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## Incidental and Integral Effects of Emotions on Self-Control

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Probably most human behaviors are impulsive. This seems especially likely to be true for infants and children, who are only beginning to develop the capacity to override impulses. But even for healthy adult humans who are presumed to have a fully developed capacity for self-control, impulsive or automatic behaviors seem to predominate. Given that humans continue to exist (thrive, even) in most corners of the globe, a favorable case can be made that the preponderance of impulsive behaviors has served humankind well.

Self-control is nevertheless an important key to success in life. Knowing how and when to regulate impulsive tendencies and then successfully regulating them increase the flexibility of human behavior. This increased flexibility appears to confer substantial benefits for individuals and for society, as suggested by evidence that success at self-control contributes to physical health, psychological well-being, longevity, occupational attainment, relationship satisfaction, and several other desirable outcomes (for an overview, see Vohs & Baumeister, 2011).

The purpose of this chapter is to consider how self-control is influenced by emotions. Emotions are associated with impulsive or automatic response tendencies, and the traditional view is that emotion and self-control are antagonists. We review evidence support-

ing this view. Another view is that negative emotions, more so than positive emotions, are likely to undermine self-control, and we also review evidence for that contention. A third view is more nuanced still in recognizing that both positive and negative emotions can impair or improve self-control under the right circumstances, and there's growing evidence for that position (reviewed below). We considered but quickly abandoned a fourth possibility—that emotions have little or no influence on self-control—because few theorists have championed this view, and the relevant published findings usually indicate that emotions have a significant impact on self-control.

The first half of the chapter thus examines the evidence for the effects of emotion on self-control. The guiding question is: Do incidental emotional states (i.e., those that are extrinsic to, or happen to coincide with, a self-control attempt) influence the likelihood of success at self-control? To answer this question, we review the results of experiments that have manipulated emotional states and assessed the consequences for self-control. In particular, we review evidence on the moderating influence of both positive and negative emotion inductions on outcomes associated with dieting and delaying gratification, respectively. Then we discuss the leading explanations for the observed effects.

## CHAPTER 15

## Emotions

Another view is that negative emotions are so much more powerful than positive emotions, they can undermine self-control, and we have abundant evidence for that contention. A more nuanced view is that positive and negative emotions both improve self-control under the same circumstances, and there's growing evidence for that position (reviewed below). But quickly abandoned a view—that emotions have little effect on self-control—because few studies have championed this view, and the published findings usually indicate that emotions have a significant impact on

the rest of the chapter thus examines the moderating influence of both positive and negative emotion inductions associated with dieting and gratification, respectively. Then the leading explanations for the effects.

The second half of the chapter takes a different approach by exploring the integral (as opposed to incidental) influence of emotion on self-control. The guiding question there is: What role do emotions play in stimulating self-control? Rather than treating emotions as outsiders that impinge on the process of self-control, as we do in the first half of the chapter, in the second half we locate emotions inside the mechanisms of self-control and outline the basic conceptual foundations of an *affect alarm model* of self-control.

Before diving into the literature review, we offer two caveats to delimit our approach. First, *emotions are complex*. They involve more or less coordinated changes to subjective experience, physiological responding, and physical (e.g., facial) expression. And they have been categorized along a number of dimensions, including arousal level (from low to high), valence (from positive to negative), and motivational direction (approach or avoidance), among others. Other theorists prefer to think of discrete emotions rather than categorical dimensions. Because the bulk of the literature on the influence of emotion on self-control involves the valence dimension (i.e., effects of positive vs. negative emotions on self-control), likewise our review focuses mainly on the valence dimension.

Second, *self-control is complex*. It involves the capacity to override or alter predominant response tendencies, and it reflects the interplay of cognitive and motivational (or reflective and impulsive) mechanisms. Furthermore, it can be applied to diverse behaviors or tendencies and includes inhibiting or suppressing impulses as well as amplifying or expressing them. To focus our review, we homed in on two well-studied and widely practiced forms of self-control: dieting and delay of gratification. If emotions have a particular impact on self-control, then we should find evidence for it whenever people attempt to restrict their food intake or to forego short-term indulgences in the pursuit of long-term rewards.

### Incidental Effects of Emotions on Dieting

Numerous studies have assessed the effects of emotions—particularly negative emotions—on eating behavior in humans (for overviews, see Greeno & Wing, 1994;

Macht, 2008). But do emotions influence the self-control of eating? That is, if a person is trying not to eat, do emotional states help him or her to refrain from eating?

### Effects of Negative Emotions on Dieting

The first research to explicitly consider the effect of emotion on the self-control of eating was reported by Herman and colleagues (Herman & Mack, 1975; Herman & Polivy, 1975), who shifted attention away from differences between obese and non-obese individuals and toward differences between restrained versus unrestrained eaters. Restrained eaters are people who are actively attempting to restrict their food consumption—that is, people who are trying to exercise self-control over their eating behavior. Several experiments have found that negative emotions cause restrained eaters to eat more food.

In a sample of female college students, Herman and Polivy (1975) found that the threat of electric shock caused unrestrained eaters to eat less ice cream compared to an impending, nonthreatening tingling sensation. Among restrained eaters, however, threat of shock led to a slight increase in ice cream consumption. Thus, anticipating an anxiety-provoking event caused participants to eat less—unless they were trying to regulate their food consumption.

