In Handbook of Self-Regulation: Research, Theory, and Applications. (2004). R. F. Baumeister & K. D. Vohs (Eds.) New York: Guildford Press.

6

Willpower in a Cognitive–Affective Processing System

The Dynamics of Delay of Gratification

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INTRODUCTION

The concept of *effortful control* in self-regulation or, in everyday language, "willpower," has survived a century of historical vicissitudes within psychology. Beginning with William James (1890) who made it central for the field's agenda, to its banishment as unscientific at the height of behaviorism, to its resurgence within contemporary psychology in an explosion of work on "self-regulation," the concept's popularity has waxed and waned. Currently, this now vigorously pursued and intensively researched—but still elusive—construct is more center stage than ever. It is difficult to find a conference in social, personality, or developmental psychology in which self-regulation and self-control—and a host of related executive and agentic functions (e.g., planning, future-orientation, goal-directed behavior, effortful control, proactive behavior)—are not major agenda items. As such, it remains a challenge for psychological research and theory on willpower to articulate a framework for studying and making sense of the diverse phenomena that the term encompasses. This chapter is intended as a step toward meeting that challenge. With this goal in mind, we begin by asking: What does the construct encompass? There are two related sides to the answer.

Individual Differences

As is intuitively obvious, there are widely observed individual differences in willpower. Historically in Western cultures these have been conceptualized as reflections of a stable broad trait that characterizes the person consistently across situations and over time. In this vein, the ancient Greeks used the term "akrasia" (a deficiency of the will) to distin-

guish between people who successfully regulated their impulses and temptations from those who did not. And in modern versions such global trait constructs as conscientiousness (Bem & Allen, 1974; McCrae & Costa, 1999) and ego resilience and ego control (Block & Block, 1980) are commonly used by researchers to explain how and why people differ in terms of their overall levels of self-regulatory ability. These trait approaches offer valuable information concerning the stability and correlates of people's self-regulatory abilities, but provide limited information about the specific processes that underlie such competencies and that enable or constrain them.

Self-Regulatory Processes

Consequently one must explicate the conditions and mechanisms that make willpower possible and that underlie the observed individual differences. Fortunately, in a rapidly accelerating trajectory, self-regulation research and theory are analyzing and illuminating many of the relevant processes influencing diverse aspects of willpower and "human agency" (e.g., Mischel & Morf, 2003; Mischel, Shoda, & Smith, 2003). For more than three decades the field has been bursting with important findings on the nature of human self-regulation, creating fresh challenges and offering exciting prospects, while at the same time still struggling with classic problems in trying to figure out the basic nature of willpower and its essential ingredients (Carver & Scheier, 1982; Gollwitzer & Bargh, 1996; Higgins, 1996; Higgins & Kruglanski, 1996; Kuhl, 1985; Mischel, Cantor, & Feldman, 1996; Mischel & Morf, 2003; Morf & Mischel, 2002).

Our overarching goal in this chapter is to outline a theoretical framework for understanding self-regulatory efforts that takes into account individual differences as well as the processes that underlie them and enable the individual to exercise willpower in the course of goal pursuit. We begin with the premise that self-regulatory processes do not operate in isolation. Rather, we assume that they are more fruitfully viewed as intrinsic aspects of the larger mental and emotional processing systems that characterize the individual. Accordingly, our specific goals in this chapter are to:

- Describe the larger processing system.
- Identify the key components of the self-regulatory system and highlight their cognitive-affective processing dynamics, drawing from research on delay of gratification illustratively.
- Illustrate how the components of the system interact with each other as well as other sub-systems in the generation of observed individual differences in self-regulation.
- Examine the implications for predicting and enhancing the individuals' ways of coping with relevant life challenges that require self-regulation.

BASIC FEATURES OF THE SELF-REGULATORY PROCESSING SYSTEM

The explosion of work on self-regulation has led to a host of informative findings about its diverse forms, determinants, and implications. Cumulatively, they suggest an emerging consensus among process-oriented researchers concerning key ingredients for a conceptual framework that demystifies the essentials of willpower and provides a road map for its further scientific analysis. We attempt that framework here in the

hope that it will have heuristic value for future research and theory development. First, we outline basic features for a self-regulatory processing system that seems to be widely assumed—albeit often only implicitly—within a broadly social cognitive-affective theoretical framework (Kunda, 1999). The view of the self-regulatory processing system presented here is closely related to Mischel and Ayduk's (2002) analysis, to the conception of the "Self as a Psycho-Social Dynamic Processing System" developed recently by Mischel and Morf (2003), to the Cognitive Affective Processing System (CAPS) presented earlier by Mischel and Shoda (1995, 1998, 1999; Shoda & Mischel, 1998), and to the Metcalfe and Mischel (1999) hot/cool model, and draws extensively on these sources. We draw on the self-system model because the very terms "willpower," "effortful control" and "self-regulation" imply an agentic self—a self-system that actively, and effortfully does the regulating. We draw on the CAPS model because self-regulation needs to be understood as an integral component within the larger cognitive-affective processing system and its sub-systems in which these processes function. And we draw on Mischel and Ayduk (2002) and Metcalfe and Mischel (1999) to illustrate key mechanisms in delay of gratification.

The Connectionist Metaphor for a Self-Regulatory Processing System

The largest challenge that faces theorists interested in constructing a scientific model, either of the self-system, self-regulation, or a broader personality processing system, is how to do so without re-invoking the "homunculus"—the little actor or "doer" in the head of the person who becomes the agent of all that follows (e.g., Kuhl, 1996). While we do not pretend to have solved this age-old problem, we try to assuage the fear of the homunculus by using connectionist models and parallel distributed processing systems as our metaphor (e.g., Baumann & Kuhl, 2002; Graziano & Tobin, 2001; Mischel & Shoda, 1995; Morf & Rhodewalt, 2001; Nowak, Vallacher, Tesser, & Borkowski, 2000; Read & Miller, 2002; Shah & Kruglanski, 2002; Shoda, LeeTiernen, & Mischel, 2002; Shoda & Mischel, 1998; Van Mechelen & Kiers, 1999). In the discussion that follows we borrow from these contributions and the connectionist metaphor. We begin with a brief summary of the key characteristics of these models.

Such models are promising metaphors because of two features. First, they are able to take account of multiple concurrent processes without invoking a single central control, thus helping to reduce the homunculus danger (Rumelhart & McClelland, 1986). As discussed by Mischel and Morf (2003), the agency is in the organization of the network, and so there is no need to invoke an internal controller. Second, connectionist models can account for a system that is biased. They do so in the sense that the patterns of activation in such a system are constrained and guided—and thus biased—by the existing network—a network that reflects the individual's unique biological, psychosocial, developmental, and life experiences. Examples of such biases are abundant and are seen every time an individual reacts predictably (e.g., with withdrawal and self-silencing or hostility and aggression) when particular threats (e.g., partner's rejection and hostility) are encountered (Ayduk, Downey, Testa, Yen, & Shoda, 1999; Ayduk, May, Downey, & Higgins, 2003; Morf & Rhodewalt, 1993; Zayas, Shoda, & Ayduk, 2002). The particular model that guides us most in this chapter, and in much of the research from which we draw, is the Cognitive-Affective Processing System or CAPS (Mischel & Shoda, 1995), which was designed as a broad processing framework for analyzing individual differences and basic processes such as self-regulation, self-control, and proactive, agentic (self-directed and future-oriented) behavior over time.

Processing Characteristics, Units, and Dynamics of the Self-Regulatory System

If we assume that self-regulatory behavior is generated by an organized, dynamic, cognitive-affective processing system like CAPS, one has to consider the nature of the units in the system, their relationship and organization, and the dynamics of their functioning. Using the connectionist, network-like metaphor, the first assumption is that in this type of processing system the mental representations consist of cognitions and affects (emotional states), abbreviated as CAUs or *cognitive–affective units*. These CAUs are interconnected within a stable network (much like a neural network, again as a metaphor) that constrains and guides their activation with pathways of activation and de-activation.

Substantively, the types of CAUs on which related theory and work has focused are based on psychological variables shown to be important in decades of past research, as proposed initially by Mischel (1973). These *person variables* include such mental–emotional representations as personal appraisals or construals (encodings) of the situation; beliefs, and expectancies (e.g., self-efficacy and outcome expectations); personal values and goals; affects (e.g., anxiety, shame, pride, eagerness); as well as evaluative self-standards, which are activated in specific situations. Particularly important for effortful control are the individual's available and accessible self-regulatory competencies. These include cognitive-attention strategies and scripts for generating diverse types of social behavior that are essential for sustained, goal-directed effort in the pursuit of difficult goals whose attainment requires impulse control and delay of gratification (Mischel & Ayduk, 2002; Mischel et al., 1996). In terms of the connectionist metaphor, the CAUs are themselves composed of activation patterns among much lower-level units (Mischel & Shoda, 1995, 1998; Shoda & Mischel, 1998). CAUs operate at multiple levels within the system and its sub-systems. These levels interact and are in part automatic and in part more deliberative, in part cognitive, and in part affective (Metcalfe & Mischel, 1999).

