

CHAPTER 18

Getting Our Act Together: Toward a General Model of Self-Control

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ABSTRACT

Research on self-control has enjoyed tremendous growth over the past few decades, as researchers from a variety of disciplines have tested different self-control techniques in different domains of self-control. The result has been a proliferation of theories, models, and approaches, each offering important, but so far largely unrelated insights. The lack of a unifying framework has been an impediment to the development of an incremental science of self-control, and has left researchers struggling to relate their work to that of others. In this chapter, we present a general model of self-control, which we call the cybernetic process model of self-control. This model integrates two existing models—Cybernetic control theory (Carver & Scheier, 1982) and the process model of emotion-regulation (Gross, 1998b)—and describes the process through which tempting impulses arise and may be regulated. The cybernetic process model of self-control provides a conceptual framework for organizing disparate findings from research on self-control, and serves as a useful aid in selecting and designing appropriate self-control techniques.

Keywords: Self-control, self-regulation, emotion-regulation, delay of gratification, cybernetic process, emotion, temptation, reconstrual, suppression, reappraisal, response modulation, intervention design

GETTING OUR ACT TOGETHER: TOWARD A GENERAL MODEL OF SELF-CONTROL

Research on self-control has been growing at an incredible pace. Based on current publication trends, the number of peer-reviewed articles on self-control for 2001 to 2010 will be greater than that of the four preceding decades put together.¹ We now know that an individual's level of self-control predicts important life outcomes including school performance, health behaviors, and substance abuse (Duckworth & Seligman,

2005; Mischel & Ayduk, 2004; Mischel, Shoda, & Rodriguez, 1989). In the clinical domain, low self-control is a central feature of many clinical disorders (Heiby & Mearig, 2002; Strayhorn, 2002a; Tangney, Baumeister, & Boone, 2004), as well as a reliable predictor of psychopathology and problematic behaviors in children (Eisenberg et al., 2001; Krueger et al., 1996).

With so much research on self-control taking place, what do we know about ways in which people can bolster their own self-control? What

options does an individual have when facing temptation? And which of these options, or what combination of them, is best? Despite their importance, the answers to these questions are not as clear as we would like. Part of the reason for this lies in the fact that our understanding of self-control is currently hampered by the lack of an integrative framework. Presently, researchers have no way of meaningfully relating their findings to those of others in the field, and the result is a hodgepodge of techniques with which to bolster self-control in specific domains or in specific situations, rather than a structured method of prioritizing and choosing the most appropriate techniques for the challenges at hand.

Our goal in this chapter is to present an integrative framework that will enable researchers and practitioners to use a shared language when communicating their insights and findings. This, in turn, will allow practitioners and researchers to systematically examine the etiology of the difficulty that their client (or research participant) is facing, determine the points that are most amenable to intervention, and then select or develop the most appropriate intervention. Our main interest is in the behavioral-experiential aspects of temptations and self-control. However, our integrative framework may also serve as a basis for neuropsychological study of self-control, and thus help build bridges between researchers studying basic self-regulatory processes, researchers studying naturalistic human behavior, and practitioners who develop interventions for real-life temptations that people face in everyday life.

The framework that we propose represents the integration of two prior models: Cybernetic control theory (Carver & Scheier, 1982) and the process model of emotion-regulation (Gross, 1998b, Gross & Thompson, 2007). The integrated model provides an overarching framework that clarifies the relations among different self-control techniques and establishes a way to prioritize diverse interventions. To provide a foundation for this model, we begin by defining temptations and self-control. We then review and compare the two existing models of self-control, integrate them, and present a general model of self-control. We explain the different types of

self-control methods and provide examples and empirical evidence relating to each one. We conclude by proposing a system of prioritization for the different types of self-control methods, based on features of the methods themselves, as well as external and internal contextual factors.

TEMPTATIONS AND SELF-CONTROL

We define temptation as *the impulse to behave in a way that one fully expects to regret at a later time*. Although people frequently behave in ways that are potentially regrettable, our focus is on behaviors that people fully expect to regret, even before they perform them. Note that this definition revolves around the belief that the individual holds about future regret *prior* to emitting the behavior. If one fully expects to regret a certain behavior and yet desires to perform it, one is experiencing temptation. It is possible that one would take the action that one expects to regret and later discover that one does not regret it (e.g., John chooses to stay in bed a few extra minutes despite knowing that he would be late for school and expecting to regret his decision, but upon arriving late at the school, he learns that his first class was cancelled). For our purposes, what matters is whether in the moment of choice the individual believes that the more immediately appealing alternative will lead to regret.

Note also that this definition does not include an element of probability ("Maybe I'll regret it, and maybe I won't.") —instead, one is certain that acting in accordance with the desired behavior will lead to regret. More specifically, people experience temptations when the goal of experiencing a relatively small short-term gain² is competing with the goal of experiencing a relatively large long-term gain (see Table 18-1). Thus, the short-term goal of feeling less upset (achievable by drinking alcohol) may compete with the long-term goal of staying sober (achievable by avoiding alcohol). Similarly, the short-term goal of feeling comfortable (achievable by staying in bed) may compete with the long-term goal of improving physical fitness (achievable by getting up to exercise). Generally speaking, despite having a clear long-term goal in mind (staying sober, improving physical fitness), one

TABLE 18-1. EXAMPLES OF TEMPTATIONS AND NONTEMPTATIONS

Short-Term Goal	Long-Term Goal	Self-Control Task
<i>Temptations (conflict between short-term and long-term goals)</i>		
Consuming alcohol	Remaining sober	Inhibiting alcohol consumption
Staying in bed	Improving physical fitness	Initiating exercising
<i>Nontemptations (no conflict between short-term and long-term goals)</i>		
Drinking water	Avoiding dehydration	N/A
Taking a nap	Being well-rested	N/A

Note: Temptations involve a conflict between a short-term goal and a long-term goal. In tempting situations, the person realizes that acting in line with the short-term goal will result in failure to attain the long-term goal and consequently lead to regret.

may feel drawn to act in a way that prevents the attainment of this goal (drink alcohol, stay in bed and skip exercise), to experience a relatively small but more immediate short-term gain.