Similar evidence was reported by Ruderman (1985), who found that taking a test of intelligence and receiving (bogus) feedback indicating failure caused a sample of college-age women to eat more crackers than did receiving success feedback, but only if the women scored high on a self-report measure of dietary restraint. Among these women, the feelings of depression, anxiety, and hostility associated with failure nearly doubled cracker consumption compared to feelings of success. Among women who were not actively trying to restrain eating, cracker consumption was slightly (but nonsignificantly) lower after failure versus success feedback. Here again, unpleasant information that induced negative affect caused only restrained eaters—those who were otherwise trying to regulate their food consumption—to eat more food.

One study suggested that only some aversive events are likely to increase eating

among restrained (but not unrestrained) eaters. More specifically, Heatherton, Herman, and Polivy (1991) found that an ego threat—information that threatens or disparages a person's self-views, such as failure at an important task—increases ice cream consumption among restrained eaters, whereas the threat of physical harm (i.e., shock) does not. The threat of physical harm reduced eating among nonrestrained eaters, consistent with earlier research by Schachter and colleagues (e.g., Schachter, 1968; Schachter, Goldman, & Gordon, 1968), but threat of physical harm had no significant effect on eating among restrained eaters. Only self-relevant negative emotions disinhibited eating behavior among restrained eaters (also see Heatherton, Striepe, & Wittenberg, 1998; Wallis & Hetherington, 2004). A more recent study found that restrained eaters ate fewer low-fat snacks under ego threat, suggesting that restrained eaters eat more of only certain types of foods (e.g., high-fat foods) under threat (Wallis & Hetherington, 2009).

In summary, research suggests that negative emotions, perhaps especially ego-threatening or self-relevant negative emotions, can undermine the self-control of eating behavior, even for relatively unpalatable foods (Polivy, Herman, & McFarlane, 1994). Among people who are not dieting, however, negative emotions appear to have a different effect. Several studies have found that fear and anxiety reduce food intake among unrestrained eaters.

### Effects of Positive Emotions on Dieting

Experimental research on the effects of positive emotions on eating behavior is fairly rare, and research on the influence of positive emotions on the self-control of eating behavior is rarer still. Eating, and perhaps especially the consumption of diet-busting foods such as cake and ice cream, often accompanies joyous celebrations (e.g., weddings, birthdays). This observation suggests that positive emotions may coincide with disinhibited eating. Indeed, the extant evidence suggests that some positive emotions, like some negative emotions, can increase food consumption among restrained eaters.

A study by Cools, Schotte, and McNally (1992) replicated the now familiar find-

ing that negative emotions increase food intake among restrained eaters. They also found that a positive mood induction (i.e., a comedy film) increases food intake among restrained eaters. These patterns led Cools and colleagues to conclude that emotional arousal, rather than negative emotional valence, plays a central role in disinhibited eating among otherwise restrained eaters.

A more recent study by Yeomans and Coughlan (2009) observed a more nuanced pattern. They found that a subset of restrained eaters—those who also had a tendency toward disinhibited eating—ate more popcorn and raisins while watching an anxiety-provoking clip from the movie *The Shining*. This pattern is consistent with evidence reviewed above regarding the effects of negative emotions on restrained eating. Among unrestrained eaters, however, those with a tendency toward disinhibited eating ate more food while viewing pleasant and humorous clips from the television comedy *Friends*. The anxiety-inducing clip and the humorous clip were equally arousing, so arousal does not easily explain the eating patterns. This study suggests that both positive and negative emotions can increase eating, depending on the eater. Negative emotions led to more eating among some individuals who were actively trying to control their eating behavior, whereas positive emotions led to more eating among a subset of individuals who were not actively trying to control their eating behavior.

One other study is relevant, though it did not directly examine restrained eaters or the self-control of eating. Macht, Roth, and Ellgring (2002) compared the effects of different emotion inductions on liking for chocolate and chocolate consumption. They found divergent effects for sadness and joy, such that joy increased appetite in a sample of men but sadness decreased it. The men in the study also found chocolate more pleasant and more stimulating following a joy induction. These are among the few experimental results pertaining to the influence of positive emotion on eating behavior, and they suggest that (compared to sadness), positive emotions may increase desire for chocolate.

To appreciate fully the influence of emotion on the self-control of eating behavior, much more research on positive emotions is needed. One useful approach for future

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research may be to compare the effects of different positive emotions, as previous research has focused mainly on the effects of amusement elicited by humorous stimuli. Positive emotions elicited by humorous stimuli may be relatively low in motivation intensity or action orientation and thus may have different effects relative to other positive emotions such as excitement, pride, or determination. Experiments that compare the consequences of low-intensity versus high-intensity positive emotions may also help to clarify the role of arousal in the effects of emotions on eating.

Another potentially useful consideration is self-relevance. As we saw, negative emotions elicited by self-relevant threats (e.g., failure, negative feedback) tend to have different effects on eating behavior compared to other threats (e.g., threat of shock). Positive emotions can also vary in self-relevance, and it may be worthwhile to ask whether flattery, task success, or other self-enhancing events have different effects on eating self-control compared to viewing funny videos. Self-relevant positive emotions may be more intense or arousing than other positive emotions.

### Conclusion

Having reviewed the evidence that emotions disrupt the self-control of eating behavior, the next question is: Why do emotions have this effect? The short answer is that no single explanation or theory has emerged to explain the relevant evidence. In the next section of the chapter, after considering the impact of emotions on another classic form of self-control, we review the leading explanations for the effects of emotions in more detail.

### Incidental Effects of Emotions on Delay of Gratification

Delay of gratification occurs whenever a person forgoes short-term satisfactions in the pursuit of more distal rewards. Dieting can be seen as delay of gratification (e.g., restraint now to fit into a swimsuit next summer), but delay behavior is more general than dieting insofar as virtually any gratification can be delayed. How do emo-

tions influence delay of gratification? Here we focus on evidence from experiments in which emotional states were induced prior to a measurement of delay of gratification.