As in CAPS, individual differences in self-regulation are assumed to reflect both differences in the *ease of accessibility* of different CAUs (e.g., trust and efficacy expectations, self-regulatory competencies, appraisals of situations as challenging or threatening), and differences in the *stable organization* of the relationships among the CAUs. Thus, it is assumed that the CAUs are organized into distinctive idiographic networks. Each network is unique, although individuals can be grouped into types and sub-types. These types may differ both on the basis of similarities in their chronic levels of accessibility (e.g., some have higher anxious expectations for rejection, or lower fears of failure, than others) and on the basis of their organization, as will be illustrated in subsequent sections.

Figure 6.1 summarizes this model. A CAPS network is illustrated by the large circle, which consists of interconnected CAUs (shown by smaller circles). The darker the circle for a CAU the more accessible it is. The inter-connections among the CAUs may be excitatory (solid lines) or inhibitory (broken lines), and the strength of these connections differs as indicated by the darkness of the links.

Within this model, the relatively stable patterns of activation are the processing dynamics of the self-regulatory system. Situational features are encoded by CAUs, which in turn, activate a subset of mediating units that are connected to other units through a stable activation network. These situational features may be events and social stimuli that are either encountered, self-initiated (e.g., thoughts and affects activated by thinking, planning, or ruminating), or created by internal states (e.g., when hungry, or craving

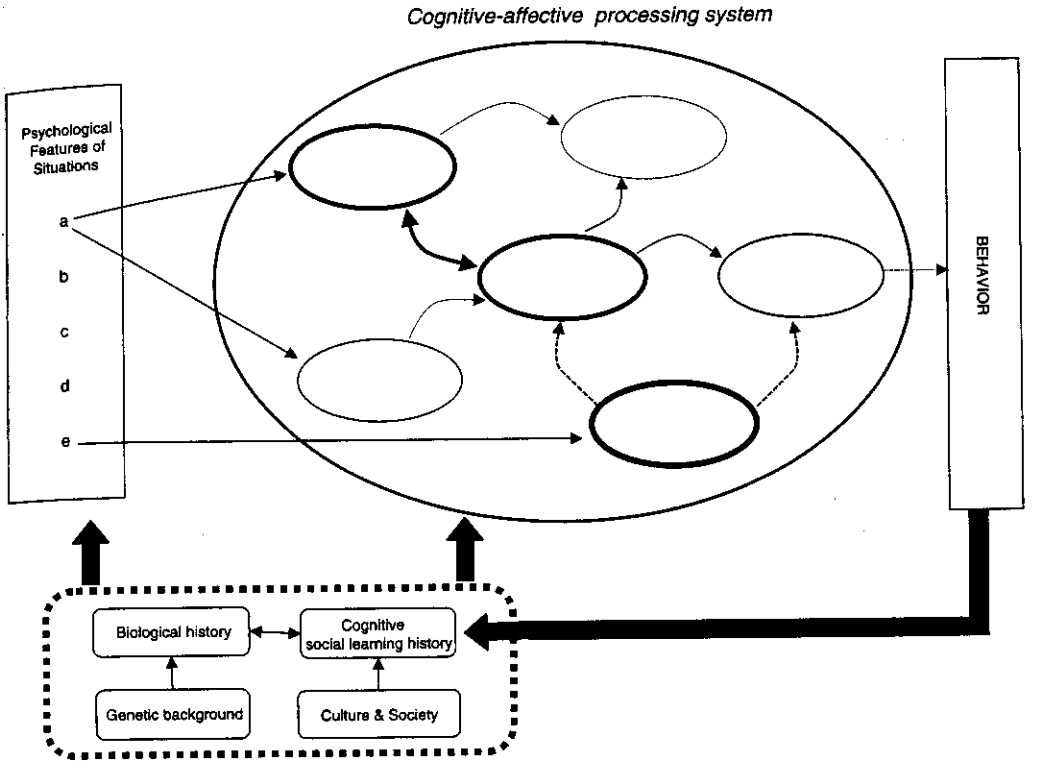

FIGURE 6.1. Illustrative self-regulatory dynamics in a cognitive–affective processing system (CAPS). Self-regulation in a CAPS network is illustrated by the large circle, and the smaller circles within it represent the cognitive–affective units (CAUs). The darker a circle, the more accessible that thought or affect is. The CAUs are inter-connected either through excitatory (solid lines) or inhibitory (broken lines); the darkness of a line indicates the strength of the association between any two CAUs. As illustrated, situational features are encoded by CAUs, which in turn activate a subset of mediating units that are inter-connected through a stable activation network. The dynamics of this network guide and constrain the individual's behavior in relation to particular situation features. The multiple influences on the CAPS network are indicated at the bottom. The system acts upon itself through a feedback loop: The behaviors that are generated influence one's subsequent experience and the social learning history, influencing the system's further development and modifying the situations encountered and generated over time.

drugs, or in other arousal states). These diverse influences may activate a contextualized construction or reconstruction process within the particular situation, rather than eliciting a retrieval of pre-existing responses or entities from storage. This reconstruction process occurs for example when the strength of the excitatory association between two CAUs is modified by a particular situation that activates one while strongly inhibiting the other. In this manner, the system becomes able to generate somewhat novel behavioral expressions; nevertheless, the preexisting dynamics of this network guide and constrain the reactions of the individual to particular features of situations. Thus the person and the situation interact reciprocally in a mutual influence process.

Development of the Self-Regulatory System

As illustrated in Figure 6.1, the CAPS network and the situational features that elicit its different aspects are assumed to develop as a function of biological and genetic predispositions as well as through the influences of the person's culture, society and idiographic social-cognitive learning history (Mischel & Shoda, 1999). Individual differences in the host of biochemical–genetic–somatic factors that influence self-regulation are conceptualized as *pre*-dispositions in this framework. The emphasis is on the "pre" to underline that these are biological precursors that may manifest themselves both directly and indirectly at multiple levels within the system and in diverse and complex forms (Grigorenko, 2002; Mischel & Shoda, 1999). These biological pre-dispositions (i.e., temperament) bias the system's development in particular directions. Nevertheless, their influences are constantly modulated by the affordances presented by the cultural, social and interpersonal contexts within which the child is situated. In particular, infant temperament and quality of parental care interact in meaningful ways in the development of effective self-regulatory mechanisms (e.g., Calkins & Fox, 2002; Kochanska, 1997). For example, children's "difficult" temperament is related to increased cortisol levels—a physiological marker of dysregulation—in the face of stress, but only in the context of poor and unresponsive adult caring (Gunnar, Larson, Hertsgaard, Harris, & Brodersen, 1992; see Gunnar & Donzella, 2002, for review).

Thus, many factors interact to influence the genesis of the person's distinctive organization, and they reflect both genetic endowment and biological history, and their interactions with social learning and developmental experiences in the course of socialization within a particular culture. Noteworthy is that the system does not merely react to the situations encountered in its course of life-long development. It also acts upon itself through a feedback loop, both by generating its own internal situations (e.g., in anticipated and planned events, in fantasy, in self-reflection), and through the behaviors that the system generates in interaction with the social world (see Figure 6.1). These behaviors (e.g., impulsive reactions, failures to carry out intentions, effective control efforts and goal pursuit) further influence the individual's social-cognitive experiences and evolving social learning history, and modify the subsequent situations encountered and generated. This way, development of the self-regulatory system becomes a life-long process of adaptation both through assimilating new stimuli into the existing CAPS network and by accommodating the network itself in response to novel or different encounters.

In the rest of this chapter, the model depicted in Figure 6.1 will be fleshed out and illustrated with research findings on delay of gratification (see Mischel, Shoda, & Rodriguez, 1989, for review) and related phenomena of willpower that exemplify its different aspects. The focus on delay of gratification reflects the fact that this program of research has data from four decades of experimental and longitudinal work that speaks both to individual differences and to basic processes that enable—or undermine—willpower or effortful self-regulation.

MOTIVATIONAL PROCESSES IN THE DECISION TO "WILL"

More than a century after James (1890) distinguished the wish or *motivation* to exert willpower in goal pursuit, and the *ability* to do so effectively, a distinction between regulatory motivation and regulatory competence is still useful because often people have one of these but not the other. This was illustrated by a recent president of the United States

whose impressive abilities to self-regulate in some contexts were seen often in his skillful handling of political and foreign affairs, yet he was either unable or insufficiently motivated to apply them to himself when it came to his personal affairs to the point of impeachment (see Ayduk & Mischel, 2002, for further discussion).

First we consider the role of motivation for effortful self-regulation in the framework of the present model. The individual's response to any given situation in which effortful self-regulation may be an option begins with the encoding process in which the subjective meaning of the situation, including its self-relevance and personal importance, are appraised. The appraisal itself activates a cascade of other cognitive–affective representations within the system—expectations and beliefs, affective reactions, values and goals. These CAUs operate at multiple levels as indicated above, and interacting in a coherent organization. To illustrate, take the hungry dieter confronted with a temptingly exquisite slice of chocolate fudge cake. The motivational strength to forgo the temptation may depend on such factors as whether the person construes the cake as "unhealthy and fattening—a "threat to health and fitness" or as a great treat" to which one is entitled at the end of a long hard day. Likewise, is the affect that is triggered primarily a strong desire or an anxious concern? And what expectations about the outcome are likely to occur if the cake is eaten, and if it is bypassed? How high are the person's expectations that self-control now will pay off in better health and appearance later? How much does the person value the long-term super-ordinate goals that are served by eating healthy and being fit? Do self-regulatory behaviors like dieting serve a higher goal that is central to the self, such as being a worthy self-respecting person, or are they merely a part of a casually tried fashionable diet of the day?

