CHAPTER 26

SELF-REGULATION AND ITS FAILURE: THE SEVEN DEADLY THREATS TO SELF-REGULATION

Dylan D.Wagner and Todd F. Heatherton

> If in each human life we count up what should be credited to the account of automatism, of habit, of the passions, and above all of imitation, we shall see that the number of acts that are purely voluntary, in the strict sense of the word, is very small. . . . Between the habits which render it useless and the maladies that mutilate or destroy it, the will as we have said above, must be taken as a happy accident. (Ribot, 1884, p. 131)

What would it be like to be in possession of an indomitable will? What if resisting temptations and ignoring distractions were simply a matter of flicking a mental switch, of irrevocably deciding not to give in to cravings or succumb to indolence? If this state of perfect self-control were achievable, addictions could be easily conquered, distractions would cease to be distracting, and fatigue or frustration would no longer jeopardize our best laid plans. Yet it is equally likely that when our schemes tend toward gluttony, vice, or malice, we may end up relentlessly pursuing them to our own detriment. It is perhaps a bitter fortune, then, that evolution has failed to endow us with complete mastery over ourselves. Indeed, most of the time it seems as though achieving long-term goals demands in tribute a thousand little self-control failures as people procrastinate and distract and disappoint themselves before finally succeeding at their plans.

Although the psychological study of self-regulation rose to prominence mainly in the 1980s and 1990s (see Baumeister, Heatherton, & Tice, 1994; Karoly, 1993), its roots can be traced back to the dawn of scientific psychology, where it was often discussed under the guise of volition, will, or voluntary attention. In contemporary usage, the terms *self-regulation* and *self-control* are often, though not always (Carver, 2004), used as synonyms referring to the effortful and voluntary control of external behavior and of internal thoughts, emotions, and attention, all in the service of meeting long-term goals. With respect to behaviors, self-regulation may deal either with the initiation of a behavior (e.g., going to work) or the inhibition of one (e.g., not drinking a glass of alcohol, especially when at work). Self-regulation is also concerned with various forms of mental control (e.g., Wenzlaff & Wegner, 2000) whereby people regulate their thoughts and emotions without necessarily exhibiting any outward behavior. Self-regulation also overlaps with—or some might say subsumes—the concept of executive function more traditionally used in neuropsychology and cognitive psychology (e.g., Norman & Shallice, 1986), and thus self-regulation includes regulating the focus of attention and the contents of working memory. Finally, in recent years the definition of self-regulation has widened to include a host of nonconscious self-regulatory processes that can be automatically triggered and often do not require effort (see Bargh & Ferguson, 2000; Fitzsimons & Bargh, 2004).

In the preceding passage we have described some of the domains of self-regulation, but equally important is the purpose of self-regulation. Perhaps the most widely agreed-on function of

http://dx.doi.org/10.1037/14341-026
APA Handbook of Personality and Social Psychology: Vol. 1. Attitudes and Social Cognition, M. Mikulincer and P. R. Shaver (Editors-in-Chief)

self-regulation is to bring thoughts and behavior in line with goals and intentions. From smokers trying to quit smoking to students striving to get good grades, everyone must continually engage in thousands of acts of self-regulation in which they set goals; initiate or inhibit actions, thoughts, or emotions; and monitor for signs of failure (Bandura, 1991; Baumeister & Heatherton, 1996; Carver & Scheier, 1981; Metcalfe & Mischel, 1999). Implicit in this process is a self that sets goals and standards, is aware of its own thoughts and behaviors, and has the capacity to change them (e.g., Baumeister, 1998; Heatherton, 2011). Given this definition of self-regulation, it should come as no surprise that self-regulation research encompasses a range of topics, few of which are under the strict purview of social and personality psychology alone. Consequently, the study of self-regulation is by necessity multidisciplinary, crossing many distinct domains of research, such as developmental psychology (Kopp, 1982), drug addiction (Marlatt & Gordon, 1985), and health psychology (Bandura, 1990, 2005). In this chapter, we similarly take a multidisciplinary view and consider empirical findings from many disciplines. That being said, the theoretical backbone underlying this chapter derives almost exclusively from the pioneering theories of self-regulation developed in social psychology (e.g., Bandura, 1991; Baumeister & Heatherton, 1996; Carver & Scheier, 1981; Metcalfe & Mischel, 1999).

In the following sections, we present an overview of self-regulation theory and research with an emphasis on the causes and mechanisms of self-regulatory failure. We then provide a brief overview of the brain basis of self-regulation failure and discuss how the empirical findings support a model of self-regulation failure that is domain general but tailored to the individual's particular goals—and vices—and sensitive to the regulatory contexts that people may find themselves in.

ORIGINS OF THE STUDY OF SELF-REGULATION

Perhaps more than any other intellectual tradition, Western thought has been preoccupied with issues of will and self-control. Ancient Greek philosophers spoke of the conflict between reason and passion and prescribed that to live a virtuous life, reason must be cultivated and the passions controlled. In his dialogues, Plato described man as being a chariot pulled by two horses; one, a noble, magnificent horse, the other a wild and ugly thing that can scarcely be controlled by spur or whip. In this allegory, the white horse represents reason and, if all goes well, should dominate the dark horse of animal passion and appetites in guiding the chariot. Inspired by Plato, Aristotle wrote extensively about self-control (*enkrateia*) and the lack of self-control (*akrasia*), arguing that it is important not only to avoid vice and beastliness (e.g., passions, appetites) but also to avoid *akrasia*. Perhaps unsurprisingly, Christianity took up these same ideas with great enthusiasm, making self-control (termed *temperance*) one of the four cardinal virtues. The importance of self-control to living virtuously was not only under the domain of religion; 19th-century education, especially in the United States, was founded on the principle of teaching children a moral education to banish the "host of private vices and public crimes, which now embitter domestic peace" (H. Mann, 1849, p. 96). It was thought that by teaching children self-control and moral values early, virtuous and lawful behavior would eventually become habitual so that as adults people could not but do good. Indeed, textbooks of the time were filled with moral epigrams and stories proselytizing the virtues of self-discipline, humility, and restraint, even going so far as to include these moral lessons in textbooks on arithmetic and spelling (McClellan, 1992).

Around this same time can be seen the first murmurings of a psychology of self-regulation. For instance, William James (1890) wrote of the need to continually practice little bouts of self-control, which he referred to as *effort,* to be sufficiently trained to resist real temptations when they arise. Other 19th-century psychologists emphasized the mental exhaustion that results from prolonged bouts of effortful attentional control and wrote of the importance of training attention early in life to enable greater self-control in adulthood (Baldwin, 1890; Sully, 1884, 1892). The British psychologist

Alexander Bain and his disciple James Sully were among the first to describe the interdependence of mental and emotional control (Bain, 1859; Sully, 1892), even going so far as to suggest that these two forms of self-control rely on the same inhibitory mechanism in the brain (Bain, 1859). Sully (1883), in particular, emphasized that self-control is subject to failure not only when one is faced with overwhelming impulses and emotions but also—echoing modern-day implicit psychology—when faced with "inseparable associations" of thought, such as when thinking of a cigarette necessarily evokes thought of how pleasurable it is to smoke a cigarette (e.g., Papies, Stroebe, & Aarts, 2008). Sully also argued that self-control may fail from impairments in the "higher brain centers" as a result of overwork, alcohol, and mental illness (Sully, 1884).

This last point warrants expanding on because James, Sully, and Baldwin were all influenced by the writings of early psychiatrists on the impulse control problems exhibited by people who were mentally insane as well as by early reports of the impaired self-control wrought by brain damage (e.g., Ferrier, 1876; Starr, 1884). The early writings on this topic by the physicians Sir Thomas Clouston (1883) and Carpenter (1875), as well as the French psychologist Ribot (1884), were assuredly the most cogent descriptions of self-regulation failure to date and prefigured many aspects of current self-regulation theories. For example, Carpenter wrote of emotion regulation techniques taught to "hysterical" patients involving the use of attention control and distraction. He also discussed extensively the role of alcohol in diminishing volitional control, thereby leaving the "automatic activity of the cerebrum" (p. 636) unchecked.

Perhaps more than any other of these 19th-century thinkers, Clouston (1883) presented an elementary theory of self-control that is eerily similar to contemporary limited-capacity theories (e.g., Baumeister & Heatherton, 1996) and developmental theories based on individual differences in self-control (e.g., Mischel, 1974). Basing his ideas on observations of various forms of mental disease, Clouston postulated that "self-control exists in every possible degree of strength" (p. 314), with those who are mentally ill possessing the least amount. Moreover, Clouston wrote,

> Many persons have so small a stock of reserve brain power—that most valuable of all brain qualities—that it is soon used up, and you see at once that they lose their power of self-control very soon. They are angels or demons just as they are fresh or tired. (1883, p. 314)

Clouston also drew parallels between motor control failures in disorders such as chorea and the mental control failures in insane people, suggesting that self-control failures "may take place from a loss of controlling power in the higher regions of the brain or from an over-development of energy in certain portions of the brain which the normal power of inhibition cannot control" (p. 314).

This brief survey of 19th-century thought on self-control presages many of the topics and models that are discussed in the remainder of the chapter. It is a strange quirk of history, then, that—short perhaps only of William James—there is no direct line connecting the theories and rudimentary physiological models posited by the likes of Sully, Baldwin, and Clouston to any of the current thinking on self-regulation and its failure (including our own recent writing on the subject: Heatherton & Wagner, 2011; Wagner & Heatherton, 2010). It has been suggested that one of the reasons for this apparent dark age of self-regulation research during the first half of the 20th century was the simultaneous dominance of Freudian psychology, on the one hand, and of American behaviorism on the other, neither of which left much room for the voluntary regulation of thoughts and behaviors (see Mischel, Cantor, & Feldman, 1996). Without lessening any of the impact of contemporary findings, it is nevertheless fascinating to see that many of the ideas concerning self-control failure that are reviewed in the following sections have been with us for a long time.

SEVEN DEADLY THREATS TO SELF-REGULATION

As anyone who has attempted to quit smoking or lose weight will attest, self-control is difficult and

often prone to failure. Humans, it seems, are battered this way and that by temptations that gnaw at their resolve and wear down their capacity to stay in control. Adding insult to injury, the mental machinery that people rely on to stay in control is itself susceptible to impairment by fatigue or emotions. In the following section, we outline seven major threats to successful self-regulation.[1] These include environmental triggers, such as seeing someone smoking or being offered a drink at a party, and internal causes that impair the capacity to engage in self-regulation, such as emotional distress or self-regulatory exhaustion. In addition, we describe failures to monitor one's behavior for signs of self-regulation failure, such as can occur when self-awareness is low or even undesired (e.g., Heatherton & Baumeister, 1991). These seven threats to self-regulation not only operate in isolation but often conspire together to bring about self-regulatory collapse.