### Effects of Emotions on Delay of Gratification in Children

Seeman and Schwarz (1974) reported one of the first experiments to find evidence that incidental positive (vs. negative) emotions enhance delay of gratification. They asked a group of 9-year-olds to draw a picture, ostensibly to be reviewed for possible inclusion in an art show. By random assignment, children were told that their pictures had been selected or had not been selected for the show. (Pilot testing had verified that this method reliably induces positive and negative emotions, respectively.) After receiving the news about their drawings, participants were asked to choose between receiving one moderately desirable object now (e.g., one pack of gum) versus receiving a more desirable object later (e.g., two packs of gum in a week).

The results were clear: Children who had been led to believe that their drawing was selected for the art show were more likely to opt for the delayed reward compared to children who had been told their drawings would not be included in the art show. Seeman and Schwarz (1974) concluded that the children's emotional state was a key determinant of their decision to delay gratification. Absent a neutral emotion condition as a control, however, the authors could not discern whether negative emotions reduced delay behavior or positive emotions increased it.

Fry (1975) did include a neutral condition and found conceptually similar results in a sample of 7- and 8-year-olds. Children in this study were asked to think of happy events, think of sad events, or read instructions for a puzzle prior to being introduced to two toys. One toy was more desirable than the other, but the experimenter explicitly instructed the children not to play with this toy; the less desirable toy could be played with at any time. The children then were left alone in a room with both toys and were secretly observed by an experimenter. Children played with the forbidden toy sooner and more often after thinking about sad events than after thinking about happy

events or solving a puzzle. And children who thought about happy events waited longer and played less with the forbidden toy compared to both other groups of children. This nice linear pattern suggested unique effects of positive and negative emotions, such that negative emotions decrease and positive emotions increase delay behavior.

Moore, Clyburn, and Underwood (1976) tested the impact of emotions on delay behavior in an even younger sample of children: 3- to 5-year-olds. Like Fry (1975), they asked children to think of happy or sad events prior to the assessment of delay behavior; in a neutral condition subjects completed a counting task. Then the children chose between eating a pretzel right then versus waiting for a lollipop. The sad mood induction caused children to favor the immediate pretzel over the delayed lollipop more often compared to the other conditions. In this experiment, however, delay behavior did not differ between the happy versus neutral conditions.

Fry (1977) manipulated emotional states in a sample of 8- and 9-year-olds using success feedback, failure feedback, or no feedback on a series of cognitive challenges. Then the children were left in a room with two toys but expressly forbidden from playing with the more desirable toy. The induction of positive emotions caused children to wait longer before playing with the forbidden toy, compared to children who received no feedback or negative feedback. And negative feedback caused children to delay less compared to no feedback. Here again, then, positive emotions increased delay behavior, and negative emotions reduced it.

Studies that followed this initial flurry of research activity on emotions and delay behavior in children used more complex methods and found more nuanced variations on the now-familiar pattern of results. For example, Schwarz and Pollack (1977, Experiment 1) used a within-subjects manipulation of happy and sad thoughts and measured delay behavior after each emotion induction. They found that happiness increased delay of gratification relative to sadness, but only in the between-groups comparison (i.e., happy first vs. sad first).

Yates, Lippett, and Yates (1981) found that a positive emotion induction (i.e., thinking happy thoughts) prior to the assessment of

delay of gratification increased delay behavior among 8-year-olds but not among 4- and 5-year-olds; the positive emotion induction increased delay behavior among the younger group of children only if they were also reminded to think happy thoughts during the delay period. This study provided a conceptual replication of Mischel, Ebessen, and Zeiss (1972), who had found that encouraging children to think happy thoughts during the delay period increased the duration of delay of gratification.

One clever experiment found that the operative norm in a situation helps to determine whether positive emotions increase or decrease self-indulgence in children. Specifically, Perry, Perry, and English (1985) observed that, compared to completing a simple count task, thinking happy thoughts caused children to indulge (i.e., to take more candy from a candy dish) when there was no hint that taking candy was wrong. However, when the experimenter suggested that they not take too many candies "as that would be greedy," children who had been thinking happy thoughts took significantly fewer candies than other children. Thus, positive emotions caused both increased self-indulgence and increased delay of gratification, depending on the presence or absence of a reminder about an undesirable aspect of self-indulgence.

In summary, emotions have a substantial influence on delay of gratification in children. Negative emotion inductions (particularly, thinking sad thoughts or receiving negative feedback) reduce delay of gratification (i.e., increase immediate gratification) relative to positive mood inductions and neutral states. Furthermore, positive emotion inductions (particularly, thinking happy thoughts or receiving positive feedback) tend to increase delay of gratification relative to neutral emotional states, although a few studies observed only nonsignificant trends in this direction.

### Effects of Emotions on Delay of Gratification in Adults

The early research on emotions and delay of gratification involved children as research subjects. Do emotions have the same impact on delay behavior in adults? Fewer studies have examined delay of gratification in

ication increased delay behavior among 4- and 5-year-olds but not among 4- and 5-year-olds. The positive emotion induction did not increase delay behavior among the younger children only if they were also encouraged to think happy thoughts during the task. This study provided a replication of Mischel, Ebessen, and Peake's (1988) finding that encouraging children to think happy thoughts during the task increased the duration of delay.