Questions like these have been considered in studies of the motivational processes in self-regulation and, specifically, in the context of cross-cultural delay of gratification choice experiments that assessed people's preference patterns for larger but delayed versus smaller or less valued but immediately available rewards beginning in the 1950s (Mischel, 1961a, 1974b). Taken collectively, the findings indicated the important roles of (1) trust and control expectations about actually obtaining the delayed outcomes, and (2) the subjective relative values of the immediately available versus the temporally delayed pay-offs (Mischel, 1961b, 1974b). These person variables significantly predict whether people form the intention and make the initial decision to exert self control and, in these examples, try to delay immediate gratification for the sake of more valued but delayed rewards. To the extent that individuals trust that the delayed rewards will materialize if they put the necessary effort into it and believe that they have control over the allocation of resources they are more likely to perceive the benefits to be greater than the costs associated with delay of gratification. Perhaps as important as these expectations in determining goal commitment in delay choice is the subjective value of the delayed reward(s). Unsurprisingly, the smaller the magnitude of the delayed rewards, and the longer their temporal delay, the less people value them and are willing to wait for them in the self-delay of gratification task (Mischel & Metzner, 1962).

The motivation to delay immediate gratification for the sake of distal goals that are contingent on the individual's own efforts also depends on the activation of beliefs that one can fulfill the necessary requirements—that is, *self-efficacy beliefs* (Bandura, 1986; Mischel et al., 1996)—on which the attainment of the distal reward is contingent. For example, when self-efficacy beliefs were experimentally manipulated by giving false success/failure feedback on an unrelated performance task, participants who were given false positive feedback chose to work for the preferred but delayed contingent reward more often than the participants who were given false negative feedback (Mischel & Staub,

1965). Thus how well the participants felt that they could perform the task determined whether or not they *chose* to try for the more difficult but preferred reward. The findings on choice or preferences for delayed versus immediate gratification are consistent with the role that control expectancies and self-efficacy beliefs play in other self-regulatory contexts as well. For example, high self-efficacy beliefs lead to greater motivation to engage in health promoting behavior (Hooker & Kaus, 1992; Kaplan, Atkins, & Reinsch, 1984) and adjustment to stressful health events and procedures (Major et al., 1990).

Similarly, positive control expectancies motivate people to try to persist in the face of challenge and also improve the way they construe and behave in response to negative situations. For example, people who suffer from psychological and/or physical distress but nevertheless believe that they are capable of influencing the outcomes of their situations adjust better in response to discomfort (Averill, 1973; Miller, 1979; Rodin, 1987; Taylor, Lichtman, & Wood, 1984; Thompson, 1981) and report feeling less anxiety and distress in relation to the pain associated with their conditions (Kanfer & Seidner, 1973; Szpiler & Epstein, 1976). Conversely, people who perceive themselves as having little control over the situations they find themselves in often feel powerless and choose not to engage in adaptive forms of self-regulatory behavior (Dweck, 1986; Seligman, 1975).

In summary, findings from studies on the motivation and choice to delay gratification (i.e., goal commitment) suggest that an expectancy-subjective value mechanism underlies the initial assessments that people make regarding this decision. It is a subjective calculation of whether the value and feasibility of attaining a delayed reward relative to the value of the immediately available one is high enough to warrant their choice to wait or work to attain it. In the connectionist, network-like metaphor for the self-regulatory processing system model, self-efficacy beliefs, positive outcome and control expectations, and the subjective value of the rewards, are the CAUs that influence these decisions and intentions to commit oneself to a difficult self-regulatory goal.

FROM GOOD INTENTIONS TO WILLPOWER: OVERCOMING STIMULUS CONTROL WITH SELF-CONTROL

Goal commitment is a necessary but not a sufficient condition for goal attainment. Well-intentioned New Year's resolutions—to adhere to that diet, to forgo tobacco, to become more attentive and caring toward a partner, to persist with regular breast self-examinations—are a first step, but unless implemented by effective self-regulatory mechanisms to sustain effortful control they easily fade away when the time comes to actually exercise the will. The failure of well-motivated good intentions is documented in decades of research on the power of *stimulus control*, beginning with work on classical conditioning at the start of the last century, to the prolific studies inspired by Skinner's work on operant conditioning (e.g., Skinner, 1938) during the dominance of behaviorism, to the current resurgence of interest showing the importance and pervasiveness of *automaticity* by Bargh and colleagues (e.g., Bargh, 1997; Chartrand & Bargh, 2002). Collectively, this impressive line of research has made plain the pervasive power of the situation for eliciting prepotent responses almost reflexively without higher-order mediation and consciousness. Indeed the incisive and persuasive work of Bargh and colleagues has been so compelling that one begins to sense that the cognitive revolution is now in trouble in social and personality psychology, and in need of new defenders ready to make the case again for the power of cognitive processes against a new form of mechanistic behaviorism that may be re-emerging (see Ferguson & Bargh, 2000). The challenge to these defenders of cognition

and purposeful self-regulation is to specify the processes and conditions that people can use to make them less susceptible to succumbing to the pressures and influences of the momentary situation as they attempt to pursue their long-term commitments and goals.

The next questions we address are: what are those processes and conditions in which individuals may overcome stimulus control and the pressures and temptations of the moment for the sake of more valued but delayed, or blocked, goals and outcomes? What makes it possible for some people to give up their addictions, to resist the temptations that threaten their cherished values and goals, to persist in the effort, to maintain their relationship, to overcome the more selfish motivation and take account of other people—in short, to exert "willpower"? And why do others seem to remain the victims of their own vulnerabilities and biographies?

Theoretically, in the CAPS model of self-regulation, effective pursuit of delayed rewards and difficult to attain long-term goals depends on the availability and accessibility of certain types of cognitive-attention strategies that are essential for overcoming stimulus control. Again the question has to be answered: what strategies and processes make it possible? How do they work and how can they be harnessed in the service of more constructive and effective self-regulation? Absent the availability and accessibility of such strategies, efforts to sustain delay of gratification and self-control are likely to be short-lived and the power of the immediate situation is likely to prevail and elicit the prepotent response—eat the cake, smoke the cigarette grab the money, succumb to the temptation. In contrast, in effective goal pursuit, these strategies become activated and utilized when the person tries to forgo impulsive, automatic reactions in response to immediate situational pressures and temptations for the sake of more valued but temporally delayed goals.

The Delay of Gratification Paradigm

Insights into the conditions and processes that enable effortful control have come from research in the preschool delay paradigm (Mischel, 1974a; Mischel & Baker, 1975; Mischel & Ebbesen, 1970; Mischel, Ebbesen, & Zeiss, 1972; Mischel & Moore, 1973). In this procedure, young children wait for two cookies (or other little treats) that they like and have chosen to get and which they prefer to a smaller treat, such as one cookie. They then are faced with a dilemma: they are told that the experimenter needs to leave for a while and that they can continue to wait for the larger reward until the experimenter comes back on his/her own, or they are free to ring a little bell to summon the adult at any time and immediately get the smaller treat at the expense of getting the larger preferred reward. In short, the situation creates a strong conflict between the temptation to stop the delay and take the immediately available smaller reward or to continue waiting for their original, larger, more preferred choice, albeit not knowing how long the wait will be. After children understand the situation, they are left alone in the room until they call the experimenter. The child of course has a continuous free choice, and can resolve the conflict about whether or not to stop waiting at any time by ringing the bell, which immediately brings back the adult. If the child continues to wait, the adult returns spontaneously (after a maximum of 20 minutes).

This simple and seemingly trivial situation has turned out to be not only compelling for the young child but also surprisingly diagnostic, making it possible to significantly predict conceptually relevant and consequential long-term outcomes from the number of seconds children wait at age 4 years to diverse indices of self-regulation in goal pursuit and social–emotional cognitive competencies decades later in adulthood (e.g., Ayduk et

al., 2000; Mischel et al., 1989). To illustrate, the number of seconds children can wait in certain diagnostic situations (i.e., when no regulatory strategies are provided by the experimenter and children have to access their own competencies) is significantly predictive of higher Scholastic Aptitude Test (SAT) scores and better social-cognitive, personal, and interpersonal competencies years later (Mischel, Shoda, & Peake, 1988; Shoda, Mischel, & Peake, 1990). These links between seconds of preschool delay time and adaptive life outcomes in diverse social and cognitive domains remain stable, persisting into adulthood, as discussed in later sections. Given the existence and psychological importance of the individual differences tapped in this situation it becomes important to understand what is happening psychologically that makes some children ring soon and others wait for what seems an eternity. What determines who will be under the stimulus control elicited by immediate temptations and who will be able to resist those pressures and sustain the choice to persist for the delayed rewards? We next consider the cognitive-attention control strategies that help and hurt such efforts and examine how they may play out in the proposed self-regulatory system.