Having defined temptation, we are now able to define self-control. Researchers have previously defined self-control as the ability to override pre-potent responses (Vohs, Baumeister, & Ciarocco, 2005), to overcome threats that short-term goals pose to long-term goals (Fishbach & Trope, 2005), or to act in accordance with perceived self-interests (Loewenstein, 1996). In the present context, we will use the term to denote *the ability to resist temptations*. The form that self-control takes depends on the temptation at hand. Referring to the examples we listed in Table 18-1, one might need to inhibit a certain impulse (e.g., avoid drinking alcohol despite the urge to do so) or to initiate a behavior despite the impulse to avoid doing so (e.g., starting to exercise despite the urge to stay in bed). Self-control refers to acting in line with one's long-term goal, despite the allure of a contradictory short-term goal.

EXISTING MODELS OF SELF-CONTROL

People attempt to control various aspects of their lives. Broadly speaking, people may try to control *extra*-personal factors (such as the temperature of the room, the Web site that their computer is displaying, the behavior of people around them, etc.), as well as *intrapersonal* factors (such as their mood, the tone of their voice, their level of hunger, etc.). Such extrapersonal and intrapersonal factors are typically tightly linked, and people often attempt to influence

one by manipulating the other. Thus, to reduce my hunger (intrapersonal), I may order a burrito at a local store (thereby manipulating the behavior of the sales person, which is extrapersonal for me). Similarly, to receive flight details from a finicky voice-activated phone system (extrapersonal), I may have to put effort into enunciating clearly rather than screaming with frustration (thereby controlling my own speech, which is intrapersonal).

Two influential models describe ways in which people exercise extra- and intrapersonal control, with each model focusing mainly on one of these. The *cybernetic control model* (Carver, 2004; Carver & Scheier, 1982) describes ways in which interactions with the environment give rise to behavioral impulses, and then details how such impulses are translated into behaviors that gradually change the environment. The cybernetic control model is largely concerned with the ways people manipulate and shape their environments—how people exert *extrapersonal* control. In addition, the cybernetic control model, although broadly applicable, does not specify how individuals may change the regulation process itself, thus rendering the regulation process blind to itself.

The *process model of emotion regulation* (Gross, 1998b; Gross & Thompson, 2007) complements the cybernetic control model by delineating ways in which impulses can be modulated, albeit in the more specific field of emotion research. The process model of emotion regulation is largely concerned with ways in which people attempt to alter their own emotional experience and control their expression

of this experience—how people exert *intrapersonal* control. Although the process model of emotion-regulation applies to a comparatively narrow domain (dealing only with emotions), it offers important insights regarding ways in which individuals regulate their own experience. We now turn to a more detailed overview of the two models.

The Cybernetic Control Model

Behavior is commonly guided by goals. People may want to help a friend, drink a glass of juice, drive safely, avoid humiliation, stay healthy, relax, or achieve any other goal. Goals typically require multiple steps to be achieved. These steps can themselves be thought of as smaller, intermediate sub-goals (Carver & Scheier, 1982; Vallacher & Wegner, 1987). Thus, eating watermelon (top goal) requires that I get it out of the refrigerator (sub-goal), which in turn requires that I stand next to the refrigerator (sub-sub-goal), which in turn requires that I get up from the sofa (sub-sub-sub-goal), and so on.

People continuously monitor their progress toward (or away from) goals by attending to their environment, and adjust their behavior in response to stimuli that seem relevant to the achievement of their various goals and sub-goals. After getting up from the sofa, I start walking towards the refrigerator. I can see that I am still too far away to reach it (my sub-goal of reaching the refrigerator hasn't been achieved), and so I continue to walk. As I walk, I hear the sound of an airplane flying by. This information is irrelevant with respect to my current goal, and so I continue on my way to the refrigerator. After a few steps, I find myself close enough to the refrigerator and I stop—I have achieved my sub-goal. I now switch to a different sub-goal (taking out some watermelon). In this way, I continuously compare the environment that I perceive ("I am standing next to the refrigerator with no watermelon in my hands.") to my current goal ("having watermelon in my hands"), and act on my environment to achieve my goal. If there is a discrepancy between my current goal and the environment I perceive, the comparison process produces an impulse that calls for a certain behavior, which is aimed at

reducing the discrepancy between my situation (my perceived environment) and my goal.

Carver and Scheier (1982) formally presented this notion to the psychological community in the form of cybernetic control theory,¹ as depicted in Figure 18-1a.⁴ In this model, each stage of the process receives input from the preceding stage, processes it in some way, and feeds an output to the subsequent stage of the process. Thus, the environment is perceived, and this impression of the environment is fed to the comparator. The comparator compares the perceived environment to a goal (or standard), and outputs an impulse, aimed at generating behavior that would influence the environment, so that it would more closely match the goal on the next comparison.⁵ This impulse influences behavior, which in turn impacts the environment. The acted-upon environment is perceived again, compared again with the goal, the comparator outputs another impulse, and so forth.

The role of the comparator bears elaboration, as it is subtler than that of the other elements of the process. In the cybernetic control model, the comparator's work is described as determining whether there is a discrepancy between the environment (which the perception element provides) and the criterion or standard (which the goal element provides). We propose a small but critical addition to the "job description" of the comparator. After receiving input from the perception element, the comparator determines the *relevance* of that input to the goal and then, if the input is deemed relevant, compares the perceived environment to the goal. Making this additional role explicit helps to connect the cybernetic control model with the extensive literatures on emotion and motivation, in which researchers have suggested that emotions arise as a response to events that are seen as relevant to one's goals (Frijda, 1988; Gross & Thompson, 2007; Lazarus, 1991), and that the intensity of emotions is related to the rate and direction at which this discrepancy is changing (Carver, 2004; Carver & Scheier, 1990; Hsee & Abelson, 1991; Lawrence, Carver, & Scheier, 2002). In the example above, distance from the refrigerator was a relevant input (and therefore used to determine the behavioral impulse), whereas the sound

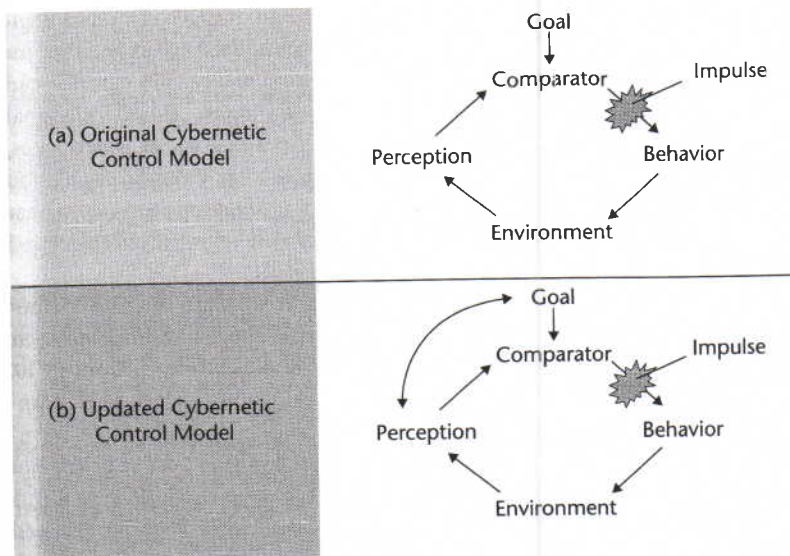


Figure 18-1. Cybernetic control model (Adapted from Carver & Scheier, 1982). The gray explosion (added by us) represents the generation of an impulse according to this model.

of a passing airplane was not (and therefore was not used to determine the behavioral impulse).