Cue Exposure and Impulse Control

Of the varieties of thought and behavior that need to be regulated, the most frequent of these are impulses. In this context, impulses are cravings or desires to perform a given behavior or consume a particular temptation. Although the extant literature has focused mainly on appetitive and compulsive behaviors (e.g., eating, using drugs, smoking, gambling), impulses also include more general hedonic behaviors such as the urge to relax or watch television. The common currency of impulses, then, is that they are pleasurable, inherently rewarding activities. Impulses capture attention and require effort to ignore or override; they are psychologically and emotionally hot (Metcalfe & Mischel, 1999). Controlling these impulses is thought to be the most common form of self-regulation in which people engage. From avoiding tempting foods to refraining from making snide remarks, impulse inhibition has been informally estimated as composing 90% of people's daily acts of self-regulation (Baumeister et al., 1994). More recently, Hofmann, Baumeister, Förster, and Vohs (2012), using an experience-sampling procedure, have estimated that people spend nearly a quarter of their day engaged in some form of impulse control, be it to avoid eating, checking e-mail, or taking a break from work. In addition to the temptations that people are conscious of resisting, there appears to also be a large number of tempting events of which people are, under normal circumstances, completely unaware. For instance, people appear to grossly underestimate the amount of food-related decisions they make in a typical day (e.g., what food to eat, when to eat it), believing that they make, on average, only 14 such decisions. However, when instructed to attend and make note of the various food-related decisions they make throughout the day, it turns out that they make, on average, 59 such decisions (Wansink & Sobal, 2007).

One of the most common ways for an impulse to arise is via an activating stimulus, such as exposure to food, alcohol, or drug cues. At any given moment, people are surrounded by readily available highly appetizing foods, be it from a nearby convenience store, vending machine, or, as is more common, their own cupboards. Although impulses, such as the desire for food, may arise as a result of internal physiological states, it is usually only in states of extreme deprivation that such internal cues dominate over external ones (e.g., Kozlowski & Herman, 1984), so that most of the time eating and smoking are driven by external factors. One of the first psychologists to study the role of external cues in triggering behavior was Stanley Schachter. In his highly influential internality–externality theory of obesity (Schachter, 1968, 1971), he posited that obese individuals are less aware of internal physiological cues indicating hunger and satiety and are simultaneously more susceptible to being controlled by external environmental influences, such as the sight and smell of bread baking. Although the finer points of this theory eventually fell out of favor (Rodin, 1981), Schachter was nevertheless the first to collect experimental evidence that external food cues can trigger eating behavior. For example, in one of these early studies, Schachter and his graduate student Lee Ross demonstrated that obese people were more

[1]We avoid calling these the *seven sins of self-regulation* because the number of seven sins in psychology is already at capacity. There are seven sins of memory (Schacter, 2002), evolutionary psychology (Panksepp, 2000), emotion (Davidson, 2003), and unconscious emotion (Clore, Storbeck, Robinson, & Centerbar, 2005). Even the unassuming Hebbian synapse is guilty of seven sins (Arshavsky, 2006).

susceptible than normal-weight people to eating when in the presence of visually salient food cues (Ross, 1969). To manipulate the salience of the food cue, they had participants sit at a table on which, among other things, there happened to be an open tin of cashews that was illuminated by either a 40-watt lightbulb or a 7.5-watt lightbulb. As predicted by externality theory, obese subjects in the more salient 40-watt condition ate more cashews, as measured by the change in weight of the tin before and after the experiment, than both normal-weight subjects and obese subjects who saw the cashews under lower levels of illumination. This same pattern was replicated in tobacco smokers by another Schachter student, Peter Herman, who, using the same manipulation of visual salience as Ross, found that nicotine-deprived light smokers showed a greater propensity to smoke after exposure to salient cigarette cues (Herman, 1974).

Since Schachter's early work, a large volume of research has been conducted examining the role of cues in inducing cravings and excessive consumption (for reviews, see Carter & Tiffany, 1999; Hofmann, Friese, & Wiers, 2008; Jansen, 1998; Niaura et al., 1988). Among chronic dieters (i.e., Herman & Polivy, 1975), compared with nondieters, exposure to food cues frequently leads to increased craving (Lambert, Neal, Noyes, Parker, & Worrel, 1991–1992), hedonic thoughts (Papies et al., 2008), and greater food consumption (Federoff, Polivy, & Herman, 1997, 2003; Harris, Bargh, & Brownell, 2009; Jansen & van den Hout, 1991; Meule, Lukito, Vögele, & Kübler, 2011; Papies & Hamstra, 2010; Rogers & Hill, 1989; Stirling & Yeomans, 2004), and it is the most often cited reason for diet failure (Grilo, Shiffman, & Wing, 1989). Even satiated normal-weight individuals are susceptible to the influence of strong food cues, showing increased desire for—and consumption of—appetizing foods after a brief taste (Cornell, Rodin, & Weingarten, 1989).

An especially remarkable example of the external control that food cues can have on eating behavior comes from research showing that patients with severe anterograde amnesia can be made to consume multiple successive meals simply by removing the previous meal and presenting a new one. In a study involving two such patients, Rozin, Dow, Moscovitch, and Rajaram (1998) administered three successive meals separated by short periods of idle conversation to momentarily distract the patients from ruminating on their recently completed meal. Surprisingly, both patients ate a second meal and then partially ate a third. In comparison, the nonamnesic control patients rejected the second meal outright. Although the patients did not continue eating ad infinitum, this study offers dramatic evidence for the theory that outside of extreme deprivation, or in this case extreme overeating, eating behavior is primarily driven by external cues (Herman, 1987; Kozlowski & Herman, 1984).

Much of what is true of dieters is also true of smokers and alcoholics, in that they both tend to show increased craving after cue exposure (Cooney, Litt, Morse, Bauer, & Gaupp, 1997; Drobes & Tiffany, 1997; Herman, 1974; Kober, Kross, Mischel, Hart, & Ochsner, 2010; Mucha, Geier, & Pauli, 1999; Payne, Schare, Levis, & Colletti, 1991; Rickard-Figueroa & Zeichner, 1985; Rubonis et al., 1994; Sargent, Morgenstern, Isensee, & Hanewinkel, 2009; Sayette & Hufford, 1997; Sayette, Martin, Wertz, Shiffman, & Perrott, 2001; Tiffany & Drobes, 1990) and consumption (Shmueli, Prochaska, & Glantz, 2010). Moreover, cue exposure has been shown to increase physiological indicators of arousal, such as heart rate and salivary response, in smokers and alcoholics (Abrams, Monti, Carey, Pinto, & Jacobus, 1988; Drobes & Tiffany, 1997; Kaplan, Meyer, & Stroebel, 1983; Payne, Smith, Adams, & Diefenbach, 2006) and in dieters exposed to food cues (Brunstrom, Yates, & Witcomb, 2004; Klajner, Herman, Polivy, & Chhabra, 1981; Legoff & Spigelman, 1987).

Does exposure to temptations always lead to self-regulation failure? Recently, a number of studies have converged on the view that, under certain circumstances, being exposed to tempting cues may actually activate self-regulatory goals, thereby decreasing the likelihood of self-control failure. For instance, Vohs and Heatherton (2000) found that when dieters were exposed to tempting foods that were physically distant, they subsequently ate less than dieters who were not exposed to food at all. To account for findings such as these, Trope and Fishbach (2000) developed a counteractive control

theory to explain the seemingly paradoxical finding that exposure to temptations can actually increase self-regulation. According to this theory, if an individual has a history of regulating his or her behavior in the face of temptation, such as a former smoker who routinely resists the urge to share a cigarette when seeing a friend smoke, then exposure to the tempting item may activate self-regulatory goals (Trope & Fishbach, 2000). Thus, in this account, when a dieter is faced with a tempting food cue, rather than increase the desire to consume the tempting item, the cue may instead activate the diet goal and reduce the likelihood of consuming the item. Evidence of this counteractive goal activation was later demonstrated by Fishbach, Friedman, and Kruglanski (2003) in a study showing that subliminal presentation of tempting food-related words led to increased activation of diet-related concepts. More important, this effect was strongest in individuals who indicated both that dieting was important to them and that they were successful in maintaining their weight; subjects for whom dieting was not important or who were unsuccessful at regulating their weight did not show increased activation of dieting goals after tempting primes (Fishbach et al., 2003; see also Ouwehand & Papies, 2010).

Often individuals are exposed to multiple cues that can elicit competing goals and desires. For example, many restaurant menus now advertise the relative health benefits of menu items. For dieters, this can lead to a self-regulatory dilemma when both the desire to eat high-calorie foods and the goal to regulate food intake are simultaneously activated. Papies and Hamstra (2010) conducted a clever field experiment in which they manipulated the presence of diet- and health-related cues in a supermarket. As shoppers entered the supermarket, the researchers measured the degree to which the shoppers ate free food samples when in the presence of a competing cue designed to elicit the goal of dieting (i.e., a poster advertising low-calorie recipes). Interestingly, they found that the presence of a competing dieting cue eliminated the ability of food cues to elicit subsequent eating in dieters (Papies & Hamstra, 2010).