Temporal Discounting

The delay of gratification paradigm for the analysis of willpower taps a phenomenon that makes effortful control especially difficult in situations when it is often most needed. It is a factor that undermines the person's motivation to keep important long-term goals in mind when faced with short-term gratifications that are immediately present. This pervasive phenomenon, found in animal species from rats to humans, is *temporal discounting* (Ainslie, 2001; Loewenstein, Read, & Baumeister, 2003; Rachlin, 2000; Trope & Liberman, 2003). Well-known to economists and philosophers as well as to psychologists, this tendency refers to the systematic discounting of the subjective value of a reward, outcome, or goal as the anticipated time delay before its expected occurrence increases. Temporal discounting is seen clearly in delay of gratification studies in the finding that the perceived subjective value of the delayed reward(s) in young children, and hence their motivation to choose to delay, decreases systematically as the length of the expected delay interval increases (Mischel, 1966, 1974b; Mischel & Metzner, 1962) as mentioned earlier. Similar findings with respect to the effect of time delays on the discounting of subjective value have long been widely documented and recognized as of central importance for understanding problems that range from the psychiatric and medical to the areas of behavioral medicine and behavioral economics (Ainslie, 2001; Loewenstein et al., 2003; Morf & Mischel, 2002; Petry, 2002; Rachlin, 2000; Wulfert, Block, Ana, Rodriguez, & Colsman, 2002). The hot/cool analysis of willpower, described next, was developed in large part to try to understand the basic mechanisms that may underlie the phenomena tapped by the delay paradigm.

Hot/Cool Systems within CAPS

Following the connectionist and parallel distributed processing neural network metaphor, two closely interacting systems—a cognitive "cool" system and an emotional "hot" system—have been proposed as components of the broader CAPS system. The interactions between these two systems are basic in the dynamics of self-regulation in general and of delay of gratification in particular and underlie the person's ability—or inability—to sustain effortful control in pursuit of delayed goals (Metcalfe & Mischel, 1999).

Briefly, the cool system is an emotionally neutral, "know" system: it is cognitive, complex, slow, and contemplative. Attuned to the informational, cognitive, and spatial aspects of stimuli, the cool system consists of a network of informational, *cool nodes* that are elaborately interconnected to each other, and generate rational, reflective, and strategic behavior. Although the specific biological roots of this system are still being explored, the cool system seems to be associated with hippocampal and frontal lobe processing (Lieberman, Gaunt, Gilbert, & Trope, 2002; Metcalfe & Mischel, 1999).

In contrast, the hot system is a "go" system. It enables quick, emotional processing: simple and fast, and thus useful for survival from an evolutionary perspective by allowing rapid flight or fight reactions, as well as necessary appetitive approach responses. The hot system consists of relatively few representations, or *hot spots* (e.g., unconditioned stimuli), which elicit virtually reflexive avoidance and approach reactions when activated by trigger stimuli. This hot system develops early in life and is the most dominant in the young infant. It is an essentially automatic system, governed by virtually reflexive stimulus–response reactions, which, unless interrupted, preclude effortful control. Although other theorists (e.g., Epstein, 1994; Lieberman, 2003) have employed somewhat different terms to describe similar sets of opponent self-regulatory processes, there is reasonable consensus that what Metcalfe and Mischel (1999) call the hot system is more affect-based relative to the cool system and generates simple, impulsive, and quick approach–avoidance responses in the presence of eliciting stimuli. The impulsive behavioral products of this system provide ample documentation for the power of stimulus control, and the formidable constraints that many hot (*affect-arousing*) situations place on a person's ability to exert willpower or volitional control. Currently, neural models of information processing suggest that the amygdala—a small, almond-shaped region in the forebrain thought to enable fight-or-flight responses—may be the seat of hot system processing (Gray, 1987; LeDoux, 1996; Metcalfe & Jacobs, 1996), but again the exact loci and circuitry remain to be mapped with increasing precision.

Consistent with a parallel-processing neural network metaphor, the hot/cool analysis assumes that cognition and affect operate in continuous interaction with one another, and emphasizes the close connections of the two sub-systems in generating phenomenological experiences as well as behavioral responses. Specifically, in the model hot spots and cool nodes that have the same external referents are directly connected to one another, and thus link the two systems (Metcalfe & Jacobs, 1996; Metcalfe & Mischel, 1999). Hot spots can be evoked by activation of corresponding cool nodes; alternately, hot representations can be cooled through inter-system connections to the corresponding cool nodes. Effortful control and willpower become possible to the extent that the cooling strategies generated by the cognitive cool system circumvents hot system activation through such inter-system connections that link hot spots to cool nodes. Thus, consequential for self-control are the conditions under which hot spots do not have access to corresponding cool representations, because these conditions are the ones that undermine or prevent cool system regulation of hot impulses.

Effects of System Maturation

Two assumptions are made about the determinants of the balance between hot and cool systems. First, this balance depends critically on the person's developmental phase. The hot system is well developed at birth, whereas the cool system develops with age. Consequently early in development the baby is primarily responsive to the pushes and pulls of

hot stimuli in the external world as many of the hot spots do not have corresponding cool nodes that can regulate and inhibit hot system processing. This assumption is in line with developmental differences in the maturation rates of the biological centers for these two systems. With age and maturity, however, the cool system becomes elaborated as many more cool nodes develop and become connected to one another, thereby greatly increasing the network of cool system associations and thus the number of cool nodes corresponding to the hot spots.

Empirical evidence from the delay of gratification studies supports these expectations. Whereas delay of gratification in the paradigm described seems almost impossible—and even incomprehensible—for most children younger than 4 years of age (Mischel, 1974b; Mischel & Mischel, 1983), by age 12 almost 60% of children in some studies were able to wait to criterion (25 minutes maximum; Ayduk et al., 2000, Study 2). Furthermore, the child's spontaneous use of cooling strategies such as purposeful self-distraction is positively related to both age and verbal intelligence (Rodriguez, Mischel, & Shoda, 1989). By the time most children reach the age of 6 years, they are less susceptible to stimulus control from mere exposure to the desired objects facing them. As the cool system develops it becomes increasingly possible for the child spontaneously to generate diverse cognitive and attention deployment cooling strategies (e.g., self-distraction, inventing mental games to make the delay less aversive), and thus to be less controlled by whatever is salient in the immediate field of attention (Rodriguez, Mischel, & Shoda, 1989).

Effects of Stress Level

Second, the hot/cool balance depends on the stress level, which in turn depends both on the stress induced by the appraisal of the specific situation and the chronic level characteristic for the person. The theory assumes that whereas at low to moderate levels of stress cool system activation may be enhanced, at high levels it becomes attenuated and even shuts off. In contrast, the hot system becomes activated to the degree that stress is increased (Metcalfe & Jacobs, 1996; Metcalfe & Mischel, 1999). The stress level of the system reflects both individual differences in the person's chronic level of stress and the stress induced within the particular situation. Consistent with the view that high stress levels tend to attenuate the activation of the cool system, delay of gratification becomes more difficult when children experience additional psychological stress (e.g., by thinking about unhappy things that happened to them), but it becomes easier when stress is decreased, for example by priming them to "think fun" (Mischel et al., 1972). It is an ironic aspect of willpower and human nature that the cool system is most difficult to access when it is most needed.

The reader who remembers Freud's conception of the id as characterized by irrational, impulsive urges for immediate wish-fulfillment, and its battles with the rational, logical executive ego, will not fail to note their similarity to the hot and cool systems as conceptualized in contemporary thinking (e.g., Epstein, 1994; Metcalfe & Mischel, 1999). The key difference is that what has been learned from research on this topic over the course of the past century now allows us to specify more clearly the cognitive and emotional processes that underlie these two systems and their interactions to enable effective self-regulation. We consider these specific processes next, drawing on experiments conducted using the delay of gratification paradigm.

The hot/cool analysis of the dynamics of willpower summarized above was based in

part on empirical evidence from the long-term research program on delay of gratification by Mischel and colleagues (e.g., see Mischel, 1974b; Mischel & Ayduk, 2002; Mischel et al., 1989, for reviews). This research provides a framework for systematically conceptualizing the processes that undermine or support the successful exertion of willpower in diverse contexts, and provides an account that seems to fit the available data reasonably well. We next consider those data and examine how they speak to the predictions and post-dictions suggested by the hot/cool analysis.

PROCESSING DYNAMICS IN DELAY OF GRATIFICATION

Mental Representation of Goals/Rewards

The experiments on mechanisms enabling delay of gratification were motivated originally by the following question, posed more than 30 years ago: how does the mental representation of deferred rewards or goals influence the person's ability to continue to wait or work for them? The question needed to be asked at that time, when behaviorism was still at its height, and because although rewards had been assigned huge power as the determinants of behavior, virtually nothing was known about how people's mental representations of them operated and influenced goal-directed behavior. Few theories or even hypotheses were available to guide the search for answers. A notable exception was Freud (1911/1959) whose writing about the transition from primary (id-based) to secondary (ego-based) processes famously theorized that the ability to endure delay of gratification begins to develop when the young child can construct a "hallucinatory wish-fulfilling image" of the wished-for but delayed object. In Freud's view, this mental image or representation of the object of desire (e.g., the maternal breast) makes it possible for the child to "bind time" and come to sustain delay of gratification volitionally.