We have also updated the diagram of the cybernetic control model to represent research findings that are relevant to our discussion of self-control, by adding a bi-directional link between the *perception* and *goal* elements (see Figure 18-1b). A strong and consistent body of research has demonstrated how goals that people hold can bias their perception, often in a way that would preserve or bolster these goals (Jonas et al., 2001; Kunda, 1990; Lord, Ross, & Lepper, 1979; Nickerson, 1998). Conversely, a growing body of research has been exploring ways in which environmental cues can activate goals, even without conscious awareness (Bargh et al., 2001; Bonson et al., 2002; Fishbach, Friedman, & Kruglanski, 2003; Forster, 2007; Kavanagh, Andrade, & May, 2004; Lowe & Levine, 2005; Mauss, Cook, & Gross, 2007; Wansink, Painter, & Lee, 2006). As will become apparent in following sections, the powerful connection between goals and perception plays an important role when considering various methods of self-control.

The canonical example of a cybernetic control system is a thermostat, which compares the ambient temperature (the environment) to the

target temperature (the goal). If the ambient temperature is higher than the goal, the mechanism works to lower the temperature, and if the ambient temperature is lower than the goal, the mechanism works to raise the temperature. But people differ from thermostats in a number of important ways—not the least of which is people's capacity to self-reflect, and their ability to hold conflicting goals. Thus, a person may experience an urge to heat a room (because he is uncomfortably cold), but at the same time realize that this would be a bad idea (because this would result in a large gas bill, which he cannot afford). This type of internal conflict, and the ways in which it may be resolved, is missing from the cybernetic control model. Although the cybernetic model provides a compelling account of the way in which people attempt to exert extra-personal control by regulating their *environment* (namely, reducing the discrepancy between it and their goal), the model is unable to adequately represent the way in which people attempt to exert intra-personal control by regulating their own *behavior*, in part because it focuses on ways in which impulses arise and are acted upon, rather than ways in which these impulses may be regulated.

The Process Model of Emotion-Regulation

Unlike thermostats, people are capable of simultaneously having multiple and even conflicting goals. As a result, people do not immediately act on all impulses that they experience; instead, they may try to postpone or change either the impulse itself or its expression, using a variety of methods. One domain in which researchers have intensively studied such efforts has been the field of emotion regulation. In subsequent sections, we will generalize findings from this field to the broader domain of self-control, to discuss ways in which people exert intra-personal control by regulating their own impulses and behavior.

Emotions are coordinated sets of responses (experiential, physiological, behavioral) that arise as a result of interacting with the environment and perceiving stimuli that are seen as relevant to one's goals, and prepare or propel individual to act in a specific manner (Frijda, 1988; Gross & Thompson, 2007; Lazarus, 1991). Thus, individuals experiencing anger become more likely to aggress, whereas individuals experiencing amusement become more likely to smile. In this manner, emotions function in a similar manner to "impulses" in the cybernetic control model.

People often try to control which emotions they experience, when they experience them, and how they express them (Gross & John, 2003). Giggling during a solemn religious ceremony can be awkward. Showing envy at a friend's good fortune is a good way to make everybody feel upset. Getting angry at the driver who just cut you off can be a very bad idea if you suffer from hypertension (or if you are driving in certain parts of L.A.). In general, people often attempt to up-regulate (i.e., have more of) or down-regulate (i.e., have less of) certain emotions, either to feel good, or because they believe that certain emotions are more beneficial in specific situations (Tamir, 2005; Tamir & Robinson, 2004).

People engage in emotion-regulation for a variety of reasons, including the motivation to avoid the unpleasant experience of negative emotions, to display more socially appropriate

behavior, or to avoid dangerous physiological arousal. Sometimes the very experience (or behavioral expression) of a certain emotion can be considered a temptation, as an individual may expect to regret doing so. At other times, people may engage in emotion-regulation without experiencing temptation (i.e., without believing that they will regret their emotional experience in the future).

People attempt to regulate their own emotions in many ways. They may imagine their "happy place," breathe deeply and count to 10, smile at their conversation partner while planning exquisite revenge, or simply force themselves to display an emotion that they are not experiencing. To organize these diverse forms of emotion regulation, Gross (1998b) presented a process model of emotion regulation, which divided the various methods of regulating emotions into two broad categories according to the stage of the emotion-generative process during which they take place. *Antecedent-focused* emotion-regulation takes place before the emotion is generated, whereas *response-focused* emotion-regulation takes place after emotion is generated. These broad categories of emotion regulation methods can be broken down further into subcategories, each influencing a particular component of the emotion-generative process (see Fig. 18-2). The five general families of emotion regulation methods are: Situation selection, situation modification, attention deployment, cognitive change, and response modulation.

The process model of emotion regulation is inherently descriptive, rather than prescriptive. It specifies different types of emotion-regulation strategies and predicts differential effects of using different strategies, but it does not indicate when specific regulation strategies should be used. Research has demonstrated clear divergence in the consequences of using at least two of the strategies proposed by the model—namely, cognitive change and response modulation—on an experiential, physiological, cognitive, and social level (Gross, 2002; Gross & John, 2003; Richards & Gross, 2000; Butler et al., 2003; Gross, 1998a; Richards, Butler, & Gross, 2003). Nevertheless, the process model of emotion-regulation remains silent with respect

Figure 18-2. Process model of emotion regulation (Adapted from Gross & Thompson, 2007). The gray explosion (added by us) represents the generation of emotion according to this model.

