusainy, C., 172, 174
 Zacks, R. T., 479
 Zadra, J. R., 211
 Zadro, L., 120
 Zajonc, R. B., 205
 Zalewski, M., 466
 Zammit, A., 234
 Zanna, M. P., 236, 247, 550, 576
 Zapf, D., 328
 Zapolski, T. C. B., 17, 354
 Zauberman, G., 151
 Ze, O., 486
 Zeelenberg, M., 11
 Zehr, C. E., 236
 Zeidner, M., 353
 Zeiss, A. R., 166, 407, 534
 Zelazo, P. D., 419, 424, 432
 Zelizer, V. A., 600
 Zentall, T. R., 140
 Zhang, H., 50
 Zhang, J., 549
 Zhang, K., 135, 170
 Zhang, L., 8, 83
 Zhang, S., 353
 Zhang, Y., 275, 595
 Zhao, M., 151, 591, 599
 Zhou, E. S., 425
 Zhou, Q., 423, 458, 461, 462, 465, 466, 467, 468, 469, 470
 Zhuo, Y., 591
 Ziaie, H., 31
 Zimmer-Gembeck, M. J., 430
 Zimmerman, G. M., 517, 520, 521
 Zinman, J., 600
 Zinser, M. C., 120, 581
 Zoladz, P. R., 420, 421
 Zuckerman, M., 346, 350, 353, 356, 358, 359, 407
 Zuffante, P., 116
 Zuffianò, A., 464
 Zyphur, M. J., 326, 336

Xiao, S., 172
 Xie, L., 185

Subject Index

- Ability, 250
 - to self-regulate, 306–312
- Abstinence self-efficacy, 579
- Abstraction, 148
- Acceptance, 85
- Achievability, 595
- Acquiescence, 580–583
- Action orientation, 52–53, 409
- Activation
 - control, 459, 467
 - of expectations, 556
- Adaptive cognitive processes, 210
- Addiction, 47–48, 571–584
- Affect, 5–13
 - and feedback processes, 5–7
 - negative, 6, 13, 120, 189, 573
 - positive, 6, 12, 50, 189, 205–207
- Agents of regulation, 284
- Aging, 479–491
 - positive versus negative social consequences of, 488–489
- Alpha, 355
- Anarchy, 147
- Antecedent-focused strategies, 330–335
- Approach-avoidance, 406–407
- Arched-back nursing, 427
- Arousal, 185–186
- Assessment, 409
- Assistance, 277
 - effect, 278
- Attachment, 520
 - insecurity, 293–301
- Attention
 - effortful, 183–184, 186–187
 - involuntary, 184
- Attention-deficit/hyperactivity disorder, 497–510
- Attentional
 - bias, 578
 - control, 458, 467
 - deployment, 333–334
 - inertia, 424
 - set shifting ability, 418
- Automatic
 - biases, 228, 482
 - desire, 79, 158
 - enrollment, 601
 - self-regulation, 203–215
- Automaticity, 63
 - strategic, 226–227
- Basal metabolic rate, 265
- Behavior change interventions, 230
- Behavioral
 - inhibition, 498
 - restraint, 189–190
- Belief, 520, 549
 - versus free thought, 549–550
- Benevolence, 250
- Beta, 355
- Capacity for self-control scale, 399–409
- Category/exemplar task, 151
- Central governor theory, 138
- Coasting, 10–11
- Cognitive
 - change, 334–335
 - control, 28–29, 165
 - dissonance, 327
 - flexibility, 418
 - models, 444, 449–450
 - neuroscience, 111
 - processes, 44, 62–63, 66, 210–212, 557–558
 - reappraisal, 85
- Color-naming task, 578
- Commitment, 520
- Comparator, 593
- Compensation, 195
- Compensatory response, 183

- Compulsive Internet use, 253
- Concentration, 334
- Conscience, 463
- Conscientiousness, 307, 350–353, 402–405
- Conservation bias, 196
- Consistency
 - of effort, 381
 - of interest, 381
- Construal
 - level, 51
 - level theory, 148–150
 - low-level, 148–160
 - high-level, 148–160
- Control, 63, 147–148, 459
- Controlled processes, 63
- Coping, 578–579
 - response, 578–579
- Corrective action, 598–602
- Counter-productive work behaviors, 332
- Counter-regulation, 32–33
- Craving, 78, 118–119, 574, 580–584
- Crime, 514–526
 - empirical analyses of, 516
 - theories of, 524
- Criminality, 515
- Critical fusion frequency, 53
- Crystallized/knowledge-based intelligence, 422