If so, Mischel and colleagues reasoned, sustained delay behavior in goal pursuit ought to be facilitated by cues that make the delayed rewards more salient and thus more available for mental representation. Similar expectations came from a second, unexpected source, in the research on learning with animals. Struggling with the question of how a rat manages to keep running to get its rewards later at the end of all those complicated mazes, learning psychologists theorized that behavior toward a goal may be maintained by "fractional anticipatory goal responses" (Hull, 1931). While eschewing the language of cognition, the concept implied some kind of partial representation of the goal as a necessary condition for maintaining the animal's goal pursuit, for example, as the animal in a learning task tries to find its way back to the food at the end of a maze. In this sense, extrapolating to the young child, anticipation and self-instructions through which the delayed rewards are made salient should sustain delay behavior in pursuit of those rewards because it makes them easier to keep in mind and anticipate the gratification of having them. In short, collectively these views from utterly different literatures suggested that focusing attention on the delayed rewards should facilitate delay of gratification.

To explore this hypothesis and to approximate the presence versus absence of mental representations of the delayed rewards, a series of experiments varied whether or not the reward objects in the choice were available for attention while the children tried to keep waiting for them (Mischel & Ebbesen, 1970). For example, in one condition, both the delayed and immediately available rewards were exposed, whereas in another condition both the delayed and immediate rewards were concealed from children's attention. In the remaining two groups, either the delayed or the immediate rewards were exposed while

the other rewards were concealed. Rather than enhancing children's delay time as was initially hypothesized by both psychodynamic and learning theories, having rewards available for attention in any combination (i.e., whether both were available or just one) dramatically reduced children's wait time.

When first obtained, these results were the opposite of what was predicted, but in retrospect, when viewed from a hot/cool systems framework, they are exactly as expected. Presumably availability of the rewards for attention increases their salience, making their consummatory, "hot" representations more accessible. This in turn, intensifies the conflict between the stimulus pull of the immediate situation (i.e., to ring the bell and get the small reward) and the desirability of the future goal (i.e., getting the larger, preferred reward), thereby increasing the child's level of frustration or stress. Under such hot system activation, it is harder to resist stimulus control, and most children reverse their initial preference, ring the bell, and settle for the less desired outcome. When the rewards are obscured from sight, however, the conflict and the frustration inherent in the delay situation is diminished, making "willpower" much less difficult, and enabling children to wait longer (Mischel, 1974b). Theoretically, when attention is not focused on the tempting reward stimuli, corresponding hot nodes are less likely to become activated, making sustained delay of gratification less effortful.

By the same rationale, moving attention away from the rewards altogether as in the use of distraction strategies even when the rewards are physically present in the environment should also prevent hot system activation and make the delay situation less difficult to endure for the child. In testing this idea, Mischel and colleagues (1972) provided children experimentally with external or internal distracters. In some conditions preschoolers were given a little toy to play with; in others they were primed with self-distracting pleasant thoughts (e.g., thinking about Mommy pushing them on a swing), or they were not given any distracters while they faced the rewards. Such self-distraction made it much easier for the children to wait (regardless of whether the distracters were external or internal), and they did so readily even though the rewards were available for attention and staring them in the face. The successful dieter who resists the desserts on the tray will not be surprised by these results.

But whereas these results showed the effects of attention to the exposed actual rewards, they still left open the more basic question: what is the effect of their internal *mental* representation? Might it be possible to represent the same stimulus in alternate ways? Foreshadowing the hot/cool formal theory by more than 30 years, a distinction had been made in the research literature between the motivational (the consummatory, arousing, action-oriented, or motivating "go" features) and the informational (cognitive cue) functions of a stimulus (Berlyne, 1960; Estes, 1972). Drawing on this distinction, Mischel and Moore (1973) reasoned that the actual rewards, or their mental representations by the child as real, puts the child's attention on the hot, arousing, consummatory features of the rewards (whether the immediately available or the delayed ones), and hence elicits the motivational effects (the "go" response: ring the bell, get the treat now). In contrast, a focus on the more cool, abstract, cue features of the rewards might have the effect of reminding the child of the delayed consequences without activating the consummatory trigger reaction, typically elicited by a focus on the motivating hot features. For example, the mental representation of the rewards as pictures emphasizes their cognitive, informational features rather than their consummatory features. Therefore, Mischel and Moore speculated that this kind of cool focus may reduce the conflict between wanting to wait and wanting to ring the bell by shifting attention away from arousing features of the stimulus and on to their informative meaning.

Hot/Cool Representations

Methodologically, the challenge was how to find operations for activating a mental representation at a time when the cognitive revolution was still in its infancy and even the concept of mental representations was still regarded suspiciously. To move beyond the effects of the actual stimulus and try to approximate their mental representations, a first step was to present the rewards in the form of *images*—literally, life-size pictures (formally, "iconic representations") of the immediate and delayed rewards presented from a slide projector on a screen facing the child. These pictorial representations were pitted against the presence of the real rewards themselves during the delay period. As predicted, the results were the opposite of those found when the real rewards were exposed: exposure to the pictures of the images of the rewards significantly increased children's waiting time whereas exposure to the actual rewards decreased delay (Mischel & Moore, 1973).

Again in retrospect, these findings are consistent with those expected from the hot/cool system analysis. The slide-presented images of the desired objects (in contrast to the actual objects) are more likely to activate cool nodes that correspond to inherently hot stimuli and attenuate the hot system. Recall that the cool nodes are conceptualized as representing informational, cognitive, and spatial aspects of stimuli. A pictorial depiction of the rewards, of a little stick of pretzel of the sort used in the studies, for example, is likely to activate a cool representation, in sharp contrast to the effects of facing the actual temptations.

Mischel and colleagues speculated that what is true for pictorial representations also should apply to diverse other forms of cognitive, cool appraisals of the "objects of desire" that might activate corresponding cool nodes for the rewards in the delay of gratification paradigm. Consequently, if the actual rewards could be construed in such a way that they psychologically become cool, for example by thinking of them as pictures rather than real, it should help the child to reduce the frustration of the delay situation cognitively rather than being at the mercy of external situational cues.

To examine this prediction, children were faced with actual rewards but this time were cued in advance by the experimenters to pretend that they were pictures by essentially "putting a frame around them in your head" (Moore, Mischel, & Zeiss, 1976). In a second condition, the children were shown pictures of the rewards but this time asked to imagine them as though they were real. Children were able to delay almost 18 minutes when they pretended that the rewards facing them were not real, but pictures. In contrast, they were able to wait for less than 6 minutes if they pretended that the real rewards, rather than the pictures, were in front of them. Theoretically, in the former group, the children were able to exert willpower by mentally activating cool nodes that corresponded to the hot stimulus in front of them (i.e., by cognitively transforming a real treat into "just a picture"). In post-tests that asked about why they waited so long, as one child put it "you can't eat a picture."

The transformations of hot, motivating representations into cool, informative ones to facilitate willpower in the delay situation also were demonstrated by Mischel and Baker (1975). In this study, children in one condition were cued with cool, informational or hot, consummatory representations of the rewards during the delay task. For example, children who were waiting for marshmallows were cued to think of them as "white, puffy clouds." Those waiting for pretzels were told to think of them as "little, brown logs." In a second hot ideation condition, the instructions cued children to think about the marshmallows as "yummy, and chewy" and the pretzels as "salty and crunchy." As expected,

when children thought about the rewards in hot terms, they were able to wait only for 5 minutes, whereas when they thought about them in cool terms, delay time increased to 13 minutes.

Summary: Attention Control in the Delay Process

Taking these findings collectively, it became clear that delay of gratification depends not on whether or not attention is focused on the objects of desire, but rather on just how they are mentally represented. A focus on their hot features may momentarily increase motivation, but unless it is rapidly cooled by a focus on their cool, informative features (e.g., as reminders of what will be obtained later if the contingency is fulfilled) it is likely to become excessively arousing and trigger the "go" response.

While most of the delay of gratification experiments have involved passive waiting in order to obtain the preferred outcomes, the same mechanisms of attention deployment seem to apply when goal attainment is contingent on the person's work and performance. This was demonstrated recently in experiments in which children were required to complete a work task instead of passively waiting for the experimenter to return in order to get the larger but delayed rewards. Attention focused on the rewards undermined delay of gratification in both working and waiting situations, thus extending the generalizability of the attention control mechanisms that enable such effortful control (Peake, Hebl, & Mischel, 2002).

Flexible Attention Deployment and Discriminative Facility

Studies conducting fine-grain analyses of second by second attention deployment during efforts at sustained delay of gratification suggest that self-regulation depends not just on cooling strategies but on *flexible attention deployment* in the process (Peake et al., 2002). For example, Peake and colleagues' (2002) study on delay in working situations showed that delay ability was facilitated most when attention intermittently shifted to the rewards, as if the children tried to enhance their motivation to remain by reminding themselves about the rewards, but then quickly shifted away to prevent arousal from becoming excessive. Such flexibility in attention deployment is consistent with the view that it is the balanced interactions between the hot and cool systems that sustain delay of gratification and effortful control, as they exert their motivating and cooling effects in tandem (see also Rodriguez, Mischel, & Shoda, 1989).

Evidence that flexible attention deployment is important for effective self-regulation also is consistent with findings showing the role of *discriminative facility* in self-regulation. Discriminative facility refers to the individual's ability to perceive the subtly different demands and opportunities of different kinds of situations, and to flexibly adjust coping strategies accordingly. A good deal of research now documents that discriminative facility is basic for adaptive social and emotional coping in diverse contexts (Cantor & Kihlstrom, 1987; Cheng, Chiu, Hong, & Cheung, 2001; Chiu, Hong, Mischel, & Shoda, 1995; Mendoza-Denton, Ayduk, Mischel, Shoda, & Testa, 2001; Shoda, Mischel, & Wright, 1993).