Up until this point we have primarily discussed the evidence that exposure to tempting cues can elicit self-regulation failure, but an equally important issue is why tempting cues cause self-regulation failure. A number of theories have been posited to explain how tempting cues can hijack an individual's self-regulatory goals. Inherent in most of these theories is the notion that impulses have a strength—that is to say, some impulses are easier to override than others. At the highest level, it is obvious that images of cigarettes pose a stronger appetitive cue for smokers than for nonsmokers (e.g., Sherman, Rose, Koch, Presson, & Chassin, 2003); however, it may also be the case that for a dieter who happens to love cheese, a wedge of Appenzeller will prove infinitely more difficult to resist than a slice of American cheese. In addition to their inherently rewarding properties, tempting cues may also lead to activation of positive hedonic thoughts about the tempting item (e.g., Hofmann, van Koningsbruggen, Stroebe, Ramanathan, & Aarts, 2010; Papies et al., 2008). For instance, abstaining smokers demonstrate positive thoughts about smoking on cue exposure (Sayette & Hufford, 1997; Sayette et al., 2001; Sherman et al., 2003), and the strength of this association predicts smoking dependence (Huijding & de Jong, 2006; Rooke, Hine, & Thorsteinsson, 2008; Waters et al., 2007; Wiers & Stacy, 2006). Moreover, tempting cues have been shown to capture attention. For instance, smokers are faster than nonsmokers to orient their gaze toward smoking cues (Bonitz & Gordon, 2008), even when presented incidentally in a cluttered scene, such as during a movie (Lochbuehler, Voogd, Scholte, & Engels, 2011). In addition, individual differences in this attentional bias have been shown to predict craving (Field, Munafò, & Franken, 2009; Mogg, Bradley, Field, & De Houwer, 2003) and self-regulation failures in smokers trying to quit (Waters et al., 2003). Appetizing cues may also promote self-regulation failure by occupying memory (Kemps, Tiggemann, & Grigg, 2008; Madden & Zwaan, 2001; Tiggemann, Kemps, & Parnell, 2010) and inhibiting regulatory goals (Papies et al., 2008). For instance, Papies et al. (2008) showed that, in unsuccessful dieters, exposure to appetizing food cues inhibited the goal of dieting as measured by their ability to detect diet-related words in a lexical decision task.

One influential model of cue reactivity posits that tempting cues, through a prolonged period of conditioned associations with the rewarding substance, activate motor schemas for consuming the forbidden item (Tiffany, 1990). Evidence for this theory comes from studies showing increased approach behavior toward food for dieters (Seibt, Häfner, & Deutsch, 2007; Veenstra & de Jong, 2010) and toward cigarettes for smokers (Bradley, Mogg, Wright, & Field, 2003; Mogg et al., 2003; Mogg, Field, & Bradley, 2005). Moreover, findings from cognitive neuroscience have suggested that, compared with nonsmokers, smokers show increased attention to—and representation of—motor actions associated with smoking (Wagner, Dal Cin, Sargent, Kelley, & Heatherton, 2011; Yalachkov, Kaiser, & Naumer, 2009).

Taken together, the results of these studies have shown that exposure to tempting cues can elicit self-regulation failure through a variety of means. Cues appear to capture attention automatically, evoke hedonic thoughts, inhibit competing regulatory goals, and occupy working memory, all of which activate approach behavior toward the desired item. Given the ubiquitous presence and easy availability of a wide range of temptations, from high-calorie foods to cigarettes and alcohol, it is little wonder that the majority of daily acts of self-regulation consist of inhibiting cravings and engaging in self-stopping (Baumeister et al., 1994; Hofmann, Baumeister, et al., 2012).

Emotional and Social Distress

A frequent catalyst for self-regulation failure is negative affect. A foul mood may lead people to act aggressively (Anderson & Bushman, 2002; Berkowitz, 1989), drink alcohol (Witkiewitz & Villarroel, 2009), engage in unprotected sex (Bousman et al., 2009), spend too much money (Bruyneel, Dewitte, Franses, & Dekimpe, 2009), engage in problem gambling (Raviv, 1993), favor high-risk gambles (Raghunathan & Pham, 1999), and—perhaps unsurprisingly—make bad decisions that will later be regretted (Leith & Baumeister, 1996). Among sex offenders, experiencing negative emotion is by far the strongest predictor of reoffending (Pithers, Kashima, Cumming, Beal, & Buell, 1988). Among chronic dieters, negative affect predicts binge eating and dieting failures (Arnow, Kenardy, & Agras, 1992; Crosby et al., 2009; Hilbert & Tuschen-Caffier, 2007; Kenardy, Arnow, & Agras, 1996; Lowe & Fisher, 1983; Stein et al., 2007), and for dieters, prolonged periods of depression are associated with weight gain rather than the typical weight loss found in cases of depression (Polivy & Herman, 1976a). Former smokers, substance abusers, and sex offenders experience a similar phenomenon in that incidences of relapse are typically preceded by periods of negative emotion (Brownell, Marlatt, Lichtenstein, & Wilson, 1986; Childress et al., 1994; Kassel, Stroud, & Paronis, 2003; Magid, Colder, Stroud, Nichter, & Nichter, 2009; Marlatt & Gordon, 1985; Pithers et al., 1988; Shiffman & Waters, 2004; Sinha, 2007; Todd, 2004).

Laboratory studies, using a variety of mood induction procedures (e.g., music, imagery, task failure), have found that acute induction of negative affect increases craving for alcohol in alcoholics (Cooney et al., 1997; Sinha et al., 2009), cigarettes in smokers (Conklin & Perkins, 2005; Tiffany & Drobes, 1990; Willner & Jones, 1996), and drugs in substance abusers (Childress et al., 1994). Inducing a negative mood has been shown to increase eating among dieters, compared with nondieters and dieters in a neutral mood (Baucom & Aiken, 1981; Frost, Goolkasian, Ely, & Blanchard, 1982; Heatherton, Herman, & Polivy, 1991, 1992; Heatherton, Polivy, Herman, & Baumeister, 1993; Heatherton, Striepe, & Wittenberg, 1998; Herman, Polivy, Lank, & Heatherton, 1987; Schotte, Cools, & McNally, 1990). For example, in one of the earliest studies of its kind, researchers induced a negative mood in dieters and nondieters using a mood induction procedure that consisted of a series of self-referential statements designed to induce negative affect (Velten, 1968). After the mood induction, it was found that dieters subsequently ate significantly more than either depressed nondieters or a group of dieters who did not undergo the negative mood induction (Frost et al., 1982).

Outside the realm of appetitive behaviors, negative affect has also been shown to play a role in precipitating self-regulation failure for more general types of behavior. For instance, inducing negative affect has been shown to increase the degree to

which people procrastinate when faced with a tedious task (Tice, Bratslavsky, & Baumeister, 2001), and a number of studies have shown an association between negative affect and people's preference for accepting immediate rewards over larger delayed ones (Knapp & Clark, 1991; Mischel, Ebbesen, & Zeiss, 1973; Schwarz & Pollack, 1977; Seeman & Schwarz, 1974; Tice et al., 2001). Perhaps as a result of this preference for immediate sources of gratification, compulsive shoppers tend to spend more when in a negative mood (Faber & Christenson, 1996), and even among normal consumers, sad mood inductions have been shown to reverse the endowment effect (Kahneman, Knetsch, & Thaler, 1991). Under normal circumstances, people are loss averse and will tend to value objects they own more than identical objects they do not. However, after a sad mood induction, people will instead spend more to buy something new while simultaneously decreasing the amount of money they ask for when selling something they already own (Lerner, Small, & Loewenstein, 2004).

Another type of negative emotional experience that has an impact on self-regulation is social rejection. Experimentally inducing social rejection has been shown to increase people's preference for immediate rewards over larger later ones (Twenge, Catanese, & Baumeister, 2003), increase overeating in dieters, and reduce persistence and impair attention control on a variety of tasks (Baumeister, DeWall, Ciarocco, & Twenge, 2005). These results are similar to those from earlier research showing that inducing embarrassment in subjects increases their propensity to make risky gambles (Leith & Baumeister, 1996). Moreover, feelings of loneliness and humiliation are associated with increased deviant urges and fantasies among sex offenders (McKibben, Proulx, & Lusignan, 1994).

Reminding members of a stigmatized group of their group status can impair performance on tests in stereotyped domains. For instance, reminding women of the stereotype that women are not as good at math as men subsequently causes them to underperform on math tests (e.g., Steele & Aronson, 1995). Research has demonstrated that the underperformance caused by this stereotype threat is mediated by a reduction in working memory capacity after exposure to negative self-relevant stereotypes (Schmader & Johns, 2003). It has been suggested that the reduction in working memory capacity, particularly verbal working memory (i.e., Beilock, Rydell, & McConnell, 2007), exhibited by people after stereotype threat is due to the load incurred by attempts to regulate anxiety (Johns, Inzlicht, & Schmader, 2008). When threatened individuals are assessed on standard self-regulation tasks, they also show signs of self-regulation failure, such as reduced task persistence and increased difficulty inhibiting prepotent responses (Inzlicht, McKay, & Aronson, 2006). In addition, stereotype threat produces findings that mirror those from research on negative affect inductions, showing that experiencing stereotype threat causes dieters to eat more than nonthreatened dieters (Inzlicht & Kang, 2010). Similarly, when people are asked to recall past experiences of discrimination they subsequently become more likely to make risky decisions (Inzlicht & Kang, 2010) and, in the case of dieters, to consume unhealthy foods (Pascoe & Richman, 2011).

Why is it that experiencing negative affect and social distress leads to self-regulation failure? A number of theories have been proposed to explain how emotion interferes with self-regulation (for a review, see Wagner & Heatherton, 2013a). One theory is that negative affect reduces working memory capacity. As we have shown, one of the hypothesized mechanisms for stereotype threat effects is that being reminded of negative stereotypes about one's social group impairs working memory, possibly because of attempts to regulate affect (e.g., Johns et al., 2008; Schmader & Johns, 2003). This theory dovetails nicely with studies showing that having people experience evaluative stress (e.g., while engaging in public speaking) reduces people's performance on standard measures of working memory capacity (Oei, Everaerd, Elzinga, van Well, & Bermond, 2006; Schoofs, Preuss, & Wolf, 2008).

Another means by which negative affect may impair self-regulation is by causing people to consider only the immediate and superficial aspects of a situation (Keinan, 1987), making it less likely that they will consider the future consequences of their decisions (Wegener & Petty, 1994). This theory fits well with research showing that inducing

negative affect increases people's attention to local, fine-grained information at the expense of more global information (e.g., Clore et al., 2001; Friedman & Förster, 2010; Gasper & Clore, 2002). Moreover, this change in the focus of attention may help to explain why negative affect increases people's preference for immediate rewards over later ones (Schwarz & Pollack, 1977; Seeman & Schwarz, 1974).

Within the domain of addiction it has been suggested that negative affect may potentiate drug-seeking behavior through a conditioned association with drug use. The idea is that negative affect is frequently paired with substance use, which leads many dieters and drinkers to believe that indulging will relieve their negative affect (Sayette, 1993). This causes negative affect itself to serve as a conditioned cue such that even in the absence of an external activating stimulus, such as the smell of cigarette smoke, negative affect acts as an internal cue that elicits drug-seeking behavior (Childress et al., 1994; Cooney et al., 1997; Poulos, Hinson, & Siegel, 1981).