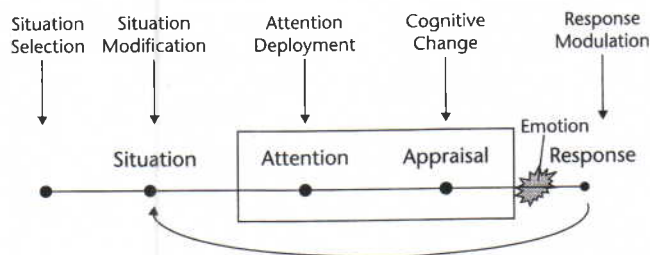
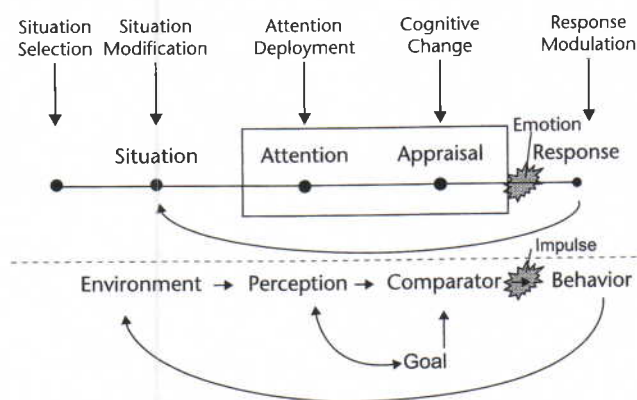


Figure 18-3. Juxtaposition of the process model of emotion regulation (top half: Gross, 1998b; Gross & Thompson, 2007) and the cybernetic control model (bottom half: Carver & Scheier, 1982). The gray explosion (added by us) represents the generation of an emotion (according to the process model of emotion regulation) or an impulse (according to cybernetic control theory).



to the levels of effort and benefit associated with each strategy of emotion regulation in particular situations, in part because it focuses on ways in which impulses are regulated, rather than ways in which these impulses arise in the first place.

THE CYBERNETIC PROCESS MODEL OF SELF-CONTROL

Overall, these two models of self-control bear remarkable similarity to one another in terms of the process that they describe (see Fig. 18-3). At the heart of both models is the view that one's behavior is motivated by the difference between how things are (one's perceived environment) and how one would like things to be (one's goals). Although each model uses slightly different language to describe this process, both models trace the root of this impulse (emotion) to the comparison between (appraisal of) the real and the ideal.

Although the two models describe a similar underlying process by which impulses (emotions) are produced, they differ in their focus on possible targets for the regulatory process (see Fig. 18-4). The cybernetic control model focuses on ways in which people regulate their environments, whereas the process model of emotion regulation focuses on ways in which people regulate their responses to these environments—their impulses and behaviors. Moreover, whereas the cybernetic control model is broadly applicable, it does not explicitly address the problem at the heart of self-control challenges: The need to override prepotent responses that may undermine important long-term goals. In contrast, the process model of emotion-regulation offered a categorization system for ways in which individuals regulate a fairly specific type of impulse—namely, emotional reactions.

Considering both models together allows us to describe in detail the process by which impulses arise, as well as ways in which impulses

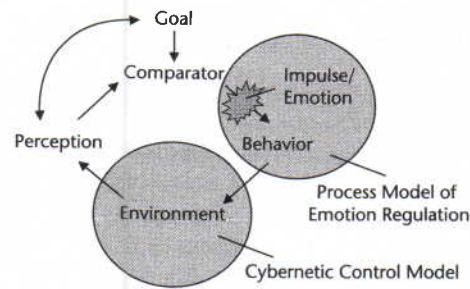


Figure 18-4. Different regulatory targets of the two models. The cybernetic control model (Carver & Scheier, 1982) focuses on regulation of the extrapersonal, whereas the process model of emotion regulation (Gross, 1998b; Gross & Thompson, 2007) focuses on regulation of the intrapersonal. The gray explosion represents the generation of an impulse (according to cybernetic control theory) or an emotion (according to the process model of emotion regulation).

can be self-regulated. In this sense, the cybernetic control model and the process model of emotion regulation complement each other well, since each describes a part of the phenomenon that self-control researchers are interested in. The former describes ways in which impulses are *externally regulated* and the *environment* is shaped, whereas the latter describes ways in which such impulses may be *self-regulated* and *behavior* may be shaped. The correspondence between the two becomes apparent when comparing the constituent elements of both models (see Fig. 18-3). Indeed, these general categories of emotion-regulation methods can be applied to the stages of the cybernetic process with respect to any domain that can be described using a cybernetic process, and can be used to analyze any process that requires or involves self-control. Applying the categories of regulatory acts that the process model of emotion-regulation offers with the broadly applicable cybernetic process model results in an integrated model that combines the strengths from both of its predecessors: Although maintaining an explicit focus on self-control processes, the new model can easily accommodate, describe, and analyze a broad array of temptation situations and self-control behaviors from a wide range of domains.

By integrating these two models, we have created the cybernetic process model of self-control (see Fig. 18-5). According to this general model of self-control, control of behavior may be achieved by applying one of the following methods, or any combination of them: (1) Situation selection, (2) Situation modification, (3) Attention deployment, (4) Cognitive change, or (5) Response modulation (see Table 18-2). Numerous common and effective responses to temptations involve using more than one type of method. A common example is engaging in an alternative activity to distract oneself (e.g., Feindler, Marriott, & Iwata, 1984; Patterson & Mischel, 1976), which combines elements of both attention deployment and response modulation. Successful application of any of these interventions will result in behaving in a manner that is better aligned with long-term goals (e.g., remaining sober, or improving physical fitness), despite competing short-term goals (e.g., drinking alcohol, staying in bed).

In the remainder of this section, we elaborate on each of the five families of self-control. We explain the general principal behind each method, and provide examples to illustrate when and how each may be used, based on examples from the research literature (see Table 18-2). To provide examples from a broad range of possible internal conflicts, we demonstrate the application of each method to two cases. In the first case, we present an individual who attempts to down-regulate (i.e., reduce or inhibit) the impulse to consume alcohol. In the second case, we present an individual who attempts to up-regulate (i.e., initiate or increase) the impulse to exercise. Following these examples, we provide a brief overview of research findings related to the methods of self-control that we presented.

Situation Selection

The most forward-looking approach to self-control is *situation selection*. This form of self-control refers to people's attempts to choose situations that make it more (or less) likely that they will experience impulses that lead to desirable (or undesirable) behaviors. In terms of the cybernetic control model, this technique operates on the *environment* element of the loop.