- Deep acting, 325–327, 329–330
- Defensive information search, 152
- Delay discounting, 316
- Delay of gratification, 407–408, 534–544
 - failure, 534
- Depression, 483–484
- Desire, 76–90
 - appetitive, 77
- Desire regulation, 82–90
 - preventive/anticipatory, 82–84
 - down-regulation, 84–86
 - inhibition/overriding, 86–89
- Devalued, 97
- Development of targeted interventions, 373–374
- Dimensional attention, 425
- Directed attention fatigue, 194
- Dissent, 153
- Distraction, 333
 - active, 333
 - passive, 333
- Distributed decisions, 591
- Doer, 596, 601
- Down-regulation, 26, 372–374
 - of negative emotions via positive emotions, 367
 - of positive emotion, 367
 - of positive emotion via negative emotion, 367
- Dual-process
 - models of functioning, 14–16
 - view, 16
- Dual-task paradigm, 43
- Durability, 452–453
- Dwelling, 555, 560

- Ecological immunology, 137
- Efference copies, 213
- Effort, 271
- Effortful attention, 183–184, 186–187
- Effortful control, 423, 458–471
 - development of, 460
 - and emotionality, 461–463
 - and moral development, 463–464
 - and social competence, 464–467
- Ego, 43
- Ego depletion, 43–56, 153, 166, 169–177, 193–196, 225, 251–253, 308–309, 326
- Emotion, 25
 - contagion, 373
 - recognition, 485–486
- Emotion regulation, 24–36, 45–46, 116–117, 188–189, 323, 329–337, 364–374, 459, 487
 - extrinsic, 333
 - goal-oriented models of, 28
 - and impulse, 45–46
 - need-oriented, 31–32
 - neural bases of, 116–117
 - person-oriented, 32–33
 - the process model of, 27–28
 - training of, 33–34
 - See also* Self-regulation
- Emotional
 - display rules, 324, 326, 328
 - labor, 323–337
 - responses, 486
 - sensitivity, 25–26
- Empathy, 463–464, 486–487, 598–599
- Energization, 558
 - low, 554–555
- Entry gradient, 25
- Equifinality, 97
 - sets, 386
- Escalation of commitment, 225
- Everyday Temptations Study, 81–82
- Executive
 - act, 500
 - attention, 422, 460
 - control, 483–491
- Executive function, 112, 165, 183–186, 189–196, 417–433, 441, 479–485, 498–510
 - as an extended phenotype, 502–509
 - and human development, 419
 - measurement of, 418, 432
 - self-directed actions of, 500–501
- Exit gradient, 26
- Exogenous, 421
- Expectancy, 387
- Expectations, 550
- Expressive suppression, 336
- Extended phenotype levels, 502–504
- Extended utilitarian zone, 503–504
- Extrinsic religiosity, 311

- Feedback loop, 4–7
- Flexibility, 501
- Fluency, 501
- Fluid intelligence, 422
- Follow-through, 382
- Free thought, 549–550

- Gambling, 49, 484, 490
- Generalizability, 442, 452
- Generativity, 501
- Generic timing hypothesis, 28