A third potential mechanism whereby negative affect gains its disinhibiting power comes from research conducted primarily with nonhuman animals, based on the idea that emotional distress increases an animal's susceptibility to rewards, such as food and drugs (Piazza & Le Moal, 1996). Inducing emotional distress (often via social isolation) in rats has been shown to increase drug self-administration (Covington & Miczek, 2001; Miczek & Mutschler, 1996) and food consumption (Teskey, Kavaliers, & Hirst, 1984). It has been suggested that this effect is the result of distress-induced release of glucocorticoids that sensitize the mesolimbic dopamine system to drugs of abuse and food (Deroche et al., 1995; Merlo Pich et al., 1995) and to their predictive cues (e.g., Peciña, Schulkin, & Berridge, 2006). Thus rewards, such as food, drugs, and alcohol, take on a larger reward value, thereby strengthening the impulse to consume them. Evidence of this effect in humans has generally been restricted to behavioral self-reports (e.g., Hofmann, Baumeister, et al., 2012); however, recent studies have suggested that experiencing stress or negative affect can increase the subjective amount of reward smokers experience when smoking a cigarette (McKee et al., 2011). This leads to greater brain activity in regions associated with reward processing when dieters view appetizing food cues (Wagner, Boswell, Kelley & Heatherton, 2012).

All of these theories may, of course, be simultaneously true, making negative affect a particularly malevolent threat to self-regulation. For instance, take a smoker trying to quit. Experiencing negative affect causes cigarettes and their cues to take on additional incentive value (e.g., Peciña et al., 2006), thereby increasing the strength of the impulse to smoke. This is compounded by reduced working memory and a tendency to focus on immediate rewards and ignore the future consequences of having a cigarette, all of which, operating together, conspire to reduce the smoker's ability to resist this heightened urge to smoke.

Do all forms of distress disinhibit behavior? The role distress plays in potentiating substance use appears to be different in substance abusers than in dieters. For instance, simple stress inductions increase smokers' desire to smoke (Kassel et al., 2003; Perkins & Grobe, 1992), alcoholics' craving for alcohol (Fox, Bergquist, Hong, & Sinha, 2007), and cocaine addicts' craving for cocaine (Sinha, Catapano, & O'Malley, 1999). These finding are at odds with research on dieters, which, by and large, appears to indicate that nonemotional stress does not lead to disinhibited eating (Heatherton et al., 1991; Herman & Polivy, 1975). One important difference in research on dieters and on substance abusers is that, for the most part, the substance abusers are not currently attempting to quit. This is obviously not the case with dieters who are, by definition, attempting to regulate their food intake. Thus, it has been suggested that in dieters, stress alone is not enough to lead to disinhibited behavior; rather, negative emotional distress, particularly when it affects self-esteem (e.g., social rejection, negative performance feedback) is required (e.g., Baucom & Aiken, 1981; Frost et al., 1982; Heatherton et al., 1991, 1993, 1998; Lattimore & Maxwell, 2004; Ruderman, Belzer, & Halperin, 1985). It has been theorized that the reason why self-involvement is critical in dieters is that they generally have a negative self-view (Heatherton, 1993; C. T. Miller &

Downey, 1999); hence, reminders of this self-view are particularly aversive and promote the desire to escape self-awareness through eating (Heatherton & Baumeister, 1991). This interpretation is further supported by a study showing that experimentally inducing feelings of social rejection, which can be considered a particularly threatening form of negative feedback about the self, causes subjects to avoid self-awareness by choosing to sit away from a mirror (Twenge et al., 2003) and that forcing subjects to sit in front of a mirror, thereby increasing self-awareness, eliminates the disinhibiting effects of social rejection (Baumeister et al., 2005). We consider escape from self-awareness later in this chapter.

Lapse-Activated Patterns and Abstinence Violations

Implicit in having a self-regulatory goal, such as refraining from telling off-color jokes to one's in-laws, is a set of standards describing the behavior of the optimal self-regulator. These standards may be as simple as "It is impolite to offend one's in-laws with unsavory humor." When they are momentarily violated, the rational thing to do is to shrug it off, apologize, and pretend it never happened. However, people do not always act rationally, and after a single slip they may no longer see any reason to hold back. One little glass of wine turns into the entire bottle, one single jibe about the in-laws' political leanings leads into an entire litany of political jokes until finally one is thrown out of the house, leaving the holidays in shambles. This phenomenon, whereby giving in to one temptation leads to total disinhibition, was first demonstrated by Herman and Mack (1975) in a clever experiment in which dieters were manipulated into breaking their diet. In this study, dieters and nondieters were asked to drink a high-calorie milkshake "preload" before participating in a supposed taste perception study. Once their diets were broken, dieters fell off the wagon and proceeded to eat considerably more than either nondieters or dieters who did not consume the preload (Herman & Mack, 1975). This disinhibited pattern of eating after a momentary lapse has been replicated in numerous subsequent studies (Heatherton et al., 1991, 1992, 1993), demonstrating that temporary violations of one's standards can elicit a wholesale abandonment of self-regulatory goals. Subsequent studies demonstrated that this lapse-activated disinhibition is primarily a cognitive phenomenon; that is, it is dieters' belief that their diet is broken that engenders loss of control (Janet, 1976; Knight & Boland, 1989; Woody, Costanzo, Liefer, & Conger, 1981). For example, when dieters ate a salad that, unbeknownst to them, was high in calories, they failed to show any lapse-activated overeating; conversely, when dieters ate an ice cream preload that contained fewer calories than the salad, they subsequently assumed their diet was blown and proceeded to overeat (Knight & Boland, 1989). Further evidence of the cognitive nature of this effect comes from research showing that anticipation of a future diet-breaking preload later in the day leads to disinhibition and overeating, even though the preload has not yet been consumed (Ruderman et al., 1985). Thus, anticipating a diet-breaking dinner out with friends may lead dieters to overeat throughout the whole day.

Why is it that a single lapse, which is not a catastrophic event in and of itself, can lead to a complete abandonment of one's self-regulatory goals? One of the proposed mechanisms for lapse-activated disinhibition is that people set too high a standard for self-regulatory success, adopting a zero tolerance policy whereby a single slip is believed to indicate complete failure and thus all further attempts at regulation are seen as futile (e.g., Baumeister et al., 1994). Studies on the causes of relapse in alcoholics and substance users suggest a related mechanism whereby simple lapses may lead to disinhibited behaviors. This theory suggests that when individuals indulge in a forbidden temptation, they experience an *abstinence violation effect* (e.g., Marlatt & George, 1984; Marlatt & Gordon, 1985), the size of which predicts whether they will return to abstinence or proceed to relapse. The abstinence violation effect is a cognitive and emotional reaction to a lapse in self-control that consists of a sense of despair and guilt after the failure to maintain control, combined with the personal attribution that one's lapse is due to personal failings (e.g., lack of willpower, inability to resist temptations) that are outside of one's control (Marlatt & Witkiewitz, 2005). When an individual experiences this noxious

combination of negative affect and the belief that he or she is incapable of resisting urges, then full-blown relapse becomes likely. If, however, individuals can minimize their sense of guilt over indulgences and attribute the causes of their lapse to situational factors (e.g., "Well, I was at a conference and everyone was having a cigarette. But I would never ever smoke back home"), then a return to abstinence is possible. Indeed, it has been demonstrated that among ex-smokers who experienced a lapse, those who attributed the causes of their lapse to more external and situation-specific causes were less likely to relapse into smoking than those who made internal attributions (Curry, Marlatt, & Gordon, 1987).

Impairments of Self-Monitoring and Self-Awareness

Monitoring is a key component of many theoretical conceptualizations of self-regulation. Monitoring refers to the process whereby people keep track of their thoughts and behaviors with reference to their standards and long-term goals (e.g., Baumeister & Heatherton, 1996; Carver & Scheier, 1981; Metcalfe & Mischel, 1999). Factors that impinge on people's ability to monitor their own behavior, such as being distracted by a concurrent task or watching an engrossing movie, tend to interfere with self-regulation. Conversely, manipulations that increase self-awareness, such as sitting in front of a mirror, tend to increase the degree to which people abide by their personal standards and attitudes (e.g., Scheier & Carver, 1983). Indeed, some theorists have suggested that the primary purpose of self-awareness is to enable self-regulation (e.g., Carver & Scheier, 1981).

Monitoring for conflicts between intended goals and behavior requires maintaining an active representation of current goals and standards in memory, a process hypothesized to rely on working memory capacity (e.g., Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008; Hofmann, Schmeichel, & Baddeley, 2012). Consequently, manipulations that occupy working memory may reduce the capacity to monitor behavior, resulting in a loss of self-control. This notion is borne out by research demonstrating that cognitive load increases people's preference for immediate versus larger delayed rewards (Hinson, Jameson, & Whitney, 2003), reduces the ability to suppress thoughts (Wegner & Erber, 1992), and leads to disinhibited eating among dieters (Shiv & Fedorikhin, 1999; Ward & Mann, 2000). For instance, Ward and Mann (2000) demonstrated the effect of cognitive load on food consumption by having dieters and nondieters memorize a series of images. In the room with the participants was a variety of appetizing snack foods, which the participants had been informed were there to help induce a pleasant mood. Dieters who experienced a high cognitive load ate considerably more snack foods during the task than nondieters under high cognitive load and dieters under low cognitive load, suggesting that the working memory load impaired their ability to monitor their eating behavior (Ward & Mann, 2000).

Does cognitive load inevitably lead to self-regulatory failure? The attentional myopia theory (T. Mann & Ward, 2007) posits that cognitive load restricts the range of attention and renders people more susceptible to the influence of external cues. Most of the time this works against people, as when they are distracted while in the presence of food; however, occasionally, it can also work to their benefit. When dieters or smokers under cognitive load are exposed to cues that signal the need to inhibit consumption, they subsequently eat less, in the case of dieters, or smoke less, in the case of smokers, than those exposed to promotion cues (T. Mann & Ward, 2004; Westling, Mann, & Ward, 2006). By comparison, dieters under low cognitive load are less susceptible to cues that signal inhibition or promotion cues (T. Mann & Ward, 2004). Thus, cognitive load apparently increases people's susceptibility to external cues, such that if food is salient then dieters eat more, whereas if dieting cues are more salient, then dieters will consume less (Ward & Mann, 2000). In a similar vein, Friese, Hofmann, and Wänke (2008) have shown that under high cognitive load, food consumption is driven by dieters' automatic hedonic reactions to foods, whereas under low cognitive load, it is dieters' explicit food preferences that determine what they eat.