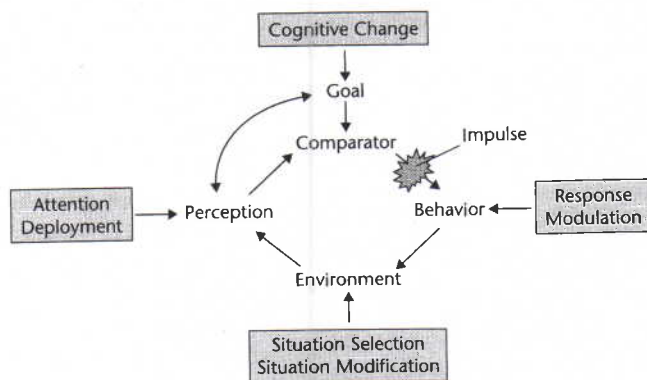


Figure 18-5. The cybernetic process model of self-control, based on cybernetic control theory (inner circle: Carver & Scheier, 1982) and the process model of emotion regulation (outer circle, gray boxes: Gross, 1998b; Gross & Thompson, 2007). The gray explosion represents the generation of an impulse (according to cybernetic control theory) or an emotion (according to the process model of emotion regulation).

TABLE 18-2. EXAMPLES OF EXISTING SELF-CONTROL TECHNIQUES AND THEIR CORRESPONDING STAGES AND INTERVENTION TYPES IN THE CYBERNETIC PROCESS MODEL OF SELF-CONTROL

Cybernetic Stage	Intervention Type	Specific Techniques
Environment	Situation selection	Breaking ties with drug-using associates ¹ Food-related stimulus control ² Hiding tempting object ³
	Situation modification	Chemical pleasure blockers ⁴ Community reinforcement ⁵ Precommitment ⁶
Perception	Attention deployment	Engaging in alternative activity ⁷ Goal verbalization ⁸ Cognitive load + self-control cues ⁹ Relaxation (e.g., deep breathing, imagery) ¹⁰
Goal/Comparator	Cognitive change	Cognitive reconstrual ¹¹ Covert modification ¹² Soft commitment ¹³ Implementation intentions ¹⁴ Acceptance and defusion ¹⁵
Behavior	Response modulation	Behavioral suppression ¹⁶ Engaging in alternative activity ⁷ Relaxation (e.g., deep breathing, imagery) ¹⁰

Note: ¹Schroeder et al., 2001; ²Foreyt & Goodrick, 1993; Poston 2nd & Foreyt, 2000; ³Metcalf & Mischel, 1999; Wansink, Painter, & Lee, 2006; ⁴Drugs meant to reduce pleasure from alcohol consumption (e.g., Acamprosate/ Disulfiram/Naltrexone); Luty, 2006; ⁵Sisson & Azrin, 1986; ⁶Ariely & Wertenbroch, 2002; ⁷Kavanagh, Andrade, & May, 2004; Patterson & Mischel, 1976; ⁸Genshaft, 1983; Patterson & Mischel, 1976; ⁹Mann & Ward, 2004; Parent, Ward, & Mann, 2007; Westling, Mann, & Ward, 2006; ¹⁰Feindler, Marriott, & Iwata, 1984; Mann & Ward, 2004; ¹¹Fujita, Trope, Liberman, & Levin-Sagi, 2006; Magen & Gross, 2007; Mischel & Moore, 1980; ¹²Feindler, Marriott, & Iwata, 1984; ¹³Kirby & Guastello, 2001; Rachlin, this volume, but cf. Khan & Dhar, 2007; ¹⁴Gollwitzer & Schaal, 1998; Milne, Orbell, & Sheeran, 2002; Sheeran & Orbell, 1999; ¹⁵Forman et al., 2007; Gifford et al., 2004; Kavanagh, Andrade, & May, 2004; ¹⁶Baumeister, Muraven, & Tice, 2000; Feindler, Marriott, & Iwata, 1984; Muraven & Baumeister, 2000.

For a number of days, Ken has been successfully abstaining from drinking alcohol. Before going to the bank, Ken realizes that his usual route will take him right past the bar in which he often used to drink. Ken decides to take a different, longer route through a local park, which does not have any bars or liquor stores next to it. This way, Ken reasons, he would not have to confront temptations that may be too powerful for him at this stage.

Before moving to a new city, Barbie is determined to begin exercising regularly. As she chooses between two potential new homes, Barbie is left with two appealing alternatives: one that is located very close to her workplace in a central part of the city, and another that is located farther away from her workplace, but close to attractive hiking and biking trails. Barbie chooses the latter, hoping that the accessibility of the trails will help her exercise more often.

In these examples, Ken and Barbie chose environments that would facilitate their goals by eliciting (or not eliciting) impulses that they consider more (or less) desirable. In the addiction literature, overwhelming evidence points to the power of environmental stimuli to evoke drug craving, if these stimuli were previously associated with drug consumption (Bonson et al., 2002; Weiss, 2005). In terms of the cybernetic process, if Ken spends time near certain stimuli (*environment*), he is more likely to notice them (*perception*). This may generate craving (a consumption goal), which may lead to alcohol consumption (*behavior*). Conversely, if Ken avoids such stimuli, he is less likely to perceive them, cravings are less likely to be activated, and drinking is less likely to be initiated.

A related line of classic research in social psychology discusses channel factors (Leventhal, Singer, & Jones, 1965), and demonstrates the strong influence that the accessibility of environmental facilitators and hindrances has on behavior. In Barbie's case, choosing to live in the second home will make her more likely to perceive the trails, exercise goals are more likely to become activated (hiking may seem like an attractive and available option), and she is more likely to go outside and enjoy the trails, thereby realizing her long-term goal of exercising more. For other examples of situation selection techniques, see Table 18-2.

Situation Modification

Being in a situation that may potentially elicit an undesirable impulse does not mean that this impulse is inevitable. *Situation modification* refers to strategically changing the situation to influence the impulses and subsequent behaviors that will result from it. Because modifying a situation beyond a certain extent can be said to produce a new situation, situation modification and situation selection are not easily separable. In terms of the cybernetic control model, situation modification operates on the *situation* element of the loop.

Ken, who recently decided to abstain from drinking alcohol, is going to his friend's house for dinner. After sitting down at the table, Ken realizes that his friend is wearing a T-shirt that features an advertisement for an alcoholic beverage. Continuing to face the advertisement poses a risk to Ken's determination to abstain from drinking, as it may trigger craving that will be hard to resist. Ken prefers not to cancel the friendly dinner (doing that would qualify as an application of the situation selection technique, and also as potentially rude). Nevertheless, Ken does not want to face the advertisement throughout the dinner. Ken decides to modify the situation by politely explaining this problem to his friend and asking the friend to wear a shirt that does not display such an advertisement.