The types of cooling strategies in these studies with preschoolers are of course only illustrative of the many adaptive ways to maintain long-term goal pursuit and to overcome stimulus control with agentic self-control. The important point is that diverse, creative cooling strategies can be constructed by the cool system, if it can be accessed before

automatic impulsive action is triggered by the hot system that preempts the person from thinking rationally and creatively. In formal terms, goal pursuit in delay of gratification depends both on the activation of motivational processes as discussed earlier in this chapter, and on the accessibility and activation of the necessary cooling strategies. It depends on the network of organization connecting the motivational processes that lead to choice and goal commitment, to the activation and generation of cooling strategies. When these strategies are accessed they serve to reduce the hot stimulus pull and the frustration aroused in the situation, so that hopeful wishing can be transformed into effective willing.

Automaticity: Taking the Effort out of Effortful Control

In order for these adaptive control efforts in the hot system/cool system interactions to be maintained over time and accessed rapidly when they are urgently needed, they have to be converted from conscious, slow and effortful to automatic activation, in this sense taking the effort out of "effortful self-control." The conversion process that enables the person to go from good intentions to effective action and goal attainment has been most extensively addressed by Gollwitzer and colleagues in their research on *implementation plans* (see Gollwitzer, 1999; Patterson & Mischel, 1975). Individuals can avoid succumbing to stimulus control by planning out and rehearsing their "implementation intentions" for difficult goal pursuit. These plans specify in detail the various steps needed to protect the person from the obstacles, frustrations, and temptations likely to be encountered, keeping in mind and in awareness the demands of the current goal that is being pursued (Gollwitzer, 1999).

When planned and rehearsed, implementation intentions help self-control because goal-directed action is initiated relatively automatically when the relevant trigger cues become situationally salient. Implementation intentions help self-regulation across a wide range of regulatory tasks such as action initiation (e.g., I will start writing the paper the day after Thanksgiving), inhibition of unwanted habitual responses (e.g., when the dessert menu is served, I will not order the chocolate cake), and resistance to temptation (e.g., whenever the distraction arises, I will ignore it). In short, Gollwitzer's work indicates that some effortful, deliberative process of linking action plans to specific situational triggers (the "ifs") is needed in the initial phases of automatization. But after this link has been established and rehearsed, effective self-regulatory behavior and cool system strategies can be activated and generated much more readily, even under stressful or cognitively busy situations, without conscious effort. That is, if the specified situational cue remains highly activated, the planned behavior will run off automatically when the actual cue is encountered (Gollwitzer, 1999).

Stability and Meaningfulness of Individual Differences in Self-Regulatory Competencies

There is increasing evidence for the long-term stability and predictive value of individual differences in the self-regulatory competencies assessed in the delay of gratification paradigm early in life. As noted earlier, the number of seconds that preschoolers at age 4 years delayed gratification in the diagnostic condition of the delay paradigm described earlier significantly predicted such outcomes as their SAT scores and ratings of their social–emotional and cognitive competencies in adolescence (Mischel, Shoda, & Peake, 1988; Shoda

et al., 1990). Likewise, in further follow-up studies preschool delay times predicted such outcomes as the attained educational level and use of cocaine-crack when the participants are about 27 years old (Ayduk et al., 2000).

Recently, the early antecedents of the ability to delay gratification in preschool, which are visible already in the toddler's behavior, also have been explored. They are meaningfully expressed in the ways in which the toddler deals with the delay of gratification demands produced by brief maternal separation in attachment studies using the Strange Situation (Sethi, Mischel, Aber, Shoda, & Rodriguez, 2000). Thus the same cooling attention control mechanisms demonstrated to be effective in preschool children appear to be visible in the toddler at 18 months and have been linked to delay behavior at age 4 years (Sethi et al., 2000). Further, these mechanisms also have been shown to apply in diverse populations in middle school years, and to have meaningful correlates supporting their validity as predictors of diverse adaptive social, cognitive, and emotional outcomes (Ayduk et al., 2000; Rodriguez, Mischel, & Shoda, 1989).

Individual differences in the types of self-regulatory behavior tapped in the delay paradigm may be related to distinct patterns of neural and biological reactivity as well as to aspects of temperament visible in early childhood (e.g., Derryberry, 2002; Derryberry & Rothbart, 1997; Rothbart, Derryberry, & Posner, 1994). For example, a number of studies have shown that the reactivity of the neural circuitry embedded in the limbic system, which underlies people's appetitive and defensive motivational systems, can be modulated by an executive attention control system that is sensitive to effortful intentions (Derryberry & Reed, 2002; Eisenberg, Fabes, Guthrie, & Reiser, 2000). This executive system, believed to be located in the anterior cingulate, appears to be related to the regulation of motivational impulses through "attention flexibility" and is assumed to contribute to the development of the ability to delay gratification, among a variety of other important developmental processes (Derryberry & Rothbart, 1997). It is tempting to speculate that the effective, flexible attention control that seems basic for the ability to delay gratification in goal pursuit also should be related to the neural circuitry that underlies the anterior attention system. To our knowledge, however, no empirical study to date has directly tested this assumptions and it seems important to explore those potential connections.

COOLING STRATEGIES IN EMOTION REGULATION: DEALING WITH DIVERSE AVERSIVE HOT SITUATIONS

The strategies that help people deal with the control of appetitive impulses as in the delay situation also apply to emotional self-regulation for dealing with aversive hot situations and dilemmas, including those produced by one's own vulnerabilities and negative emotions (e.g., fears of abandonment and rejection) in diverse interpersonal contexts. Experimental research reported years ago that an attitude of detachment helps people react more calmly when exposed to gory scenes portraying bloody accidents and death (Koriat, Melkman, Averill, & Lazarus, 1972) or when expecting electric shock (Holmes & Houston, 1974). Since then, experiments have helped to specify further the processes that allow people to regulate their negative emotions. In a typical study to probe the underlying processes in emotion regulation, Gross (1998) brings participants into the laboratory and informs them that they will be watching a movie. The film they will see shows detailed close up views of severe burn victims or of an arm amputation. Participants then are divided into different groups and given different instructions prior to viewing the film. For

ɔle, in one condition (called "cognitive reappraisal"), they are asked to use a cool-
:ategy, and to try to think about the movie in a detached unemotional way, objec-
focusing attention on the technical details of the event, not feeling anything person-
:.g., pretend that you're a teacher in medical school).

ı terms of the present model, this is a cognitive cooling strategy, similar to the pre-
lers' trying to think about the real treats facing them as if they were "just pictures"
focusing on their cool rather than hot qualities. As predicted, Gross's results sup-
l the value of the cooling strategy. Cooling enabled adaptive regulation of negative
ɔns better than either a control condition (in which participants are simply asked to
the movie), or a suppression condition in which they were asked to try to hide their
ɔnal reactions to the film as they watched it so that anyone seeing them would not
that they were feeling anything at all. The cooling strategy by means of cognitive
raisal was a much more adaptive way to regulate negative emotions, as seen in mea-
of the intensity of people's negative experiences as well as in their levels of physio-
l autonomic nervous system arousal and distress. Thus individuals who are cued to
about the movie in a way that cools the emotional content experienced fewer feel-
f disgust and less physiological activation (evidenced by less blood vessel constric-
when compared to those who attempted to completely hide and suppress their emo-
responses to the film faces (Gross, 1998; see also Richards & Gross, 1999, 2000).

. word of clarification is due however about the distinction between our conceptual-
ı self-distraction as an effective self-regulatory strategy and emotional suppression
ved by Gross and thought suppression as discussed by Wegner (1994). Self-distrac-
f the kind we propose involves strategically moving attention away from hot infor-
n while actively attending to cool aspects of the situation in a way that creates "psy-
ɣical distance." In this sense, it is different both from thought suppression where
mply tries to avoid thinking about an unwanted thought and emotional suppression
the individual is merely asked to not reveal his/her affective reactions without an
ative stimulus on which attention can be purposefully focused. Indeed, research on
ht suppression indicates that when people are provided with focused distraction
ɣies (i.e., are given an alternative thought to focus on every time the to-be-
:ssed idea comes to mind) they are buffered against the typical rebound effect
ıer, Schneider, Carter, & White, 1987).

good deal of related research further supports the conclusion that self-distraction,
possible, can be an excellent way to reduce unavoidable stresses like unpleasant
al examinations (Miller, 1987) and coping with severe life crises (Bonanno, 2001;
ıno, Keltner, Holen, & Horowitz, 1995; Taylor & Brown, 1988). Self-distraction
watching travel slides or recalling pleasant memories) increases tolerance of experi-
lly-induced physical pain (e.g., Berntzen, 1987; Chaves & Barber, 1974). Similarly,
:ting and relaxation-inducing activities such as listening to music reduce anxiety in
:e of uncontrollable shocks (Miller, 1979), help people cope with the daily pain of
ıatoid arthritis (Affleck, Urrows, Tennen, & Higgins, 1992) and even with severe
ises (e.g., Taylor & Brown, 1988). Minimization of negative affect and instead be-
gaged in everyday tasks following the death of a spouse predicted minimal grief
oms more than a year after the loss (Bonanno et al., 1995).