One of the most common means of increasing monitoring is by manipulating people's self-awareness.

In their influential model of self-control, Carver and Scheier (1981) proposed that self-awareness—and thereby monitoring—is increased when people are exposed to circumstances or stimuli that direct attention toward the self, such as when viewing oneself in a mirror or having to perform in front of an audience (see also Duval & Wicklund, 1972). Increasing self-awareness in this manner increases monitoring for discrepancies between one's goals and current behavior, which ultimately benefits self-regulation. For example, increasing self-awareness by having people sit in front of a mirror inhibits aggression in men (Scheier, Fenigstein, & Buss, 1974), reduces cheating on tests (Diener & Wallbom, 1976), increases effort on mundane tasks (Wicklund & Duval, 1971), and increases the degree to which people behave according to their own standards (e.g., Carver, 1975; Gibbons, 1978). In dieters, it decreases the amount of food consumed (Pliner & Iuppa, 1978; Sentyrz & Bushman, 1998). Other methods of increasing self-awareness have similar effects on self-regulatory success; for instance, increasing self-awareness by having people keep a diary of their consumption behavior leads to reduced smoking in smokers trying to quit (McFall, 1970) and to greater weight loss (Baker & Kirschenbaum, 1993) and fewer incidences of overeating in dieters (Tomiyama, Moskovich, Haltom, Ju, & Mann, 2009). Similarly, having dieters eat in front of an audience, narrate their thoughts into a tape recorder while eating, or write down how much they are currently eating reduces food consumption (Collins, 1978; Herman, Roth, & Polivy, 2003) and eliminates the tendency to overeat after a caloric preload (Jansen,Merckelbach, Oosterlaan, Tuiten, & van den Hout, 1988; Polivy, Herman, Hackett, & Kuleshnyk, 1986). Conversely, situations that tend to reduce self-awareness, such as watching television, have been associated with increases in self-regulation failure. For instance, people who tend to eat in front of the television gain more weight (Leon & Chamberlain, 1973), and dieters watching an engrossing movie eat more popcorn than dieters watching a neutral film (Cools, Schotte, & McNally, 1992). Recently, it has been suggested that the experience of craving a tempting food or a cigarette can, in itself, reduce self-awareness. For example, smokers who were forced to abstain from smoking for at least 6 hours, compared with nondeprived smokers, showed increased mind-wandering during a dull and repetitive reading task (Sayette, Schooler, & Reichle, 2010).

Although increasing self-awareness can help to defend against the desire to indulge in temptations or indolence, too much self-awareness can become aversive by reminding people how little success they have made toward accomplishing their goals. In their influential theory of objective self-awareness, Duval and Wicklund (1972) suggested that when people become aware of the discrepancies between their current and ideal self, they find this discrepancy aversive, leading to a negative self-view. This idea is echoed in Carver and Scheier's (1981, 1982) theory of self-regulation, in which they posit that people experience negative affect when they realize they are falling short of their self-regulatory goals. Finally, Higgins (1987) went on to suggest that when self-awareness is aversive, people may be motivated to reduce self-awareness.

That self-awareness can lead people to experience negative affect is borne out by findings from a large number of studies (for a review, see Fejfar & Hoyle, 2000; Mor & Winquist, 2002). In fact, the experience of negative affect alone is known to conjure up negative self-evaluations (Wright & Mischel, 1982), which makes the interplay between self-awareness and negative affect all the more pernicious. Dieters in particular are vulnerable to this vicious cycle, because they tend to hold negative self-views (Heatherton, 1993) and experience low self-esteem (Garner, Olmsted, Polivy, & Garfinkel, 1984; Polivy, Heatherton, & Herman, 1988). This has led to the escape from self-awareness theory of binge eating proposed by Heatherton and Baumeister (1991). This theory suggests that because dieters hold a negative view of themselves, they may regularly seek to escape from this aversive state by directing attention away from their self and focusing it on the immediate situation, thereby ignoring long-term goals. Thus, the dieter experiences a cognitive narrowing (see Baumeister, 1990) in which attention is focused on the low-level meaning of actions (e.g., their mechanics and

immediate purpose) rather than on higher levels of action identification (e.g., the long-term consequences of actions; see Vallacher & Wegner, 1987). Under this state of reduced self-awareness, dieters are less able to inhibit their cravings and may become more susceptible to tempting cues and succumb to bouts of disinhibited eating (Heatherton & Baumeister, 1991). Evidence for this theory comes from studies showing that experiencing threats to self-esteem leads dieters, but not nondieters, to engage in disinhibited eating (Heatherton et al., 1991; Herman et al., 1987), which can be reversed by reinstating self-awareness (e.g., by exposing dieters to a video of themselves; Heatherton et al., 1993) or by having dieters increase their self-focus by keeping track of how much they ate (Polivy et al., 1986). Indeed, even under normal circumstances, dieters are less aware of how much food they have consumed (Collins, 1978; Janet, 1976; Polivy et al., 1986), suggesting reduced self-awareness when eating.

The escape from self-awareness model is also applicable to self-regulation failure in other domains (Baumeister, 1990). For instance, the motivated escape from self-awareness has been used to explain why negative affect increases not only how much television people watch after a self-esteem threat (Moskalenko & Heine, 2003) but also how much they become engrossed in the narrative of a television show (Greenwood, 2008). It can also explain why people drink more alcohol after negative self-threat (Hull & Young, 1983) and why, after social rejection, people will chose to avoid sitting in front of a mirror (Twenge et al., 2003).

Across the various accounts of why reductions in monitoring and self-awareness can lead to self-regulation failure, it appears that a common thread is that reduced self-awareness is associated with a narrowing of attention (e.g., Baumeister, 1990; Heatherton & Baumeister, 1991; T. Mann & Ward, 2007) in which people are more easily influenced by environmental cues, while simultaneously being unaware of failures to control their behavior. In cases in which self-awareness itself is aversive, people may actively seek to reduce their self-awareness, thereby leaving them especially vulnerable to temptations.

Influence of Other People

The presence of other people may often lead to increased inhibition; for instance, giving a talk to a room full of colleagues tends to sharply reduce the likelihood that one would give in to the urge for a strong drink or a cigarette. However, many occasions arise when the presence of other people may reduce inhibitions or promote risky or antinormative behavior. One such occasion is when people become immersed in a group and lose their individual identity, a phenomenon called *deindividuation* (Diener, 1979, 1980; Festinger, Pepitone, & Newcomb, 1952; Zimbardo, 1969). This loss of individual identity in a crowd can lead otherwise normal people to steal (Diener, Fraser, Beaman, & Kelem, 1976), cheat (Diener & Wallbom, 1976), act aggressively (Mullen, 1986; Prentice-Dunn & Rogers, 1982), or even goad a suicidal jumper to jump off a ledge (L. Mann, 1981). In addition to being in a crowd, increasing anonymity through something as simple as being in the dark with other people (Gergen & Barton, 1973), wearing a team uniform while playing sports (Rehm, Steinleitner, & Lilli, 1987), or wearing a Halloween mask (Diener et al., 1976) can lead individuals to act in a disinhibited manner that they might, under any other circumstances, find at odds with their personal standards.

One mechanism proposed to explain why deindividuation occurs is that both being immersed in a crowd and feeling anonymous (either through sheer numbers or by wearing uniforms and disguises) reduces self-awareness (Diener, 1980; Mullen, 1986; Prentice-Dunn & Rogers, 1982). As explained in earlier sections of this chapter, this reduction in self-awareness can lead to self-regulation failure through decreased monitoring and increased vulnerability to immediate situational cues (Diener, 1980). As in the previously mentioned work, in which reductions in monitoring were associated with increase in eating if eating cues were present in the environment or a decrease in eating if dieting cues were present (T. Mann & Ward, 2004), research on deindividuation has suggested that deindividuation need not always lead to antinormative behaviors. For instance, when the immediate situational cues promote positive behaviors, such as affiliation or helping others, deindividuated people

will instead act in a more prosocial manner (e.g., Johnson & Downing, 1979). This research has led to the view that deindividuation effects may largely be due to people assuming a group identity, which comes with new norms and standards for behavior (Postmes & Spears, 1998; Reicher, Spears, & Postmes, 1995). Thus, behaviors that might not conform to one's personal standards nevertheless become more likely if they are part of the normative behavior of the group in which a person suddenly finds him- or herself, such as when an otherwise well-intentioned protestor helps to flip over a police car during a riot.

Seeing other people engage in an indulgence that one may be trying to avoid can also be a potent catalyst for self-regulation failure. For instance, the sight of other smokers smoking (O'Connell & Martin, 1987) or other people eating (Conger, Conger, Costanzo, Wright, & Matter, 1980) is a strong cue for smokers and dieters to engage in the behavior themselves. Indeed, among ex-smokers, most instances of relapse occur as a result of interacting with other smokers (Borland, 1990). Strong evidence of this effect can be seen in people's reports of their daily attempts at self-control. In an experience sampling study of people's daily desires and self-regulation attempts, Hofmann, Baumeister, et al. (2012) found that seeing other people indulging themselves (e.g., eating, drinking alcohol, relaxing) was a strong predictor of whether a person would cease self-regulatory efforts and engage in the behavior. Similar findings have been obtained even for occasions when others are not physically present. For example, people are more likely to litter in a public area if other people have previously violated a social norm, such as spraying graffiti on the walls (Keizer, Lindenberg, & Steg, 2008). Even simply priming people with the goal of being social increases the odds that they will choose alcohol over coffee or tea (Sheeran et al., 2005).

When people are eating with others, they spontaneously mimic other people's consumption patterns, eating more or less depending on how much others are eating (Nisbett & Storms, 1974; Wansink, Just, & Smith, 2011), an effect so strong that it seems to occur regardless of dieting status (Polivy, Herman, Younger, & Erskine, 1979). The influence of the presence of others on eating behavior appears to be strongest for friends compared with strangers (Salvy, Howard, Read, & Mele, 2009; Salvy, Jarrin, Paluch, Irfan, & Pliner, 2007), possibly because people are motivated to make a good impression on strangers, which would be undermined by overeating (e.g., Vartanian, Herman, & Polivy, 2007). The influence of others on eating behavior is sufficiently powerful that a person's chance of becoming obese is increased by 57% if a close friend or romantic partner becomes obese (Christakis & Fowler, 2007).