Barbie just started biking, but would like to go at a more vigorous pace. She switches on her MP3-player, to listen to energizing music while biking, hoping that listening to the music will sustain a higher level of effort on her part.

In both of these examples, Ken and Barbie altered the situations they were in so as to prevent the elicitation of undesirable impulses, or facilitate the elicitation of desirable impulses. In this way, even without avoiding the situation or choosing a new environment, Ken and Barbie successfully prevented impulses which they wished to avoid. Making small changes to tempting situations, such as hiding treats behind a screen or moving them a short distance away, can significantly impact the power that such temptations exert over children (Mischel & Ebbesen, 1970) as well as adults (Wansink, Painter, & Lee, 2006). For other examples of situation modification techniques, see Table 18-2.

Attention Deployment

People often find themselves in situations that they cannot easily choose or change (thus ruling out situation selection or situation modification), and which may give rise to problematic impulses and behaviors. Yet even without changing the external situation, it is possible to selectively attend to certain aspects of the situation, to influence the impulses that arise. Situations have many aspects, and *attention deployment* refers to the way in which individuals direct their attention within a given situation to influence their reactions to it. Although this method of self-control does not change the external situation, it can be thought of as an internal version of situation selection, as it changes the *internal* situation that is experienced. In terms of the cybernetic control model, this technique operates on the *perception* element of the loop.

The train that Ken is riding on his way home from work stops between two stations. The conductor's voice on the PA system apologizes for the delay, and explains that they will be stopped for a few minutes. Looking out the window, Ken realizes that he is stopped right next to a liquor store. Ken knows that continuing to pay attention to this store is likely to result in alcohol craving, which may be too great of a challenge at this stage of his abstinence. The train is packed, and Ken is unable to move elsewhere, cannot make the train start going (although, like many other passengers, he dearly wishes he could), and is unable to change the location or appearance of the store. Shutting his eyes, he finds that his mind wanders to the store, and tempts him to look at it more. Ken shuts his eyes again, this time keeping himself engaged by imagining the furniture in his apartment and trying to reposition the various pieces in his mind's eye. After a few minutes, the train jolts back into motion, and the liquor store disappears behind Ken's back.

After biking for some time, the batteries in Barbie's MP3 player have run out—and Barbie is beginning to feel sore. To shift her attention away from her aching muscles, Barbie listens to the sounds that her bike is making on the dirt path, and improvises a song that incorporates the rhythmic squeaks and clanks.

In both of these examples, Ken and Barbie selectively turned their attention towards certain aspects of the situations that they were in, and away from others. By doing this, Ken and Barbie promoted desirable impulses and behaviors (and prevented the elicitation of undesirable impulses and behaviors), even without changing the external situations that they were in. Ken engaged in mental imagery (Feindler, Marriott, & Iwata, 1984), whereas Barbie kept herself busy by engaging in an alternative behavior (Mischel & Ayduk, 2004; Patterson & Mischel, 1976). Both of these diversions served to prevent them from attending to the stimuli that were eliciting the undesirable impulse. In general, attention deployment can be performed externally (e.g. by covering the eyes or ears) or internally (e.g. through distraction or concentration). This method of self-control is one of the first self-regulatory processes to appear in development (Rothbart, Ziaie, & O'Boyle, 1992), and appears to be used from infancy through adulthood, particularly when it is not possible to select or modify one's situation. For other examples of attention deployment techniques, see Table 18–2.

Cognitive Change

Selecting or modifying our environment is not always an option, and there are times when we need to attend to problematic situations or objects, which may give rise to counter-productive impulses and behaviors. Nevertheless, even in such difficult situations, one can still change the way in which one thinks about the situation, to alter the impulses that are generated in response to perceiving it. *Cognitive change* refers to the way in which people can either strategically transform the relevance of a stimulus to their goal, or change the goal against which they compare the stimulus. In terms of the cybernetic control model, this technique operates on the *goal/comparator* elements of the cybernetic loop.

Ken, who is carrying on with his efforts to abstain from drinking alcohol, is watching a movie in which one of the actors plays an alcoholic who is trying to stop drinking, and exerts super-human efforts to this end. At the very end of the

movie, the character surprises most of the audience members by exclaiming that "no human being can possibly resist such cravings" and promptly embarking on a drinking binge. When the lights turn back on, Ken feels shaken—if this impressive character could not do it, how could he? And if he is about to eventually fail, what is the point of going through this suffering in the meantime? As self-doubt gnaws at him, his craving for alcohol grows—if I'm going to start drinking again at some point, I may as well do it now... But Ken manages to calm himself down, by reminding himself that the movie is made for dramatic effect, and doesn't really reflect anything about his own experience. Comforted by this thought, Ken continues with his alcohol-free evening.

Before going to sleep, Barbie decided that she would exercise early on the following morning. When she wakes, exercising seems unappealing, and the bed is so warm and inviting... Exercising somehow seems less important at that moment, and Barbie realizes she is likely to fall back asleep. She then decides to think about the situation differently, and to view getting up for exercise as a test of willpower. Can she do it? Barbie now feels that getting up would be a sign of strength, while staying in bed would be a sign of weakness. Staying in bed suddenly seems less appealing...

In both of these examples, Ken and Barbie strategically changed how they thought about their situations to elicit more desirable reactions (and less undesirable reactions), even without changing the situation or shifting their attention away from the situation. In the example above, Ken used a method that Feindler and colleagues termed "covert modification" (Feindler, Marriott, & Iwata, 1984), and which proved helpful for aggressive school children who learned to control their aggression when responding to the words of others. By doubting the realism of the events in the movie, Ken was able to dramatically reduce the relevance of this information for his goal of remaining sober, and preserve his sense of self-efficacy (Bandura & Locke, 2003; Gwaltney et al., 2002; Zimmerman, Bandura, & Martinez-Pons, 1992). Barbie employed a different strategy—she *reconstrued* her experience and changed

the meaning of her choice. By thinking about her situation as a test of an internal quality that was important to her (willpower), Barbie changed the appeal of her possible choices. In an empirical test of this method, undergraduate students who were performing a math task were distracted by comedy video clips. Students who were instructed to think of the distracting comedy clips as a test of willpower were less distracted by them, and showed less enjoyment when they did attend to them—possibly as a result of perceiving themselves as failing on their own test of willpower (Magen & Gross, 2007). For other examples of cognitive change techniques, see Table 18–2.