The experiment found that the presence of a situation helps to determine whether positive emotions increase or decrease indulgence in children. Spitzer, Perry, and English (1985) found that, compared to completing a task, thinking happy thoughts led children to indulge (i.e., to take more candy dish) when there was no candy. However, the experimenter suggested that they had many candies "as that would be wrong for children who had been thinking happy thoughts took significantly fewer candies than other children. Thus, positive emotions caused both increased self-control and increased delay of gratification on the presence or absence of an undesirable aspect of the task.

Overall, emotions have a substantial effect on delay of gratification in children. Positive emotion inductions (partially sad thoughts or receiving a reward) reduce delay of gratification. In contrast, positive mood inductions increase immediate gratification. Furthermore, positive emotions (particularly, thinking happy thoughts or receiving positive feedback) increase delay of gratification. In contrast, neutral emotional states, although they did not have an observed only nonsignificant effect, did not have a significant effect on delay of gratification.

### Emotions on Delay of Gratification in Adults

Research on emotions and delay of gratification involved children as research subjects. Do emotions have the same impact on delay of gratification in adults? Fewer studies have examined delay of gratification in

adults. This is due in part to the fact that delay behavior is more difficult to study in laboratory experiments with adult subjects. Sadly for self-control researchers, most adult humans easily forgo one marshmallow now for two marshmallows later. Nevertheless, meaningful measures of delay have been devised for adults, and the results suggest that emotions influence delay behavior somewhat differently in adults versus children.

Wertheim and Schwarz (1983) reported one of the first studies assessing the link between emotions and delay of gratification in adults. They found that individuals with higher scores on the Beck Depression Inventory (BDI) chose immediate rewards (e.g., a six-pack of soda now) over delayed rewards (e.g., two six-packs in 3 weeks) more often than did individuals scoring lower on the BDI. Although the correlational nature of the study precluded the authors from making strong causal inferences, their findings fit with the evidence from children indicating that negative emotions decrease (or lack of negative emotions increases) delay of gratification.

Gray (1999) conducted an experiment to examine the effects of threat-related negative emotions on "temporally-extended choice," which is closely related to delay of gratification (see also Knapp & Clark, 1991). Participants earned small monetary rewards for viewing pictures; the more pictures they viewed, the more money they earned. Participants controlled, via button press, how quickly the pictures advanced on the display screen, but the picture-viewing task was arranged so that pressing the button quickly to advance pictures carried a long-term cost. More specifically, advancing pictures quickly increased the rate of picture-viewing in the short term but slowed the rate over the long term, thereby reducing the total amount of money to be earned.

Within the context of this temporally extended choice task, Gray (1999) manipulated emotions by varying the content of the pictures. In the neutral condition, participants viewed images of mundane objects and scenes. In the negative emotions condition, participants viewed unpleasant images from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008), including images of a mutilated body,

a dead animal, and a disgusting toilet. The dependent measure was amount of money participants earned during the last third of the task, after having sufficient opportunity to observe the contingency between button press behavior and subsequent picture durations.

Participants viewing negative pictures earned less money than did participants viewing neutral pictures, suggesting that negative emotions reduce delay of gratification. As Gray (1999) put it, "the aversive group repeatedly favored the option that had beneficial immediate effects, despite larger subsequent costs to the goal of doing well on the task" (p. 71). In a second study, individuals reporting higher stress levels earned less money on the picture-viewing task relative to individuals reporting lower stress levels. Together, the results of these two studies mimic the pattern observed in studies of children: Negative emotions reduce delay of gratification. It is worth noting that the temporally extended choice task was likely to involve other processes (e.g., how quickly and how well participants discerned the contingencies underlying task performance) that may have been influenced by negative emotions, which introduces ambiguity as to whether the results reflect changes in delay or changes in some other process.

As with children, then, the research suggests that adults also become more inclined to seek immediate gratification when they feel negative emotions. Do adults and children show similar effects of positive emotions as well? That is, do positive emotions cause adults to become more inclined to delay gratification?

A study by Hirsh, Guindon, Morisano, and Peterson (2010) tested this hypothesis. Participants completed a series of puzzles faster than a confederate, slower than a confederate, or with no confederate present. Participants then completed a measure of delay discounting, which assesses preferences for immediate versus delayed rewards. This measure asked participants to make a series of choices between hypothetical rewards, one a smaller reward to be received sooner, and the other a larger reward to be delayed (e.g., \$2 now or \$20 in a year?; \$900 now or \$1,000 in 6 months?; \$18 now or \$20 in a week?). Altogether, participants' choices yield idiosyncratic discount rates,

such that higher discount rates indicate lower delay of gratification (i.e., a preference for smaller, immediate rewards over larger, delayed ones).

Changes in positive emotions from before to after the puzzle task predicted subsequent discount rates, but only among extraverts. Specifically, among more extraverted individuals, greater increases in positive emotions predicted higher discount rates (i.e., lower delay of gratification). Changes in negative emotions did not predict discount rates. Hirsh and colleagues (2010) proposed that positive emotions potentiate the tendency for extraverted individuals to orient toward opportunities for reward, leading to a bias toward immediate gratification.

The findings of Hirsh and colleagues (2010) are notable because they run counter to the findings from studies of children, which had revealed that positive emotions increase delay of gratification. This research is thus among the first to suggest that positive emotions can reduce delay of gratification, and the findings fit with evidence that sexual arousal makes adult males more likely to discount the future (Wilson & Daly, 2004; see also Ariely & Loewenstein, 2006).