- Glucose, 139–140
- Goal, 3, 81–82, 103–104, 147, 155–156, 183–184, 190–196, 203–215, 265–279, 384–390, 440–441, 444, 507–508, 592–596, 599–602
 - abstinence/restraint, 81
 - achievement-related, 81
 - attainment, 4, 223–227, 236–238
 - content, 269
 - coordination, 266
 - disengage from, 224
 - efficacy, 270, 274
 - general constructs, 272, 276
 - health, 81
 - outcome, 272, 275–276
 - parallel partner-oriented, 269
 - parallel self-oriented, 269
 - partner-oriented, 269
 - priority, 183, 195–196
 - pursuit, 270–271, 274–276, 284–285, 558–562, 592, 595–596
 - relevant orientations, 273
 - relevant resources, 273
 - self-oriented, 269
 - setting, 592, 595
 - shared system-oriented, 269
 - shared target-oriented, 269
 - social, 81
 - standard, 269
 - striving, 223–238, 441, 595
 - support, 277–278
 - system-oriented, 269
 - time-use, 81
 - value, 270
- Goal concept, 3
- Goal-setting theory, 238
- Grit, 380–391, 408
 - measurement of, 381–382
 - motivational, cognitive, and behavioral correlates of, 383–384
- Growth mindset, 383
- Habit, 95–105, 207–210
- Habituation, 26
- Harm avoidance, 407
- High-persistence environment, 537–540
- Homeostasis, 4
- Ideals, 9
- Impeding, 556
- Imperfect recall, 601
- Implementation
 - intention, 88, 223–238, 562–564, 580
 - plan, 30
- Implicit Association Test, 155, 481–482
- Implicit measure, 63–73
 - and goal construal, 65
 - and goal-driven processes, 64
 - models, 66
 - and reactive correction, 65–72
- Improvement, 440–442
- Impulsivity, 345–358, 406, 515, 526
 - measurement of, 348–349
- Indulging, 555, 560
- Induration, 132
- Inhibition, 154, 192, 211, 480–484
 - behavioral, 498
- Inhibitory control, 418, 441, 459–460, 465
- Instrumental–self-directed, 502–503
- Intention–implementation gap, 596, 601
- Internal locus of control, 383
- Internalities, 151
- Intrinsic religiosity, 311
- Invariance, 518–519
- Involvement, 520
- Knowledge, 227,
 - based intelligence, 422
 - structures, 207–208
- Labeling, 600
- Levels of abstraction, 5
- Limited-persistence environment, 537–540
 - ubiquity of, 538–539
- Limited resource model, 52, 167, 431. *See also* Ego depletion
- Locomotion, 409
- Logrolling, 159
- Low Self-Control Scale, 397–398, 401, 403–404
- Maintenance, 27
- Means, 271
- Melioration, 151
- Mental
 - accounting, 596–597
 - attainment, 553–554
- Mental contrasting, 555–564
 - evidence of, 556–557
 - with implementation intentions, 562–564
 - as an intervention, 561–562
 - mechanisms of, 557
 - spontaneous, 559–560
- Mesolimbic dopamine system, 118
- Methodical–self-reliant, 502–503
- Michelangelo phenomenon, 276
- Mindfulness, 31, 85, 335–336
 - training, 550
- Misregulation, 120, 571–573
- Moderators of if–then plans, 232–236
 - contextual features, 235–236
 - features of if–then plans, 232–234
 - features of planning person, 234–235
 - features of targeted goal, 235
- Monitoring, 575–576, 598–599
- Morality, 521
- Motivation, 78, 159, 174–175, 250–251, 305–306, 313–314, 316–318, 383, 451, 501, 507–508, 592
 - self-regulatory, 313
- Motivational
 - models, 175–176, 443–444, 448–449
 - processes, 558
- Multinomial modeling, 66–73
- Negative direct tactics, 290–293
- Negative indirect tactics, 290–293
- Nudging, 157–158
- Operating conditions, 64
- Operating principles, 64
- Opportunity, 62, 277, 517–518, 523
 - effect, 278
- Optimistic explanatory style, 383

- Output function, 593
- Overpersistence, 541
- Parallel-processing capacity, 193
- Partitioning, 600
- Partner
 - buffering, 284, 295–301
 - efficacy, 270
 - regulation, 284–301
- Passion
 - harmonious, 390
 - obsessive, 390
- Peer effects, 599–600
- Perseverance, 353, 381
- Persistence, 190, 533–544
 - adaptive calibration of, 539–543
- Personal
 - attributes, 227
 - goal content, 269
- Personality, 345–358, 370, 402–408, 410
- Perspective taking, 335, 486
- Physiological response modulation, 336–337
- Planner, 596, 601
- Plasticity, 355, 402, 404–405
- Polyregulation, 373
- Positive
 - affect, 6, 12, 50, 189, 205–207
 - thinking, 548–549
- Positive-direct tactics, 290–293
- Positive emotion, 365
 - dampening of, 372
 - magnitude of, 368
 - situation of, 368–369
 - stability of, 369
 - striving for, 369–370
- Positive emotion dysregulation, 364–374
 - future of, 372
- Positive emotion regulation, 365–366, 368–372
 - individual differences in, 370–372
- Positive fantasy, 550–559
 - dark side of, 552–555
 - mechanisms of, 553–555
- Positive future thought, 548–549
- Positive-indirect tactics, 290–293
- Precommitment, 88, 542–543, 602
- Prefrontal cortex (PFC), 112–122, 419–422, 426–428
- Premeditation, 352–353
- Principle, 5
- Principled
 - mutualistic activities, 503
 - structure, 147
- Priority management, 11–14
- Process model, 172–175
 - strengths and weaknesses of, 174–175
 - See also* Shifting priorities model
- Process-specific timing hypothesis, 28
- Processes
 - cognitive, 44, 62–63, 66, 210–212, 557–558
 - motivational, 558–559
- Program of action, 5
- Psychological inertia, 577
- Psychopathology, 17
- Quadruple process model, 67–70
 - applications of, 68–70
- Reappraisal, 85, 335
- Reference value, 593
- Reflexive (impulsive) response, 228–230
 - affective, 228
 - behavioral, 229
 - cognitive, 228
- Relational goal content, 269
- Religion, 305–318
- Religiosity
 - extrinsic, 311
 - intrinsic, 311
- Reprioritization, 12
- Resource
 - depletion, 225
 - model, 167–172
- Response
 - focused strategies, 330,
 - inhibition, 499
 - modulation, 335–336
- Responsiveness, 277
 - effect, 278
- Restraint, 192
 - behavioral, 189–190
- Reverse contrasting, 555, 560
- Revised resource model, 168–169, 175–176
- Right-wing authoritarianism, 486
- Risk, 191
- Savoring, 581
- Scalability, 453
- Self-agency, 212–214
- Self-conscious emotion, 487–489
 - negative, 487
- Self-control, 3, 16–17, 42–56, 95–105, 153–160, 165–177, 251–260, 345, 384–390, 396–410, 441, 498–499, 514–526, 533
 - behavioral signals of, 257–258
 - conceptualization and measurement of, 522–523
 - by continuation, 399
 - development of, 519–520, 525–526
 - individual differences in, 187–188
 - by inhibition, 399–400, 404–410
 - by initiation, 399–400, 404–410
 - interventive, 83
 - measures of, 396–402
 - nonconscious initiation of, 155–156
 - and personality, 402–405
 - prospective, 154
 - and psychopathology, 17
 - resource model of, 167–172
 - rule-governed, 542–543
 - scale, 398–405, 408–409
 - See also* Self-regulation
- Self-evaluation maintenance model, 277
- Self-licensing, 195
- Self-regulation, 3, 63–73, 76–77, 111–123, 131–141, 146–153, 156–160, 182–184, 187–196, 203–215, 265–279, 284, 288–289, 305–318, 326, 368–369, 380, 409–410, 417, 419–433, 440, 462, 466–470, 487–491, 498–499, 508–509, 515, 560, 571–584, 592–603
 - automatic, 203–215
 - capacity for, 183, 192–196
 - cognitive models of, 444, 449–450
 - conceptual issues of, 63–64
 - and financial well-being, 592–603