Response Modulation

There are times when one experiences undesirable impulses which push one to act in a way that is clearly not in one's best interests, such as attacking one's friend, overeating, engaging in unsafe sex, or generally acting in a way which one expects to regret. Fortunately, experiencing powerful undesirable impulses does not necessarily result in undesirable behavior. *Response modulation* refers to the way in which people can attempt to directly control their own behavior despite the impulse that they experience to act in a certain way, by figuratively (or literally) clenching their teeth and willing themselves to behave in a manner that is more aligned with their own long-term goals. In terms of the cybernetic control model, this technique operates on the behavior element of the cybernetic loop.

Shopping at a supermarket, Ken is surprised when a salesman walks up to him and offers a free wine sample from a clear plastic cup. Having been abstinent from alcohol for nearly a week, the powerful impulse to accept the drink almost overwhelms Ken. With the salesman is holding the drink up to him, Ken is unable to turn his attention away from the drink and does not have the wherewithal to think about the situation in a new way. Instead, Ken swallows hard and forces his legs to take him away from the maddeningly aromatic wine. Two aisles later, sweating and breathing deeply, Ken is able to start thinking again.

Biking up an especially difficult part of the trail, Barbie is having a hard time. She is out of breath and can't stop thinking about getting off her bike for a rest. She can't change her situation without abandoning her exercise goal, and she is unable to shift her attention away from her difficulty, or to think about it differently. Nevertheless, Barbie wills herself to continue biking without stopping, and eventually completes her exercise routine. A few minutes later, after completing her ride, Barbie smiles to herself as she stretches.

In both of these examples, Ken and Barbie acted in a way that was different from the impulse they were experiencing. After perceiving the wine, Ken experienced a strong urge to drink the wine (perceiving the alcohol activated a consumption goal), but did not comply with this urge. Similarly, Barbie experienced a strong impulse to stop exercising (perceiving her own pain activated a resting and rejuvenating goal), but acted in opposition to this urge. Baumeister and colleagues (Chapter 20; Muraven, Collins, & Neinhaus, 2002) have been studying this form of self-control in a wide variety of domains, promoting the theory that the capacity for response modulation relies on a limited internal resource, which becomes depleted as a result of prior efforts, much like a muscle that becomes tired following exertion. According to this theory, such depletion results in a short-term reduction in the capacity to successfully apply this form of self-control (but cf. Martijn, Tenbèult, Merckelbach, Dreezens, & de Vries, 2002). For other examples of response modulation techniques, see Table 18-2.

IMPLICATIONS FOR SELECTING AND DESIGNING SELF-CONTROL INTERVENTIONS

With such an array of methods for self-control, how do we choose the method that will serve us best? Which method is most likely to succeed, and at what cost? Are some methods better suited for certain contexts or people? In the remainder of this chapter, we address these questions by considering the properties of the different intervention methods, as well as the role of external and internal contextual factors.

High-Leverage versus Low-Leverage Methods

The ideal place to intervene is usually at the beginning. Unfortunately, the cybernetic process is a recursive loop, and therefore does not have a clear starting point. This difficulty notwithstanding, we assert that intervention at some stages can be more efficient, and thus more likely to be successful than at others. In particular, we propose that the cybernetic stages can be divided into two types: high-leverage and low-leverage. We further propose that self-control methods targeting high-leverage stages (high-leverage methods) are more likely to be successful, and require less sustained effort, than the interventions that target low-leverage stages (low-leverage methods). Table 18-3 presents our proposed prioritization when selecting and designing self-control interventions.

TABLE 18-3. GENERIC PRIORITIZATION OF SELF-CONTROL METHODS, BASED ON DIVISION TO HIGH-LEVERAGE AND LOW-LEVERAGE METHODS

Cybernetic stage	Self-control method
<i>High-leverage methods</i>	
1. Environment	Situation selection/Situation modification
2. Goal/Comparator	Cognitive change
<i>Low-leverage methods</i>	
3. Perception	Attention deployment
4. Behavior	Response modulation

Note: The order of the stages as listed here is different from their chronological order (e.g., Figure 18-5). See text for the definitions of high-leverage and low-leverage methods.

In the cybernetic process, a *high-leverage* stage is one that exerts a strong influence on the subsequent stage, but is not necessarily influenced as strongly by the preceding stage. We propose that the environment exerts a strong influence on perception (the subsequent cybernetic stage), but can clearly exist and change independently of one's behavior (the preceding cybernetic stage). Similarly, we propose that one's goal/comparator exerts a strong influence on one's behavior (the subsequent cybernetic stage), and yet the goal itself can be determined irrespective of the stimuli that are being perceived (the preceding cybernetic stage). Therefore, we consider the environment and the goal/comparator stages to be high-leverage stages.⁶

In contrast, a *low-leverage* stage is one that is strongly influenced by the preceding cybernetic stage, and does not necessarily exert a strong influence over the subsequent stage. We propose that the environment exerts a strong influence on perception, whereas perception does not necessarily exert a strong influence on the goal/comparator. Similarly, we propose that the goal/comparator exerts a strong influence on behavior, whereas behavior does not necessarily exert a strong influence on the environment. Therefore, we consider the perception and the behavior stages to be low-leverage stages.⁶

Research has demonstrated that intervening at any stage of the cybernetic process can be effective, in terms of avoiding unwanted behavior and promoting desirable behavior (Strayhorn, 2002a). Nevertheless, there are important implications to choosing self-control methods that target high-leverage vs. low-leverage stages of the cybernetic process. Interventions that target low-leverage stages (perception, behavior) are likely to require constant energy expenditure and vigilance, since influential input from the preceding stages will continue to feed into them unaltered. Distracting oneself away from a tempting object (attention deployment, e.g. Ken's mental rearrangement of his furniture while sitting on the train next to a liquor store) requires sustained effort for as long as the tempting object is perceivable. Directly controlling one's own behavior to stop oneself from acting in a detrimental manner (response modulation,

e.g. biting one's lip to avoid shouting insults at a friend) also requires sustained effort, since as long as the environment does not change, the environment → perception → comparator → impulse flow will continue to produce the same behavioral impulse, and this impulse will have to be continuously overridden via direct response modulation. This type of continuous effort may cause such interventions to backfire, as it exerts a psychological (Gross, 2002; Muraven, Collins, & Neinhans, 2002; Muraven, Tice, & Baumeister, 1998; Richards & Gross, 2000) and physiological (Gross, 2002) toll on individuals who employ them, and can only be sustained for a limited duration before breaking down (Muraven & Baumeister, 2000; Muraven, Collins, & Neinhans, 2002; Shiffman, 1984).