Additional evidence has accumulated to support the idea that, in adults at least, positive emotions can reduce delay behavior. One experiment found that both positive and negative emotions reduce delay of gratification, depending on the person. Specifically, Augustine and Larsen (2011) had participants view positive or negative pictures from the IAPS prior to completing a delay discounting task. Individual differences in neuroticism ended up playing a central role in the results. Participants higher in neuroticism had higher discount rates (i.e., lower delay of gratification) after viewing negative pictures, compared to those lower in neuroticism. The patterns were slightly more complicated among those who viewed positive pictures. Here, only more neurotic individuals who reported little or no unpleasant affect exhibited higher discount rates. Thus, the positive emotion induction (like the negative emotion induction) tended to reduce delay of gratification, but only among more neurotic individuals who experienced lower levels of negative emotions in response to viewing positive pictures.

Two other studies are relevant to the question of how positive emotions influence

self-control. These studies differ from the research reviewed above, insofar as these used a one-shot decision as the key dependent measure. Note, however, that the decision was always between a more indulgent versus a less indulgent option, which is highly relevant to delay of gratification.

Fedorikhin and Patrick (2010) found that viewing a film clip that elicited low-arousal positive emotions caused participants to choose grapes over candy, compared to viewing a neutral film clip. Viewing a film clip that elicited high-arousal positive emotions, however, did not cause participants to choose grapes over candy more often than did viewing a neutral clip. Although the one-shot choice of candy versus fruit does not map perfectly onto delay of gratification as it has been operationalized in the studies reviewed thus far, the results do suggest that positive emotions increase resistance to temptation relative to neutral emotional states, but only if the positive emotions are associated with low levels of arousal.

A series of experiments by Wilcox, Kramer, and Sen (2011) found that pride increases self-indulgence, which is consistent with the notion that positive emotions can reduce delay of gratification. Specifically, after writing about a personal accomplishment of which they were proud, participants were more likely to choose a gift card that could be used to buy entertainment supplies (an indulgent choice) versus a gift card that could be used to buy school supplies (a utilitarian choice). Thinking of a happy memory did not have a significant effect on gift card choice compared to thinking of neutral events.

In summary, the research suggests that emotions influence delay of gratification behavior in adults. Negative emotions mostly reduce delay of gratification, as was found in children. Positive emotions have more mercurial effects. The bulk of the evidence suggests that positive emotions render adults less likely to delay gratification, much like negative emotions do. However, inconsistencies in the literature justify caveats to this conclusion. Positive emotions may reduce delay behavior particularly among extraverts (Hirsh et al., 2010), or among neurotics who experience a drop in negative affect prior to the delay measure (Augustine & Larsen, 2011). And high-arousal positive emotions may be more likely than low-



These studies differ from the reviewed above, insofar as these are not decision as the key dependent variable. Note, however, that the decisions between a more indulgent and a more indulgent option, which is not to delay of gratification.

and Patrick (2010) found that a film clip that elicited low-arousal positive emotions caused participants to choose over candy, compared to a neutral film clip. Viewing a film clip that elicited high-arousal positive emotions, did not cause participants to choose over candy more often than a neutral clip. Although the choice of candy versus fruit does not directly onto delay of gratification, it is operationalized in the study. Thus far, the results do suggest that positive emotions increase resistance to delay of gratification relative to neutral emotional states, especially if the positive emotions are high levels of arousal.

In a series of experiments by Wilcox, Sen (2011) found that pride in indulgence, which is consistent with the idea that positive emotions can increase delay of gratification. Specifically, when participants thought about a personal accomplishment they were proud of, participants were more likely to choose a gift card that could be used to buy entertainment supplies (a indulgent choice) versus a gift card that could be used to buy school supplies (a utilitarian choice). Thinking of a happy memory had a significant effect on gift card choice compared to thinking of neutral

thought. In sum, the research suggests that positive emotions influence delay of gratification in adults. Negative emotions increase delay of gratification, as was found in children. Positive emotions have mixed effects. The bulk of the evidence suggests that positive emotions are more likely to delay gratification, whereas negative emotions do. However, there is some evidence in the literature that justifies a more cautious conclusion. Positive emotions may increase indulgent behavior particularly among children (Birsh et al., 2010), or among adults who experience a drop in negative affect. The delay measure (Augustine et al., 2011). And high-arousal positive emotions may be more likely than low-

arousal positive emotions to reduce delay of gratification (see also Leith & Baumeister, 1996). Low-arousal positive emotions have been observed to improve resistance to temptation (Fedorikhin & Patrick, 2010), as was typical in research with children, but also low-arousal positive emotions have been found to have no significant effect on resistance to temptation (Wilcox et al., 2011).

### Why Do Incidental Emotions Influence Dieting and Delay of Gratification?

In reviewing the research on the effects of incidental emotions on self-control, we found consistent evidence that emotions influence success at both dieting and delay of gratification. Why do emotions influence self-control as they do?

The single most prominent explanation for the influence of negative emotions on self-control is hedonic emotion regulation. Virtually all of the authors and articles reviewed thus far endorsed this view to some degree. The idea is simple. When people feel bad, they become more inclined to do something to feel better. Of course, this is not the case all of the time or for all persons (see Tamir, 2009), but it often seems to be the case for most. If the opportunity to eat (for dieters) or to self-gratify happens along when one is in a bad mood, then one is more likely to eat or to self-gratify, presumably because this helps to alleviate the bad mood.

Or, at the least, people believe that immediate gratification will alleviate bad moods. The evidence that eating food or choosing smaller immediate rewards actually improves mood is far from conclusive. In fact, none of the studies we reviewed provided any evidence that immediate gratification makes people feel better (nor has research on the related topic of binge eating; see Haedt-Matt & Keel, 2011; cf. Dingenmans, Martijn, Jansen, & von Furth, 2009). Most studies simply did not assess this possibility. Thus, one obvious avenue for future research is to examine the emotional consequences of seeking immediate gratification when in a bad mood.