Why does the presence of others lead people to eat, smoke, or drink more than they intend? One possible mechanism is that observing the behavior of other people may implicitly activate behavioral schemas and goals (e.g., Bargh & Ferguson, 2000), thereby increasing the odds of engaging in the observed behavior. This behavioral mimicry of others' actions can occur even for simple actions, such as when people unconsciously scratch their face after seeing someone else do the same (Chartrand & Bargh, 1999). The role of behavioral mimicry has been extended to eating behavior in research showing that people tend to mimic the amount eaten by other people (Johnston, 2002; McFerran, Dahl, Fitzsimons, & Morales, 2010), eat the same types of foods as other people (Bevelander, Anschütz, & Engels, 2011; Tanner, Ferraro, Chartrand, Bettman, & Baaren, 2008), and even mimic the rhythm (e.g., biting or sipping) of other people's eating and drinking behavior (Hermans et al., 2012; Larsen, Engels, Souren, Granic, & Overbeek, 2010; Larsen, Overbeek, Granic, & Engels, 2012).

Another proposed explanation of the influence of others on an individual's consumption of food, drink, or drugs is that observing other people influences one's perception of how normative a given behavior is, such that people's standard for how much food is acceptable to eat is influenced by the quantity of food consumed by others in the immediate environment (e.g., Herman et al., 2003). Finally, as with deindividuation, another possible mechanism for the disinhibiting effect of others is that, in some group settings (e.g., parties and celebrations), attention is focused outward on other people, thereby reducing self-awareness. As described

in the previous section, reductions in self-awareness can lead to reduced monitoring and a focus on the immediate situation, leaving people vulnerable to the influence of appetitive cues. Unfortunately for people attempting to regulate their behavior when out with friends, it is likely that all of these mechanisms may be simultaneously active, such that the presence of others not only primes behavior and increases mimicry but can also influence the perception of what is normative and reduce the ability to monitor consumption. Worse still, people appear to be utterly unaware of these influences on their behavior, believing instead that the amount of food they consume is driven largely by how good the food tastes and how hungry they feel, even though the actual quantity of food they consume can be shown to be strongly influenced by the presence of other people (Vartanian, Herman, & Wansink, 2008).

Thus far we have focused on how observing others engaging in antinormative behavior or indulging in tempting foods or drink can influence people to do the same. However, other people can also engender self-regulation failure through other means. For example, simply having to engage in difficult social interactions, such as when discussing racially charged issues with a member of a minority group or when having to act nice around an obtuse colleague, requires so much effort that people's self-regulatory resources are temporarily depleted and they are subsequently unable to resist tempting foods or persist at a difficult task (Finkel et al., 2006; Richeson & Trawalter, 2005; Trawalter & Richeson, 2006; Vohs, Baumeister, & Ciarocco, 2005). Research has shown that other people may also serve as a crutch, leading individuals to be less likely to exert effort at achieving their goals when they believe other people will be there to help them (e.g., Fitzsimons & Finkel, 2011). For instance, when people are asked to recall times when their partner helped them with academic work, they are subsequently more likely to procrastinate before having to complete an academic test (Fitzsimons & Finkel, 2011). This might be a worthwhile strategy, insofar as others can be expected to help keep one on track; however, relying too much on others could also jeopardize a person's self-regulatory efforts in cases in which other people are not as reliable as expected. Finally, we note that the presence of others need not always have a deleterious effect; for instance, studies have shown that being in close physical proximity to loved ones reduces physiological (Edens, Larkin, & Abel, 1992; Grewen, Anderson, Girdler, & Light, 2003) and neural markers (Coan, Schaefer, & Davidson, 2006; Eisenberger, Taylor, Gable, Hilmert, & Lieberman, 2007) associated with anxiety in the face of threat.

Self-Regulatory Resource Depletion

People are frequently subject to the pull of multiple temptations (e.g., food, drink, media, and entertainment) that compete for self-regulatory resources required for other demands, such as the need to go to work to make money. The limited-strength model of self-regulation (Baumeister & Heatherton, 1996) suggests that having to juggle these different forms of self-control exerts a toll on people's capacity to engage in further acts of self-control. At the heart of this model is the proposition that effortful self-regulation consumes a domain-general resource and that, when this resource becomes depleted, further acts of self-regulation are impaired. From this standpoint, engaging in effortful self-regulation contains within it the seeds of its own failure.

Since this model's formulation, evidence for it has been gathered from a wide variety of sources (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Muraven, Tice, & Baumeister, 1998; Vohs & Heatherton, 2000; for a meta-analysis, see Hagger, Wood, Stiff, & Chatzisarantis, 2010). For example, Vohs and Heatherton (2000) demonstrated that chronic dieters could be made to break their diet by expending self-regulatory resources on a previous task. Specifically, dieters first engaged in an emotion suppression task, followed by an ice cream taste-test task, ostensibly as part of another study. Dieters who had previously expended self-regulatory effort ate twice as much afterward as dieters in the control condition (Vohs & Heatherton, 2000). Over the past several years, studies of self-regulatory resource depletion have shown that self-regulatory capacity can be depleted by a wide range of tasks, such as suppressing thoughts (Muraven et al., 1998) and stereotypes (Gordijn, Hindriks, Koomen, Dijksterhuis, &

Van Knippenberg, 2004), inhibiting emotions (Baumeister et al., 1998; Gailliot et al., 2007; Schmeichel, Vohs, & Baumeister, 2003), making decisions (Vohs et al., 2008), resisting conformity (Kahan, Polivy, & Herman, 2003), being the victim of prejudice (Inzlicht et al., 2006; Johns et al., 2008), and managing the impressions one makes (Richeson & Shelton, 2003; Vohs et al., 2005).

That self-regulation relies on a limited-capacity resource has important ramifications for a variety of prosocial and health-related behaviors. For instance, self-regulatory depletion has been shown to reduce helping behavior toward strangers (DeWall, Baumeister, Gailliot, & Maner, 2008) and increase the likelihood that people will lie and cheat for financial gain (Mead, Baumeister, Gino, Schweitzer, & Ariely, 2009). With regard to health behaviors, participants who have had their self-regulatory resources depleted by a prior task drink more alcohol (Muraven, Collins, & Nienhaus, 2002), are more likely to consume high-calorie foods (Hofmann, Rauch, & Gawronski, 2007; Vohs & Heatherton, 2000), and are less able to control their emotions (Muraven et al., 1998; Schmeichel, 2007). For example, in an early study examining the conditions leading up to a failure to regulate emotions, participants were asked to write autobiographical accounts of situations in which they either maintained or lost control of their emotions. Cases in which people lost control of their emotions were frequently preceded by greater fatigue, stress, and the presence of competing regulatory demands, such as simultaneously trying to make a good impression on others (Muraven et al., 1998). More recently, using an experience-sampling procedure in which 208 participants were regularly interrogated about their daily desires and self-control attempts, Hofmann, Vohs, and Baumeister (2012) showed that self-control failures are more likely to occur if a participant has already engaged in multiple self-control attempts earlier in the day. Together, the findings of these two studies suggest that, in real-world situations, impaired self-regulation is precipitated by events that place a demand on self-regulatory resources.

What exactly is the resource that is being depleted during self-regulation tasks? As noted early on by Herman (1996), one of the issues with the strength model is its inherent circularity, with no independent means to assess resource depletion; the only evidence of its occurrence is impaired performance on subsequent tests of self-regulation. In recent years, there has been an attempt to determine physiological bases of resource depletion that can be used as independent evidence of its occurrence. On the basis of research showing that performance on a range of cognitive tasks appears to rely on circulating levels of blood glucose (Donohoe & Benton, 1999; Fairclough & Houston, 2004; Martin & Benton, 1999; Scholey, Harper, & Kennedy, 2001), including the Stroop task commonly used in self-regulation experiments (Benton, Owens, & Parker, 1994), Gailliot et al. (2007) suggested that self-regulatory effort requires and consumes glucose. In a series of experiments, they demonstrated that engaging in self-regulation reduces circulating blood glucose levels and that glucose levels after self-regulatory depletion predict subsequent persistence on an unsolvable task (Gailliot et al., 2007). Moreover, across a number of studies, it has been shown that administering glucose eliminates the effects of self-regulatory depletion on subsequent task performance (DeWall et al., 2008; Gailliot, Peruche, Plant, & Baumeister, 2009). Thus, it appears that circulating levels of glucose may serve as an indicator of resource depletion. However, some caution is warranted because the proposition that reductions in glucose levels, particularly glucose levels in the brain, is responsible for self-regulation failure has been challenged on a number of physiological and methodological grounds (Beedie & Lane, 2012; Kurzban, 2010). The most serious criticism is addressed to the claim that changes in circulating blood glucose reflect changes in the availability of glucose in the brain. Glucose metabolism in the brain is a tightly controlled process that is generally impervious to momentary changes in circulating blood glucose; therefore, the measurement of glucose at the periphery is unlikely to be diagnostic of glucose availability in the brain (Gibson, 2007). Moreover, estimation of the amount of energy required by cognitive events over and above the brain's basal metabolism suggests that the amount of energy consumed is as small as a single calorie per 25 minutes of effortful cognitive

activity (Kurzban, 2010). An alternative explanation has instead suggested that when the circulating blood glucose level is low, self-control failures occur not as a result of limited glucose availability but rather as a result of the desire to conserve energy for more meaningful tasks. However, when glucose levels are high, motivation to continue engaging in self-control is maintained even though the task might be dull or of little importance (Beedie & Lane, 2012). Initial evidence for this motivational account of the effects of glucose on self-regulation comes from recent research showing that simply swishing in one's mouth, but not ingesting, a glucose drink eliminates the effects of self-regulatory depletion on subsequent task performance (Molden et al., 2012).

Other accounts of the mechanism by which resource depletion brings about self-regulatory failure have focused instead on people's motivation to continue performing tasks. For instance, Inzlicht and Schmeichel (2012) have proposed a model theory of self-regulatory resource depletion in which performing effortful self-regulation tasks leads to shifts in motivation and attention whereby after the self-regulatory exertion, people attend to—and seek to gratify themselves with—pleasurable substances or enjoyable activities. In a similar vein, Job, Dweck, and Walton (2010) have suggested that self-regulatory depletion effects may result from lay beliefs whether willpower relies on a limited resource or not. Across multiple experiments, they showed that beliefs about willpower moderated subsequent impairments in self-control such that people who believed that willpower was resource limited performed worse on subsequent self-regulation tasks than those who believed that willpower did not consume any resource (Job, Dweck, & Walton, 2010). Although these findings suggests that lay beliefs can moderate self-regulatory depletion, more recent research has suggested that, as with physical endurance, there is a limit to how much personal beliefs and motivation can influence performance. For instance, when participants are required to perform multiple effortful self-control tasks in a row, manipulation of beliefs about willpower cease to have an effect on performance, and participants with both limited resource and unlimited resource beliefs show impaired self-regulation on subsequent tasks (Vohs, Baumeister, & Schmeichel, 2013).