- Self-regulation (*cont.*)
 - functional organization of, 112–116
 - motivational models of, 443–444, 448–449
 - and neuropsychology, 111–123
 - physiology of, 131–141
 - processes, 595–598
 - strength model of, 121, 443, 445–448
 - See also* Self-control, Emotion regulation, Desire regulation
- Self-regulation training, 442–454
 - conceptual issues in, 451
- Self-regulatory
 - depletion, 120–122
 - motivation, 313
 - power, 548
 - strength, 576–582
- Self-regulatory failure, 571–584
 - neural basis of, 116–120
- Sensation seeking, 353–354, 407
- Shifting priorities model, 172–175. *See also* Process model
- Situation modification, 27, 332
- Situation selection, 27, 332, 487
- Skill, 227, 273, 306–318
- Sleep, 182–196
 - deprivation, 117, 185–196
 - disruption, 185–196
 - quality, 185–188
 - restriction, 185–188
- Social interactions, 232
- Somatic markers, 501
- Specificity, 595
- Speed governors, 592
- Spoiled pleasure, 82
- Spontaneous mental contrasting, 559–560
 - variables of, 559–560
- Stability, 355, 402–403, 518
- Standards, 573–576
 - setting of, 573–575
- State orientation, 52–53, 409
- Stereotype Misperception Task, 70
- Strain tests, 297
- Strategic, 502
- Strategic-cooperative, 502–503
- Stress, 100
- Structure, 147
- Surface acting, 325–327, 329–330
- Tactical, 502
- Tactical-reciprocal, 502–503
- Targets of regulation, 284
- Temporal
 - discounting, 150–151
 - limits, 193
 - uncertainty, 535
- Theory of mind, 486
- Time-varying reassessment, 535
- Training, 440–442
 - transfer, 442
- Transactive
 - density, 266, 278
 - gain, 267, 272
 - goal conflicts, 271
 - loss, 272
- Transactive goal dynamics, 266–279
 - process framework, 268–278
- Transcendence, 575
- Transfer, 385
- Transference, 232
- Trust, 247–260
- Trustee, 248, 258
- Truster, 248, 258
- Underregulation, 571
- Unstable choice, 347
- Up-regulation, 27, 374
 - of positive emotion, 367
- Urgency, 354–355
- Value, 191, 387
- Versatility, 518
- Vigilance, 185–186
- Vigilant monitoring, 98
- Wake state instability hypothesis, 186
- Why/how task, 150
- Willpower, 99–100, 227–230
- Work withdrawal, 332
- Working memory, 418