One investigation that did examine the effects of negative emotions on self-indulgence found little evidence that indulgence improves mood. In a series of experiments, Tice, Bratslavsky, and Baumeister

(2001) manipulated emotional states and assessed their effects on eating, a resource dilemma game, and procrastination. The main finding was that individuals self-indulged when experiencing negative emotions because they believed that self-indulgence would improve their moods. When participants had been led to believe that self-indulgence would not improve their moods, negative emotions did not increase self-indulgence.

For present considerations, the key evidence pertains to the emotional consequences of self-indulgence. Did indulgence actually alleviate participants' negative moods? At the end of two of the experiments reported by Tice and colleagues (2001), participants self-reported their emotional states. Indulgence did not clearly produce an increase in positive emotions in either study. The authors suggested that their mood measures may have lacked sensitivity to find subtle changes in mood, or that the benefits of indulgence were too fleeting to be detected at the end of the experiments. However, they argued against these possibilities and concluded that indulgence does not actually improve mood and that people are mistaken in their belief that indulgence will improve moods. More research is needed on this seeming lack of insight into the hedonic benefits of indulgence and on the limits of indulgence as a mood regulation strategy.

Compared to the hedonic emotion regulation explanation for the effects of negative emotions on self-control, much less consensus exists for explaining the effects of positive emotions on self-control. Perhaps this is because positive emotions can both help and hurt self-control. As we saw, positive emotions tended to increase delay of gratification in kids. A handful of explanations was proposed for this effect, but none has been supported. Fry (1975) speculated that positive emotions heighten self-efficacy and expectations for success, thereby enabling kids to pursue delayed reward. Moore and colleagues (1976) thought that positive emotions allow kids to attend to broader, long-term interests, thereby increasing delay behavior. And Fry (1977) suggested that positive emotions serve as a buffer that allows kids to tolerate the more aversive course of action (e.g., not playing with a desired toy) needed to delay gratification.

In adults, unlike in children, positive emotions tend to reduce delay of gratification, so the proposed explanations here are different. Hirsh and colleagues (2010) proposed that positive emotions prime reward-seeking tendencies, especially for extraverts. Augustine and Larsen (2011) thought that mood regulation accounts for reduced delay under positive emotions. That is, because people tend to want to maintain positive emotions, those who are currently feeling good opt for immediate over delayed gratification to sustain their good moods. Wilcox and colleagues (2011) hypothesized that positive emotions such as pride cause individuals to feel as though they are progressing toward their goals, and these feelings help to justify self-gratification. Ironically, the self-licensing of immediate gratification can negate hard-won progress toward long-term goals.

We think that it is likely that emotions, and particularly positive emotions, can influence self-control via several different mechanisms. Much more evidence and theoretical development is needed before definitive conclusions can be drawn. In the subsequent portions of this chapter, we develop an affect alarm model of self-control that casts negative affect, specifically anxiety, as an integral component of success at self-control. After developing our model, we propose ways to integrate research on the effects of incidental emotions on self-control with our view of negative affect as an integral contributor to self-control. Such integrative efforts promise to advance our understanding of why emotions influence self-control.

### **Integral Effects of Emotions on Self-Control**

Up until now, we have examined the evidence for the idea that incidental emotions moderate the effectiveness of self-control. The evidence indicates that emotional states can undermine or enhance self-control depending on the person and his or her circumstances. We now turn in a different direction to consider the idea that emotions are intrinsic to self-control. That is, rather than viewing emotion as an interloper that impinges upon or moderates self-control

from the outside, we now explore whether emotion is, in fact, integral to the process of self-control, central to the way control is signaled and implemented.

We propose an *affect alarm model of control*, whereby emotion alerts organisms to when self-control is needed. In this sense, emotional processes can be seen as mediating mechanisms of self-control, with emotions acting as information (Schwarz & Clore, 1983) that can tell people when self-control is needed. We should note that although the evidence reviewed above for moderation by incidental emotions is abundant, it is less so for mediation by integral emotions. The evidence we marshal is largely theoretical and our thesis, therefore, more speculative.

One of the "laws" of emotion is that it orients organisms to cues in the environment that signal evolutionarily important needs for survival and reproduction, while tuning out less motivationally relevant information (Frijda, 1988). One class of motivationally relevant events involves needs, desires, and goals that are threatened or at risk of going unmet because they conflict with other needs, desires, and goals. This type of event typically yields negative emotions such as anxiety (Gray & McNaughton, 2000) and is precisely the kind of event in which self-control is needed to bias responding and resolve the conflict. Examples of such goal conflicts include the desire to lose weight coming into conflict with the desire to eat fattening french fries, or the goal of writing a chapter coming into conflict with the goal of reading and replying to e-mail. These forms of goal conflict require attention and resolution so that one can decide what to do and how best to meet long-term goals. In our affect alarm model of control, these types of goal conflicts quickly and automatically elicit negative affect, which serves as an alarm to alert us to possible goal failure and the need to remediate behavior.

We would like to clarify and put boundaries on three aspects of our thesis. First, we suggest that negative emotion, and not positive, acts as an alarm for self-control recruitment. Positive and negative events are both motivationally relevant and thus attract attention (Weinberg & Hajcak, 2010), but only negative events prompt change and remediation. This is because positive affect signals that goals are being

inside, we now explore whether in fact, integral to the process of self-control, central to the way control is implemented.