Alcohol Intoxication

Among the many threats to self-regulation that have a large effect on the health and welfare of individuals and society at large, alcohol may be the worst offender (see Baumeister et al., 1994). Alcohol is implicated in more than half of all violent crimes, accidental deaths, thefts, and suicide (see Steele & Josephs, 1990). Even among noncriminals, people frequently report being intoxicated as a prelude to self-regulation failure (Hofmann, Baumeister, et al., 2012; Muraven et al., 1998). The disinhibitory role of alcohol intoxication is no surprise, because people knowingly seek out alcohol precisely to experience the disinhibitory effects of intoxication (Cooper, Frone, Russell, & Mudar, 1995; Labouvie & Bates, 2002; Wood, Nagoshi, & Dennis, 1992). In some cases, they drink so as to create attributional ambiguity for their behaviors, so that any failures, including failures in self-control, can be blamed on alcohol (e.g., Berglas & Jones, 1978).

Among those attempting to curb their smoking or eating, alcohol intoxication is by far the largest cause of relapses (Shiffman, Balabanis, Fertig, & Allen, 1995), with more than half of the cases of smoking (Brandon, Tiffany, Obremski, & Baker, 1990) and binge eating (Abraham & Beumont, 1982) reportedly being due to alcohol intoxication. In addition to increasing smoking behavior, alcohol consumption also appears to increase the hedonic qualities of smoking, such that people frequently report greater enjoyment of cigarettes after consuming alcohol (Piasecki, McCarthy, Fiore, & Baker, 2008; see also Hofmann, Baumeister, et al., 2012). Laboratory studies have similarly shown that drinking alcohol before being exposed to cigarette cues increases craving compared with a placebo condition (Sayette, Martin, Wertz, Perrott, & Peters, 2005) and that the degree of craving is related to the amount of alcohol consumed (King & Epstein, 2005). Similarly, among dieters, alcohol consumption has been shown to increase food intake, compared with dieters who did not consume alcohol (Polivy & Herman, 1976b, 1976c). Even among nondieters, consuming alcohol leads to greater

consumption of unhealthy foods, compared with subjects who drank orange juice (Hofmann & Friese, 2008).

Outside of resisting temptations, alcohol is also frequently associated with disinhibited social behavior. As people become intoxicated, they are more likely to self-disclose to others, engage in risky sexual behaviors, and become more aggressive after provocation (for reviews, see Bushman & Cooper, 1990; Hull & Bond, 1986; Steele & Southwick, 1985). For instance, when male subjects were tasked with playing a competitive game in which they could administer shocks to the other player, subjects who had consumed alcohol were much more likely to shock their opponent than sober subjects (Taylor, Gammon, & Capasso, 1976). With regard to risky sexual behavior, alcohol is associated with decreased perception of risk from unsafe sex (Fromme, D'Amico, & Katz, 1999; MacDonald, MacDonald, Zanna, & Fong, 2000), increased willingness to engage in risky sexual behavior (Lyvers, Cholakians, Puorro, & Sundram, 2011a; MacDonald, MacDonald, et al., 2000), increased perception of the attractiveness of members of the opposite sex (Jones, Jones, Thomas, & Piper, 2003; Lyvers, Cholakians, Puorro, & Sundram, 2011b), and an increased propensity to have sex with a just-met stranger (Patrick & Maggs, 2009; Testa & Collins, 1997).

It is all too common for those who have enjoyed a few drinks to, at some point, experience the disinhibiting effects of alcohol and the subsequent regret that comes with remembering the events of the prior evening. Although alcohol intoxication is, of course, mainly a physiological effect, many of the proposed mechanisms for the effects of alcohol on self-regulation are psychological. One such theory proposes that alcohol's ability to impair self-regulation is due mainly to a reduction in self-awareness brought about by a failure to encode the self-relevance of cues and of evaluative feedback (e.g., Hull, 1981). For example, when people consume alcohol they are less likely to talk about themselves (i.e., fewer self-focused statements and personal pronouns) and are more likely to focus their attention on other people or on nonspecific details (Hull, Levenson, Young, & Sher, 1983). More recently, drinking alcohol has been shown to increase both the frequency of mind wandering and also failures to catch oneself mind wandering (Sayette et al.,), serving as further evidence that alcohol reduces self-awareness. Interestingly, when self-awareness is increased, alcohol ceases to have strong disinhibitory effects on aggression (see Ito, Miller, & Pollock, 1996).

An alternate account of alcohol's role in self-regulation failure suggests that alcohol leads to a narrowing of attention, causing intoxicated people to focus only on the immediate situational cues (Steele & Southwick, 1985). This alcohol myopia model of the effects of alcohol on self-control (Steele & Josephs, 1990) has much in common with the previously mentioned attentional narrowing model of negative affect (Baumeister, 1990; Heatherton & Baumeister, 1991) and the attentional myopia model of cognitive load (T. Mann & Ward, 2007). In this instance, it is posited that alcohol consumption impairs attention such that only highly salient internal and external cues are processed. In this model, alcohol-induced self-regulation failure occurs only for behaviors that are susceptible to strong instigating pressures (e.g., aggression after provocation, smoking a cigarette after seeing friends smoking). In situations in which cues to engage in a tempting behavior are low, intoxicated individuals are no more likely to lose self-control than are sober people (Steele & Southwick, 1985). In fact, when cues to inhibit behavior are highly salient, intoxicated individuals may paradoxically show increased self-regulation compared with sober individuals. For example, when cues promoting safe sex were made highly salient, intoxicated subjects reported fewer intentions to engage in risky sex than sober peers (MacDonald, Fong, Zanna, & Martineau, 2000).

Of course, both the reduced self-awareness and the alcohol myopia theories may be simultaneously accurate. For instance, self-awareness may be reduced precisely because attention is focused on highly salient external cues, such as conversations with other people, loud music, cigarettes, or appetizing foods. The results of a recent experience-sampling study (i.e., Hofmann, Baumeister, et al., 2012) have suggested that alcohol consumption may cause a double whammy of self-regulatory impairment because the ability to inhibit behavior is

impaired, possibly because of reduced self-awareness, all while the strength of temptations and desires increases (see also Piasecki et al., 2008).

A Conspiracy Against Self-Control

Although we have considered the seven threats to self-regulation separately, in reality they conspire to chip away at inhibition and control. For instance, resisting cravings and temptations (Threat 1, cue exposure) can induce negative affect (Threat 2, negative affect) and occupy working memory and reduce the ability to monitor behavior (Threat 4, monitoring and self-awareness). Moreover, resisting cravings also depletes limited self-regulatory capacity (Threat 6, self-regulatory resource depletion), which, together with negative affect, can reduce the capacity to self-regulate, all while increasing the strength of desires and impulses. Even if self-regulators were still able to resist, they might later go out with friends and find themselves surrounded by people (Threat 5, influence of other people) who are smoking, drinking, or eating. Faced with this assault, it would take little more than a few sips of alcohol (Threat 7, alcohol intoxication) before these poor souls say to themselves, "What the hell! I'll have a few cigarettes/drinks/cheeseburgers/dubious sexual partners tonight and then start fresh tomorrow!" (Threat 3, lapse-activated patterns). From this perspective, it becomes clear that one of the major ironies of self-regulation is that resisting a temptation may ultimately—with a little help from the seven deadly threats—strengthen the desire for the tempting substance or activity (e.g., McKee et al., 2011; Piasecki et al., 2008; Vohs et al., 2012), thereby making it more difficult to successfully self-regulate.

NEUROPSYCHOLOGY AND COGNITIVE NEUROSCIENCE OF SELF-REGULATION FAILURE

In recent years, the role of the brain sciences in psychological research has exploded. Perhaps no domain stands to benefit more from such a multidisciplinary approach than research on self-regulation. Indeed, as we noted in the beginning of this chapter, some of the earliest theoretical musings on self-regulation and its failure were inspired by the pioneering work of neurologists such as Ferrier and Starr and their descriptions of the unique deficits found in patients with damage to the prefrontal cortex (PFC). Much of our current knowledge of the critical role of the PFC in the initiation and regulation of behavior stems from neuropsychological case studies published over the past 2 centuries. From the brief reports of disinhibited behavior in patients such as Phineas Gage (Ferrier, 1878; Harlow, 1868) or the remarkably prescient descriptions of loss of self-control after PFC damage by Leonore Welt (1888) to the more sophisticated analyses of modern-day neuropsychology (Stuss & Levine, 2002), it has become clear that the PFC plays a vital role in regulating emotions, behaviors, and appetitive cravings (for a review, see Beer, Shimamura, & Knight, 2004; Wagner, Demos, & Heatherton, 2011).

Patients with damage to ventromedial portions of the PFC often display a remarkable lack of control in social and appetitive domains. For instance, such patients show a surprising disregard for social norms (Blumer & Benson, 1975; Dimitrov, Phipps, Zahn, & Grafman, 1999), make inappropriate sexual displays and aggressive sexual advances (Grafman et al., 1996; B. L. Miller, Cummings, McIntyre, Ebers, & Grode, 1986), and demonstrate impaired decision making, often choosing risky but disadvantageous outcomes over safer ones (Bechara, Tranel, & Damasio, 2000; Sanfey, Hastie, Colvin, & Grafman, 2003). In comparison, patients with damage to the lateral PFC appear to have particular difficulties in organizing and planning behavior (Penfield & Evans, 1935; Shallice & Burgess, 1991; Stuss & Alexander, 2007) and can easily become distracted and perseverate on simple tasks (Jones-Gotman & Milner, 1977; Milner, 1963). Unfortunately, few studies in patients with damage to the PFC have examined self-regulation at the level described in this chapter. Although there is evidence of "stimulus-bound" behavior in patients with PFC damage, few studies have examined, for instance, whether such patients are more susceptible to appetizing foods or, conversely, to cues promoting dieting goals (e.g., Papies & Hamstra, 2010).