In contrast, interventions that target high-leverage stages may effectively alter the trajectory of the process and result in a self-sustaining change. Such an intervention, if performed successfully, does not require the expenditure of additional resources and does not tie up precious psychic resources. Avoiding exposure to a tempting situation (situation selection, e.g. asking a waiter not to bring the dessert menu) removes any subsequent need to resist this temptation, since the option is simply not available. Thinking about a tempting object as an opportunity to display a valued internal quality (cognitive change, e.g. Barbie thinking about getting out of bed as a test of willpower, rather than as simply an opportunity to exercise) changes the relevant goal against which the environment is compared, thereby producing different impulses in response to the same environment (Fujita et al., 2006; Magen & Gross, 2007). Thus, successful implementations of high-leverage interventions can result in lasting change that does not require sustained effort, even when the tempting object remains nearby and available.

The Role of External and Internal Contextual Factors

Both external and internal contextual factors may affect the effectiveness and suitability of particular self-control interventions. With respect to external factors, there are times when

high-leverage methods are inappropriate, or when low-leverage interventions may be sufficient for the task at hand. If Barbie realizes that she has difficulty with controlling her anger at work during disagreements with customers, avoiding disagreements altogether (situation selection, a high-leverage self-control method) may not be a satisfactory, or even possible, solution. In this case, Barbie may be wise to explore possibilities for cognitive change (the next-best intervention method). Conversely, a low-leverage intervention may be a perfectly acceptable solution when the self-control effort does not need to be sustained for a long time, as in situations in which an environment is likely to change very soon (e.g., swallowing nasty-tasting cough syrup).

Internal factors that influence the effectiveness of self-control interventions include transient internal states such as cognitive load or intoxication. Cognitive load occurs when a person's cognitive resources are taxed (e.g., being asked to hold a random digit string in memory while naming the capitols of different countries). The effect of cognitive load on self-control is not straightforward, but a number of studies suggest that the main impact of cognitive load is to make people more reliant upon salient environmental cues to guide their behavior—a reliance which can promote either low or high degrees of self-control, depending on the cues that are present (Mann & Ward, 2004; Parent, Ward, & Mann, 2007; Westling, Mann, & Ward, 2006). Similarly, research suggests that the main effect of intoxication is similar to that of cognitive load (Casbon et al., 2003; Ditto et al., 2006; MacDonald et al., 2003), by causing behavior to become more dependent on external cues.

People appear to underestimate the magnitude of the effect that such changes will have on them (Gilbert, Gill, & Wilson, 2002; Loewenstein, 1996; Nordgren, van der Pligt, & van Harreveld, 2006), a phenomenon which Loewenstein (2005) labeled "empathy gap." This empathy gap is potentially the most pernicious aspect of transient vulnerabilities of the sort we discussed here. The bulk of the evidence suggests that the best strategy may be to rely heavily on situation selection in preparation

for times in which cognition may be impaired (e.g., intoxication, cognitive load, fatigue), and situation modification while in these states. Unfortunately, people are not likely to structure environments when they do not realize the extent of their future dependence on external cues. Thus, before drinking with a group of friends, one would be wise to avoid carrying car keys, credit cards, or large amounts of cash, all of which could lead to a variety of problems in the hands of an individual who (temporarily) determines how to act on the basis of the objects around him. Similarly, before going on a date with an attractive but unknown stranger, one would be wise to ensure the availability of contraceptives, rather than relying on their own sound judgment in the event that sex becomes a viable possibility.

CONCLUSION

In modern society, the role of self-control is perhaps more important than it has ever been before. Increasingly sophisticated marketing techniques have set up an environment that some researchers consider "toxic" (Wadden, Brownell, & Foster, 2002, p. 510), and which exerts its influence on people of an ever-younger age, as evidenced by a recent study demonstrating that children 3–5 years of age reported that food wrapped in McDonald's wrapper tastes better than food wrapped in plain wrapper (Robinson et al., 2007). Such an environment promises an abundance of short-term pleasure—and long-term suffering. Harming ourselves and others is easier than ever, as dangerous foods, drugs and weapons all continue to become increasingly more available, and as physical activity becomes a matter of choice for many members of society. Throughout our lives, the ability to successfully navigate this veritable sea of temptations is of the utmost importance.

Despite decades of research, systematic answers about how to manage temptations have remained elusive, in part because there has been no clear way to organize the multitude of domain-specific findings. In this chapter, we have presented the cybernetic process model of self-control, which provides a domain-

general framework for analyzing both the arising and regulation of tempting impulses. This model delineates five general families of self-control methods, and prescribes a system for prioritizing these methods, while considering the idiosyncratic features of the person and the situation at hand. The five families of self-control methods are by no means mutually exclusive—indeed, successful treatment programs often combine several interventions that correspond to a number of the methods in our model (Feindler, Marriott, & Iwata, 1984; Forman et al., 2007; Strayhorn, 2002b). The selection of the specific techniques will depend on the nature of the temptation, as well as the person who will be facing it. We hope that the model we have presented here will prove beneficial for researchers and practitioners alike, by facilitating clear communication regarding the general and domain-specific features of self-control.

AUTHOR NOTE

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NOTES

- 1 We used *PsycInfo* to identify peer-reviewed publications containing the phrase “self-control” or “self-regulation” in their title, abstract, or descriptor from 1960 to the present. To project the total number of publications for 2001–2010, we computed the average yearly publication rate for the years 2001–2006 and then multiplied this yearly average by 10. Results were: 1960–1970: 233; 1971–1980: 1,000; 1981–1990: 1,543; 1991–2000: 1,324; 2001–2010: 4,550.
- 2 We use the word “gain” to mean either the experiencing of a pleasant state, or the avoidance of experiencing an unpleasant state.
- 3 The word “cybernetic” derives from a Greek word meaning “pilot” or “governor,” and relates to ways in which systems (both living and non-living) use feedback to operate more efficiently. The term in its present meaning was coined by Norbert Weiner (1948).
- 4 The original model included another source of influence on the environment (separate from the individual’s behavior) labeled “disturbance.” We chose not to display this component to maximize the clarity of the general model of self-control (which we present later).
- 5 The same authors have also postulated the existence of “anti-goals,” which are standards that people wish to avoid, rather than approach (e.g. Carver, 2004). For the sake of simplicity, we limit our present discussion to regular goals, although we believe that our discussion applies equally to both types of goals.
- 6 Our delineation of high/low leverage stages is purely hypothetical, as we are not aware of existing research that addressed this issue.

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