We propose an *affect alarm model* of control. Any emotion alerts organisms to when self-control is needed. In this sense, these processes can be seen as mediating the process of self-control, with emotions providing information (Schwarz & Clore, 2007). They tell people when self-control is needed. We should note that although the evidence reviewed above for moderation by emotions is abundant, it is less so for the role of integral emotions. The evidence presented is largely theoretical and therefore, more speculative.

One "law" of emotion is that it responds to cues in the environment and evolutionarily important needs such as food and reproduction, while tuning out motivationally irrelevant information (e.g., a TV commercial). One class of motivationally relevant events involves needs, desires, and goals that are threatened or at risk of going unmet, or that they conflict with other needs, desires, and goals. This type of event often elicits negative emotions such as anxiety (Gray & McNaughton, 2000) and is the kind of event in which self-control is needed to bias responding and avoid conflict. Examples of such goal conflicts include the desire to lose weight conflicting with the desire to eat french fries, or the goal of writing an e-mail coming into conflict with the goal of replying to e-mail. These conflicts require attention and decision that one can decide what is best to meet long-term goals. In the affect alarm model of control, these conflicts quickly and automatically elicit affective affect, which serves as an alarm to possible goal failure and mediates behavior.

We would like to clarify and put boundaries on aspects of our thesis. First, we argue that negative emotion, and not just any emotion, serves as an alarm for self-control. Positive and negative events that are motivationally relevant and thus elicit affect (Weinberg & Hajcak, 2009). Only negative events prompt self-remediation. This is because negative affect signals that goals are being

met or even exceeded, whereas negative affect signals that goals are threatened and falling short (Carver & Scheier, 2011). So it is not just any negative affect that does the signaling. To be even more specific, we suspect that the negative emotion that fosters self-control is anxiety, an aversive state characterized by vigilance, attention, and inhibition (Gray & McNaughton, 2000). Critically, anxiety is evoked by situations high in goal conflict and other forms of uncertainty (Hirsh, Mar, & Peterson, 2012), which are precisely the situations where self-control is required.

Second, we suggest that affect, rather than full-blown emotions, serves as the signal. Emotions are multifaceted, whole-body responses involving changes to conscious experience, behavior, and physiology that are slow to arise and slow to dissipate. Affect, on the other hand, has been conceptualized as a quick twinge or feeling that may not be conscious, arises very rapidly, possibly within fractions of a second, and may dissipate just as quickly (LeDoux, 1989; Winkielman & Berridge, 2004; Zajonc, 1980). Affect is more likely than full-blown emotions to signal the need for control because consciously experienced emotions are too slow and complex to be useful as self-control signals (see Baumeister, Vohs, DeWall, & Zhang, 2007). In fact, as the first half of this chapter observed, emotions can get in the way of good self-control. Affect, by contrast, is simple, rapid, and automatic and thus well suited to guide ongoing behavior.

Third, we suspect that the kind of control that is triggered by negative affect is inhibition. Researchers who study executive control divide this umbrella concept into smaller subcomponents, including maintaining, switching, and inhibiting (Miyake et al., 2000), and even planning and deciding (Zelazo & Cunningham, 2007). Although these subcomponents tend to tap the same central capacity, we suspect that negative affect most likely signals inhibitory processes. Inhibition involves suppressing or overriding prepotent responses and is triggered by the goal conflicts that produce negative affect (Gray & McNaughton, 2000). Thus, prior research has established a link between negative affect and behavioral inhibition. It is unclear, however, if the other components of executive control are similarly set into motion by negative affect.

## Theoretical Models Incorporating Emotions in Self-Control

To make the case that emotion is central to the process of the self-control—that it signals the need for control—we first need to dismiss the notion that emotions are separable from, and unrelated to, cognition. For a number of reasons both historical and cultural, emotion has been considered the antithesis of reason (Solomon, 2008). Emotions are often cast as artifacts of an ancient animal past that hijacks otherwise rational, deliberative minds. The philosophical position of dualism represents a strong version of this view, stating that passionate, animalistic, physical bodies are wholly and completely separate from rational, conscious, nonphysical minds (Descartes, 1649/1989). With this view it is difficult to argue that emotions are an integral part of cognition and, by extension, part of self-control. However, most contemporary researchers do not view emotion and cognition as opposable or mutually exclusive constructs, with some suggesting that they are fully integrated and only minimally decomposable (e.g., Pessoa, 2008). Modern theories view emotions and cognition as interrelated (Frijda, 2008) and thus open the door to the idea that emotions may play a central function in cognition, including higher cognitive functions such as executive control. We now turn to theoretical support for the idea that emotions or affects play an integral role in self-control by signaling the need for control.

## Cybernetic Models of Control

Cybernetic or feedback loop models have been very successful in modeling control in humans, but also in simple machines like thermostats. These models invariably identify control with three components: (1) goals/standards, (2) comparators/monitors, and (3) effectors/operators. *Goals/standards* are desired setpoints or criteria; *comparators/monitors* scan the current state of the environment to detect and alert for mismatches with goals and standards; and *effectors/operators* are called upon to make corrections to reduce the size of state-goal mismatches. When a goal or standard is set, control involves one process of monitoring when something shifts away from the crite-

tion and a second process of returning this something to criterion. For example, if the goal is to finish writing a chapter, every glance at an e-mail inbox may trigger the monitoring system to sound the alarm that goal pursuit is going off course and to reorient goal pursuit.