'ooling strategies as illustrated by re-construal mechanisms can also help one to
ɔrm potentially stressful situations to make them less aversive. For example, if sur-
ɔatients are encouraged to re-construe their hospital stay as a vacation to relax a
from the stresses of daily life, they show better postoperative adjustment (Langer,
& Wolfer, 1975), just as chronically ill patients who reinterpret their conditions

more positively also show better adjustment (Carver, Pozo, Harris, & Noriega, 1993). In sum, when stress and pain are inevitable, the adage to look for the silver lining and to "accentuate the positive" seems wise.

IMPLICATIONS OF EFFORTFUL CONTROL FOR COPING WITH PERSONAL VULNERABILITIES AND INTERPERSONAL DIFFICULTIES

Most of the delay of gratification studies have focused on conflicts between immediately available smaller rewards and delayed larger outcomes in essentially simple "less now" versus "more later" dilemmas. Similar psychological processes, however, underlie the subtler interpersonal conflicts that threaten to undermine many human relationships both in the work place and in intimate relations. Good intentions to maintain harmony and to work cooperatively toward common goals all too often are sabotaged by the explosion of anger, hostility, and jealousy within the daily tensions of life. It is in the heat of the moment that the need to inhibit hot, automatic—potentially destructive—reactions becomes most difficult in interpersonal relationships, particularly when those relationships are of high importance to the self.

These situations often create conflicts between the tendency to make immediate, self-centered responses, as opposed to focusing on the long-term consequences and implications for the partner and the preservation of the relationship itself (e.g., Arriaga & Rusbult, 1998). In the present model of self-regulation, a constructive approach to such conflicts requires cooling hot system activation by accessing cooling strategies that allow the long-term goals to be pursued, so that " . . . immediate, self-interested preferences are replaced by preferences that take into account broader concerns, including considerations to some degree that transcend the immediate situation" (Arriaga & Rusbult, 1998, p. 928). Basically, to attain interpersonal accommodation requires delay of gratification—making and sustaining a choice between immediate but smaller self-interest and a delayed but larger interest (larger in the sense that it is good both for the self and for the relationship).

Supporting this analysis, evidence suggests that cooling attention control processes that underlie delay ability also help in the regulation of defensive reactions in interpersonal contexts. To illustrate, we explored the hypothesis that delay ability serves as a protective buffer against the interpersonal vulnerability of *rejection sensitivity* or RS. Viewed from a CAPS perspective, RS is a chronic processing disposition characterized by anxious expectations of rejection (Downey & Feldman, 1996) and a readiness to encode even ambiguous events in interpersonal situations (e.g., partner momentarily seems inattentive) as indicators of rejection that rapidly trigger automatic hot reactions (e.g., hostility–anger, withdrawal–depression, self-silencing (Ayduk et al., 1999, 2002, 2003). Probably rooted in prior rejection experiences, these dynamics are readily activated when high RS people encounter interpersonal situations in which rejection is a possibility, triggering in them a sense of threat and foreboding. In such a state, the person's defensive, fight-or-flight system is activated, and attention narrows on detection of threat-related cues, which in turn makes the high RS person ready to perceive the threatening outcome—and to engage in behaviors (e.g., anger, hostility, exit threats) likely to ultimately confirm their worst fears by wrecking the relationship (Downey, Freitas, Michaelis, & Khouri, 1998). Repeated rejection and disillusionment with relationships tend to erode self-worth, and low self-esteem is a common characteristic of people high in RS.

In short, RS may predispose vulnerable individuals to react in automatic and reflexive impulsive hot ways, rather than engage in reflective, goal-oriented, or instrumental responses in interpersonal interactions. According to our self-regulatory processing model, however, whether this characteristic pattern unfolds or not should depend on the availability of self-regulatory competencies. To the extent that high RS individuals are capable of accessing the strategies that enable them to attenuate negative arousal, they may be able to inhibit some of their destructive behavioral patterns.

These theoretically expected processing dynamics are depicted in Figure 6.2. Panel A shows a high RS network in which potential trigger features (e.g., partner seems bored and distracted) activate anxious rejection expectations and are encoded as rejection which quickly activates hot thoughts ("she doesn't love me anymore") and negative affect. Attention control and cooling strategies are relatively inaccessible and/or have weak inhibitory links to the RS dynamics, allowing this vulnerability to have an unmediated effect on eliciting destructive behavior. In contrast, Panel B depicts a high RS network where attention control and cooling strategies are highly accessible and de-activate the RS dynamics via strong inhibitory links so that the event is not encoded as rejection, and hot thoughts and feelings are inhibited. Consequently the individual's dispositional vulnerability—the tendency to behave in a destructive manner—is attenuated and the negative consequences of this disposition are circumvented.

To explore these expectations empirically, in one set of studies self-regulatory ability was assessed by measuring the child's waiting time in the delay of gratification situation at age 4 years (Ayduk et al., 2000, Study 1). This longitudinal study showed that among vulnerable (high RS) individuals, the number of seconds participants were able to wait as preschoolers in the delay situation predicted their adult resiliency against the potentially destructive effects of RS. That is, high RS adults who had high delay ability in preschool had more positive functioning (high self-esteem, self-worth, and coping ability) compared with similarly high RS adults who were not able to delay in preschool. Furthermore, high RS participants showed higher levels of cocaine-crack use and lower levels of education than those low in RS, only if they were unable to delay gratification in preschool. That is, high RS people who had high preschool delay ability had relatively lower levels of drug use and higher education levels, and in these respects were similar to low RS participants.

A similar pattern of results was found in a second study with middle school children from a different cohort and from a very different socio-economic and ethnic population (Ayduk et al., 2000, Study 2). Namely, whereas high RS children with low delay ability were more aggressive toward their peers and thus had less positive peer relationships than children low in RS, high RS children who were able to delay longer were even less aggressive and more liked by their peers than low RS children. Consistent with the moderating role of delay ability in the RS dynamics, a cross-sectional study of preadolescents boys with behavioral problems characterized by heightened hostile reactivity to potential interpersonal threats also showed that the spontaneous use of cooling strategies in the delay task (that is, looking away from the rewards and self-distraction) predicted reduced verbal and physical aggression (Rodriguez, Mischel, Shoda, & Wright, 1989).

In a more direct experimental test of the effect of hot and cool systems on hostile reactivity to rejection, college students imagined an autobiographical rejection experience focusing either on their physiological and emotional reactions during the experience (hot ideation) or contextual features of the physical setting where this experience happened (cool ideation). In a subsequent lexical decision task, hostility and anger words were less accessible to those individuals primed with cool ideation than those primed with hot ideation. More important, this was true for both high RS and low RS participants. The same