Recent work in the cognitive neurosciences has suggested that effective self-regulation, particularly

in the domain of impulse control, is reliant on a balance between brain regions involved in representing the rewarding or emotional value of a given temptation or situation and regions of the PFC implicated in top-down control (see Heatherton & Wagner, 2011). In this balance model, when people are faced with impulses that run counter to current regulatory goals, they become embroiled in a tug of war between desires and self-control. Self-regulation failure occurs when the strength of desires overwhelms the current capacity to engage in control or when the impulse strength remains constant but the capacity to engage in self-control is itself impaired (e.g., after imbibing alcohol, when experiencing self-regulatory resource depletion, or when self-awareness is low). Neuroscientific evidence of this balance comes from neuroimaging research on the regulation of appetitive desires, emotions, and thoughts (for a more detailed review of the cognitive neuroscience literature, see Wagner, Demos, & Heatherton, 2011). For instance, research on the regulation of food cravings (Kober, Mende-Siedlecki, et al., 2010; Siep et al., 2012) and drug cravings (Kober, Kross, et al., 2010; Volkow et al., 2010), as well as negative emotions (Johnstone, van Reekum, Urry, Kalin, & Davidson, 2007; Ochsner et al., 2004) and stereotypes (Lieberman, Hariri, Jarcho, Eisenberger, & Bookheimer, 2005; Richeson et al., 2003), has converged on the view that successful regulation is supported by an increase in activity in the PFC with a concomitant reduction in cortical and subcortical regions associated with reward or emotional processing.

But what happens in the brain when self-regulation is threatened? Recently, a number of neuroimaging studies have begun to reveal what happens in brain regions implicated in reward or emotional processing during various forms of self-regulatory threat. For instance, when dieters fall off the wagon by consuming a fattening milkshake (Threat 3, lapse-activated patterns) or are caused to experience negative affect through a mood induction procedure (Threat 2, negative affect), they subsequently show greater activity in brain regions associated with reward processing when exposed to appetizing food cues than dieters whose diet has not been broken (Demos, Kelley, & Heatherton, 2011) or dieters who have undergone a negative mood induction (Wagner et al., 2012). Within the domain of emotion, it has been shown that activity in the amygdala in response to negative and aversive emotional images is increased after self-regulatory depletion (Wagner & Heatherton, 2013b), whereas within the domain of rewards, recent work has demonstrated that self-regulatory depletion increases neural responses to rewarding stimuli, and this increase occurs in conjunction with reduced functional connectivity between the PFC and brain regions involved in encoding reward value (Wagner, Altman, Boswell, Kelley, & Heatherton, 2013), a finding that mirrors recent behavioral research showing that the strength of emotions and desires is increased when people are in a depleted state (Vohs et al., 2012). Even in the absence of direct threats to self-regulation, individual differences in the recruitment of brain regions associated with reward processing can predict future self-regulation failures. For instance, brain activity measured when participants are viewing food or sexual images is correlated with future weight gain or number of sexual partners when assessed 6 months later (Demos, Kelley, & Heatherton, 2012).

It is worth noting that the neuroscientific model of self-regulation failure we have outlined shares similarities with current theoretical explanations for why adolescents appear to be disproportionately impaired in controlling their behavior and emotions (Somerville, Jones, & Casey, 2010) and why patients with mood disorder and individuals with drug addictions have difficulty controlling emotions and addictions (e.g., Goldstein & Volkow, 2011; Kim et al., 2011). In the case of adolescents, it has been suggested that the maturation of the PFC and brain regions involved in representing reward and emotions is unevenly matched, such that the PFC is slower to mature, leading to an imbalance between prefrontal regions involved in impulse control and bottom-up regions implicated in appetitive desires and emotions. Evidence for this comes from research showing that, compared with adults, adolescents show exaggerated activity in regions involved in representing the saliency of rewards when viewing happy facial expressions (Somerville, Hare, & Casey, 2011) or when receiving monetary

rewards in a gambling task (May et al., 2004). Similarly, studies of psychiatric populations and individuals with drug addiction have suggested that impaired emotion and impulse control may result from a structural uncoupling between the PFC and subcortical brain areas (e.g., Crews & Boettiger, 2009; Kim & Whalen, 2009), leading to impairments of top-down control. By analogy, we propose that what occurs in adolescence because of a developmentally mediated structural imbalance between the PFC and subcortical limbic regions, or what occurs in patients with mood disorders and individuals with drug addiction because of structural damage, is similarly occurring in adults during self-regulation failure as a result of a temporary functional imbalance between the relative recruitment of the PFC and cortical and subcortical regions involved in reward, cravings, and emotions (e.g., Heatherton & Wagner, 2011).

CONCLUSION

Effective self-regulation is important not only for achieving personal goals and ambitions but also for harmonious social relationships. If individuals, particularly repeat offenders, fail to regulate themselves, they may be excluded from friends and family or indeed from society at large. Conversely, those who are better able to self-regulate have better relationships (Luchies, Finkel, & Fitzsimons, 2011), increased academic and job success (Duckworth & Seligman, 2005; Tangney, Baumeister, & Boone, 2004), and better mental health (Shoda, Mischel, & Peake, 1990). In nearly every domain of life, improved self-regulation predicts better objective outcomes. In the case of interpersonal relationships, better self-control predicts greater relationship satisfaction (Vohs, Finkenauer, & Baumeister, 2011), reduced partner violence (Finkel, DeWall, Slotter, Oaten, & Foshee, 2009), and increased facilitation of relationship goals (Luchies et al., 2011). Moreover, studies of large samples of children followed from birth to adulthood have powerfully shown that individual differences in self-control predict reduced involvement in criminal activities and drug use along with improved physical health (Moffitt et al., 2011).

In this chapter, we have reviewed the situations and circumstances that contribute to failures of self-regulation, focusing on what, in our view, are the seven most common and pernicious threats to self-regulation. Our review focused largely on failures of inhibition. Although studies have suggested that this form of "self-stopping" represents the dominant mode of self-regulation in daily life (e.g., Baumeister et al., 1994; Hofmann, Baumeister, et al., 2012), self-regulation also encompasses a range of behaviors beyond impulse control (for a review, see Fujita, 2011). For example, people may engage in proactive self-regulation by refusing to expose themselves to strong temptations or by imposing penalties on themselves for giving in to indulgences (e.g., Ariely & Wertenbroch, 2002; Trope & Fishbach, 2000). People may also attempt to train themselves to be better self-regulators by explicitly defining alternate behaviors to enact when faced with tempting cues (i.e., implementation intentions; Gollwitzer, 1999; Gollwitzer & Brandstätter, 1997), which may take the following form: "When someone offers me a glass of wine and a wedge of Appenzeller cheese, I will promptly turn tail and flee the vicinity." Moreover, simply exercising self-control in unrelated domains is associated with an improved ability to regulate when faced with personal temptations (e.g., Muraven, 2010).

Throughout this chapter, we have highlighted many of the mechanisms proposed to explain how each of the seven deadly threats contributes to self-regulation failure. Although we examined each threat in isolation, they clearly share many underlying mechanisms. For instance, negative affect, cravings, other people, and alcohol intoxication may all serve to reduce self-awareness and monitoring, thereby leading to a failure to engage in self-control when temptations arise. Similarly, self-regulatory depletion, alcohol intoxication, and negative affect may all increase the strength of desires and temptations independent of their effects on self-regulatory capacity.

Given the observed commonality across the seven threats, we can discern three axes along which threats to self-regulation operate. The first is impulse strength. Whenever a desire or tempting stimulus elicits a strong impulse to perform a given

behavior or consume a forbidden item, this impulse becomes inherently more difficult to inhibit. More important, the strength of an impulse is not static but is subject to modulation by emotions, self-regulatory capacity, and attention. Hence, the strength of the desire to shirk work and watch television increases as self-awareness, for example, decreases.

Another major axis along which the threats to self-regulation appear to operate is self-awareness. Reductions in self-awareness are associated with a failure to monitor behavior and, by extension, a failure to enact self-regulatory strategies. As with desire strength, self-awareness itself is subject to modulation by negative affect, alcohol intoxication, and situations that reduce self-awareness (e.g., other people). Moreover, exposure to a particularly strong temptation can by itself reduce self-awareness and monitoring by eliciting cravings that occupy working memory and refocus attention on the immediate environment, thereby further increasing impulse strength in a vicious feedback loop.

The third and final axis is self-regulatory capacity. Across multiple threats, whenever self-regulatory capacity is decreased, either through concurrent cognitive loads (owing to cravings or stereotype threat) or exhausted self-regulatory resources, self-regulation failure becomes more likely to occur. As with impulse strength and self-awareness, self-regulatory capacity is not static and is subject to modulation by negative affect, exposure to temptations, and disruption by alcohol and drugs or by brain damage.

Findings from cognitive neuroscience have suggested brain systems that these mental and behavioral axes may map onto. As we have discussed, regulation of cravings and appetitive cues involves a balance between regions of the PFC involved in executive control and cortical and subcortical areas involved in representing reward and emotional salience. When this balance is broken, such as in adolescents, people with drug addiction, patients with mood disorders, or indeed in anyone faced with overwhelming temptations, self-regulation failure is more likely to occur. Although we discussed this model primarily in terms of the interplay between cognitive control and appetitive and emotional impulses, decrements in self-awareness and monitoring are an equally important factor underlying many of the threats to self-regulation reviewed in this chapter. From a neuroscience perspective, there is some evidence that damage to brain regions implicated in self-monitoring and representing psychological aspects of the self (e.g., Heatherton, Macrae, & Kelley, 2004) are also associated with impaired self-regulation (Beer, John, Scabini, & Knight, 2006) and failures of monitoring in drug addiction (Goldstein & Volkow, 2011).

As we noted at the beginning of this chapter, failures of self-control have been a perennial interest among philosophers and scientists of many stripes. The virtue of self-control is written in our laws and enshrined in our religions, and likely for good reason: Many of society's ailments, from domestic violence and criminal behavior to obesity and poor health, can be traced back to poor self-control. Individuals who are better at self-regulation enjoy not only greater mental and physical health but also increased job success and better relationships. It seems, then, that the importance of self-regulation cannot be overstated. However, staying in control is no simple task because successful self-regulation is under constant siege from the seven threats surveyed in this chapter. These threats operate by increasing the strength of impulses, by reducing self-awareness and self-monitoring, and finally by tearing down our capacity to regulate our thoughts, emotions, and desires. Fortunately, awareness of these threats suggests methods for countering their unwanted effects. Research from a variety of domains has shown that self-regulation can be improved by practicing small acts of self-regulation every day, by increasing self-awareness through the use of a journal to monitor successes and failures, and by engaging in proactive control and implementation intentions.

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