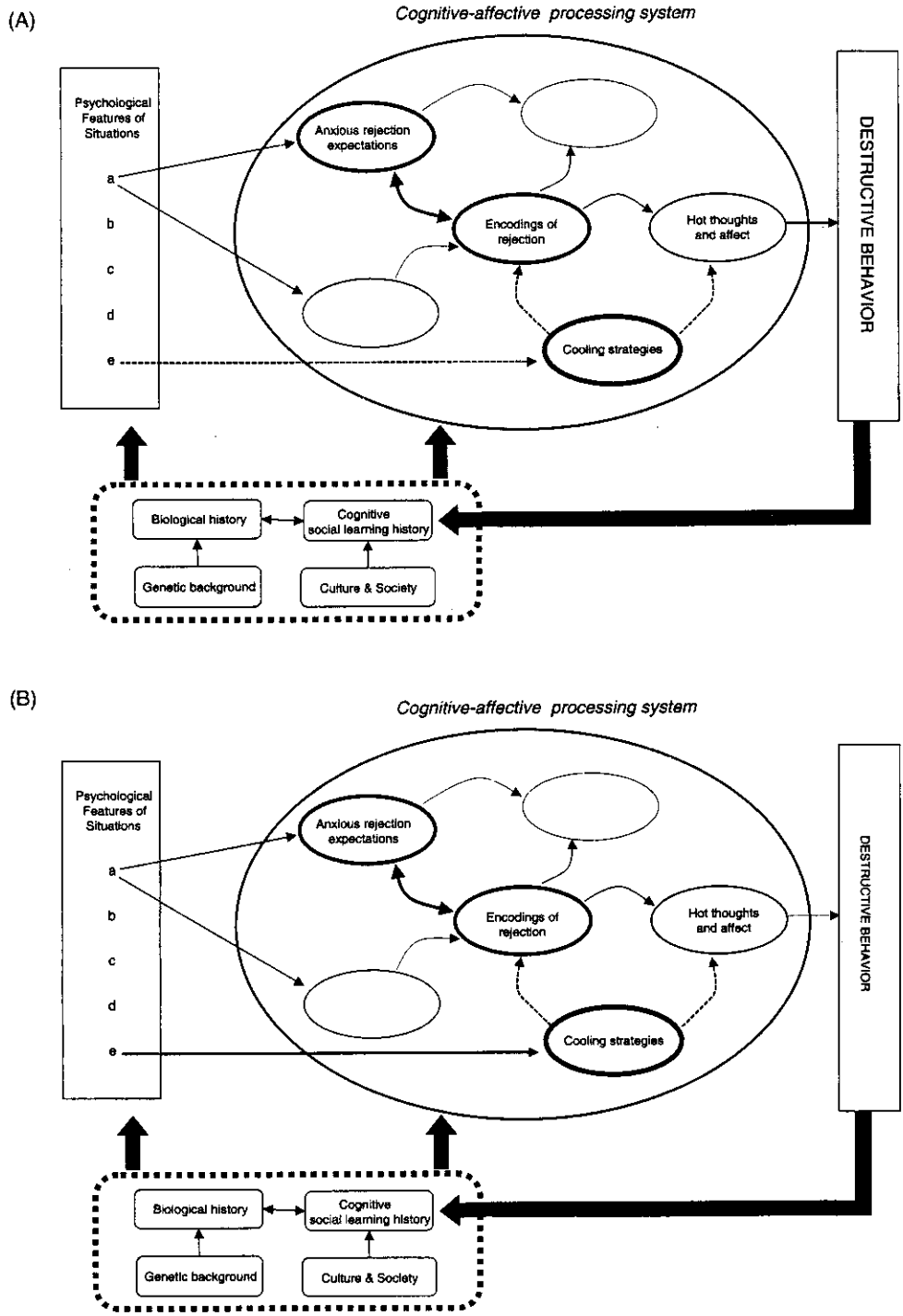

FIGURE 6.2. Interactions between attention control and rejection sensitivity (RS) in the CAPS network. (A) A high-RS network where attention control and cooling strategies are relatively inaccessible and/or weakly connected, through inhibitory links, to the RS dynamics, allowing them to have an unmediated effect on eliciting destructive behavior. (B) A high-RS network where attention control and cooling strategies are highly accessible and connect to the RS dynamics via strong inhibitory links, attenuating the individual's tendency to behave in a destructive manner.

pattern of anger reduction in the cool condition was found in people's self-report measures of angry mood and in the level of angry affect expressed in their descriptions of the rejection experience (Ayduk, Mischel, & Downey, 2002).

In sum, these correlational and experimental findings, taken collectively, suggest that how high RS translates into behavior over the course of development depends on the accessibility of self-regulatory competencies like those tapped by the delay of gratification paradigm. In the present model the extent to which an individual is likely to engage in the destructive interpersonal behavior to which the RS vulnerability readily leads depends on the connection—or lack of connection—between the activation of the RS dynamic and the activation of the relevant attention control strategies. If these two subsystems are inter-connected within the network's organization, the cooling strategies can modulate the hot reactivity of the RS dynamic, as illustrated by Figure 6.2, and the individual may be protected against the maladaptive behavioral consequences of this vulnerability.

What is true for the RS vulnerability also may apply to diverse other dispositional vulnerabilities. A growing body of research is examining similar interaction patterns between self-regulation competencies and other personality variables for diverse set of behavioral outcomes. To illustrate, Derryberry and Reed (2002) report that attention control (measured by a self-report measure of flexible shifting and focusing of attention) helps regulate attention biases of high anxious individuals in processing threat-related information. Whereas anxious individuals with poor attention control show a bias to focus on threat-related cues, anxious participants with good attention control are better able to shift their attention away from threat information, showing the buffering effects of attention control on trait anxiety. Consistently, Eisenberg and colleagues find that dispositional negative emotionality and attention control predict children's social functioning both additively and multiplicatively (see Eisenberg, Fabes, Guthrie, & Reiser, 2002, for review). More specifically, children high in negative emotionality and low in attention control seem to be at greatest risk for difficulties with peers, and externalizing as well as internalizing problems, while high regulation seems to buffer against the effect of negative emotionality on problem behaviors.

CONCLUDING REMARKS

We have argued that in the CAPS model of self-regulation, willpower requires the joint operation of regulatory motivation and competencies. Whereas strength of desire, and goal commitment, are necessary first steps in order to be able to sustain those intentions to completion, often under hot, frustrating, temptation-filled conditions, the individual has to rapidly access and flexibly utilize certain cognitive-attention deployment strategies whose key ingredients we have attempted to articulate. Furthermore, the interaction between motivation and competencies is not a one-time serial process, nor is there only one choice to be made (e.g., when the individual decides whether or not to delay gratification in the first place). Rather the process of sustaining effortful control plays out over time, as choices shift when the experience proves to be more difficult than initially anticipated, and as the power of the situation exerts its effect. In a connectionist, dynamic view of self-regulation, motivational and cognitive-attention control processes operate simultaneously and in a mutually recursive manner: the strength and commitment to one's long-term goals, and their importance within the goal hierarchies of the total system, affect how much effort may be expended in utilizing available self-regulatory skills. At the same

time, utilization of attention control mechanisms and the subsequent inhibition of hot system processing helps one to stay committed to the initial goal by making all the relevant CAUs—self-efficacy beliefs, control expectancies, value of the goal and so on—highly salient and accessible.

To reiterate, for the effortful control processes necessary to maintain willpower to be accessed rapidly when they are urgently needed, and maintained over time, they have to be converted from conscious, slow and effortful to automatic activation, in this sense taking the effort out of "effortful self-control." Fortunately, as reviewed earlier in this chapter, the processes that enable this conversion (e.g., through planning and rehearsal) have become increasingly clear (see Gollwitzer, 1999; Patterson & Mischel, 1975).

We also want to re-emphasize that effective self-regulation and adaptive coping depend on the particulars of the continuous interactions between the motivating effects of the emotional, hot system and the strategic competencies enabled by the cognitive, cool system, not on the predominance of either system with the shut down of the other. It is true that in many situations in which the person wants to exercise self-control and finds it most difficult to do so, the hot system is activated by the situational pressures of the moment (the tempting pastry tray is in one's face) and cooling strategies may be urgently needed—at least some of the time. But it would be a misreading to think that adaptive goal pursuit is served by shutting down the hot system altogether and having the cool system prevail.

At the level of brain research, the work of Damasio and colleagues documents in detail the importance of both systems and their continuous interactions (e.g., Bechara, Damasio, Damasio, & Lee, 1999). For example, their somatic marker hypothesis suggests that both the ventromedial prefrontal cortex (VMF; a "cool system" structure in our conceptualization) and the amygdala (locus of the "hot" system) are essential parts of a neural circuitry that is necessary for advantageous decision making. In the "gambling tasks" in these studies, subjects choose between decks of cards that yield either immediate or delayed gratification (i.e., high immediate gain but larger future loss vs. lower immediate gain but a smaller future loss). Although we cannot elaborate the details here, briefly these studies show how both the patients with damage to the VMF and those with damage to the amygdala make disadvantageous decisions in the gambling game (i.e., choose immediate gratification), but this is the consequence of different kinds of impairments. Patients with amygdala damage cannot effectively experience somatic (emotional states) either after winning or losing money, and never develop conditioned affective reactions (i.e., increased skin conductance reflecting high arousal); subsequently, the potential impact of this kind of somatic information on decision making is precluded. VMF patients on the other hand, show somatic states in response to reward and punishment but they cannot integrate all of this information in an effective and coherent manner; thus, the somatic states (although experienced) cannot be used as feedback in subsequent decision making. These studies make it clear that patients who have impairment in what we call the hot system, as opposed to those with damage in the cool system, both encounter serious problems with delay behavior: clearly we need both systems and their interactions to make the choice to delay gratification for a larger yet distal good and to sustain effort toward its attainment.

Years ago, a distinguished humanist, Lionel Trilling (1943) also addressed both the gains and losses that either the absence or the excess of willpower can yield. After noting the place of passion in life and "the strange paradoxes of being human," he emphasized that "the will is not everything," and spoke of the "panic and emptiness which make their onset when the will is tired from its own excess" (p. 139). Excessively postponing

gratification can become a stifling, joyless choice, but an absence of will leaves people the victims of their biographies. Often the choice to delay or not is difficult, yet in the absence of the competencies needed to sustain delay and to exercise the will when there is a wish to do so, the choice itself is lost.

In this chapter we have tried to show that while many of the ingredients of willpower, and particularly the processing dynamics that enable regulatory competence and delay of gratification, have long been mysterious, some of the essentials now are becoming clear. Self-regulatory ability assessed in the delay of gratification paradigm reflects stable individual differences in regulatory strength that are visible early in life and cut across different domains of behavior (e.g., eating, attachment, aggression). Much is also known about the basic attention control mechanisms that underlie and govern this self-regulatory competence. These control rules help to demystify willpower and point to the processes that enable it. Further, the implications of regulatory ability—or its lack—for the self are straightforward, influencing self-concepts and self-esteem, interpersonal strategies (e.g., aggression), coping, and the ability to buffer or protect the self against the maladaptive consequences of chronic personal vulnerabilities such as rejection sensitivity.

An urgent question remains unanswered: can self-regulation and the ability to delay gratification be taught? We already know that attention control strategies are experimentally modifiable (Ayduk et al., 2002; Mischel et al., 1989). Also, modeling effective control strategies can have positive consequences, generalizing to behavior outside of the lab in the short run for at least a period of a month or so (Bandura & Mischel, 1965). What we do not know yet is whether—and how—socialization, education, and therapy can effectively be utilized to help individuals gain the necessary attention control competencies to make willpower more accessible when they need and want it. For both theoretical and practical reasons it is time to pursue this question. We hope the answers will turn out to be affirmative—and not too long delayed.

ACKNOWLEDGMENTS

The preparation of this chapter was supported by Grant No. MH39349 from the National Institute of Mental Health. We would like to thank Ethan Kross for his constructive comments on several drafts of this chapter.

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