Social and personality psychologists have elaborated upon this structure, postulating, for example, test versus operate mechanisms in action control (Carver & Scheier, 1981) or monitoring versus operating processes in thought control (Wegner, 1994). Similarly, neuroscientists have described cognitive control as relying on two separate neural systems. The first, described as a conflict-monitoring or error-detecting system (Botvinick, Braver, Barch, Carter, & Cohen, 2001; Gehring, Goss, Coles, Meyer, & Donchin, 1993; Holroyd & Coles, 2002), monitors ongoing behavior and detects discrepancies between intended and actual responses. When a discrepancy is detected, this information is passed to the second, regulatory or operating system, which implements the desired response while suppressing incompatible ones. Neuroimaging studies have suggested that these systems are implemented by the anterior cingulate cortex (ACC) and the prefrontal cortex (PFC), respectively (e.g., Kerns et al., 2004).

Although all three components (i.e., standards, monitors, and operators) are important, the monitoring process is fundamental to self-control because it alerts organisms to the need for control and remediation. If the function of the monitoring process sounds like the function we have postulated for negative affect, this is not an accident. Some theorists have hypothesized that the detection of state-goal mismatches is not affectively neutral; rather, mismatches can produce negative affect (Carver & Scheier, 1998, 2011). When people act on their goals and reduce the discrepancy between their goals and current states at an acceptable rate, they experience no affect or possibly positive affect. If, however, the rate of discrepancy reduction is stalled or otherwise too slow, people experience negative affect. This negative affect tends to hasten discrepancy reduction. Negative affect, in other words, can instigate control by orienting people to the fact that a discrepancy was detected and that discrepancy reduction is required.

Returning to our example, when one detects inadequate progress toward completing the goal of writing a chapter, a quick twinge of negative affect may arise and lead the author to correct behavior and once again focus on goal completion. The negative affect produced by the detection of goal-state mismatches can hasten self-control and correction and thereby prevent full-blown emotional reactions from occurring later, if and when the goal is not met. A little negative affect now can prevent a larger amount of negative emotion later.

### Reinforcement Sensitivity Theory

According to the revised reinforcement sensitivity theory (RST; Corr, 2008; Gray & McNaughton, 2000), control of behavior depends on three underlying motivational systems. First, the behavioral activation system (BAS) is strongly related to approach motivation and actively increases sensitivity to appetitive stimuli that signal reward or nonpunishment (Carver & White, 1994; Gable & Harmon-Jones, 2008). Second is the fight-flight-freeze system (FFFS), which mediates reactions to aversive stimuli and is associated with avoidance and escape behaviors, with high sensitivity to negative cues. Third is the behavioral inhibition system (BIS), which is associated with anxiety, risk assessment, and worry and helps to resolve conflicts that arise within and between the other two systems. When BIS is activated, it inhibits current behavior to allow alternative response options to be reevaluated.

BIS is the most relevant to the current model. BIS can be conceptualized as the control system because the kinds of conflicts that activate BIS are precisely the kinds of conflicts that instigate inhibitory control. For example, the conflict between saving money for the future versus spending it right now would activate BIS, as would the conflict between reading a word or naming its color. In both cases, one response may be inhibited or suppressed, thereby allowing the second response to take precedence. As with cybernetic models, conflict detection and BIS activation are accompanied by negative affect, specifically anxiety (Gray & McNaughton, 2000). In fact, self-report measures of BIS are dominated by words such as *worry*, *fear*, and *nervousness* (Carver

to our example, when one makes adequate progress toward completion of writing a chapter, a quick positive affect may arise and lead to correct behavior and once a goal is completed. The negative affect produced by the detection of goal completion can hasten self-control and thereby prevent full-blown distractions from occurring later, if a goal is not met. A little negative affect can prevent a larger amount of distraction later.

### Sensitivity Theory

The revised reinforcement sensitivity theory (RST; Corr, 2008; Gray & McNaughton, 2000), control of behavior is based on three underlying motivational systems: the behavioral activation system, which is strongly related to approach and actively increases sensitivity to reward stimuli that signal reward; the behavioral inhibition system (BIS), which is related to aversive stimuli and is associated with anxiety, risk aversion, and worry and helps to resolve conflicts that arise within and between the systems. When BIS is activated, it inhibits behavior to allow alternative options to be reevaluated.

The BIS is most relevant to the current discussion because the kinds of conflicts that are resolved by BIS are precisely the kinds of conflicts that instigate inhibitory control. For example, the conflict between saving for the future versus spending it now would activate BIS, as would the conflict between reading a word or naming it. In both cases, one response may be activated or suppressed, thereby allowing the other response to take precedence. In dynamic models, conflict detection and activation are accompanied by negative affect, specifically anxiety (Gray & McNaughton, 2000). In fact, self-report studies of BIS are dominated by words such as *fear*, and *nervousness* (Carver

& White, 1994). Goal conflict produces anxiety that then impels attempts to resolve those conflicts, which includes the inhibition of both approach (BAS) and avoidance (FFFS) behaviors, increases in arousal, and increases in vigilance, all of which stop current behaviors so that the organism can calculate the best course of action.

The point here is that according to revised RST, negative affect plays a prominent role in BIS and therefore in stopping ongoing behaviors so that an organism can reorient and establish control. Evidence suggests that high-trait BIS relates to indices of self-control, including brain-implemented performance monitoring (Amodio, Master, Yee, & Taylor, 2008; Boksem, Tops, Wester, Meijman, & Lorist, 2006), behavioral indices of inhibition (Avila & Parcet, 2001), and corrective behavioral adjustments under some conditions (Boksem, Tops, Kostermans, & De Cremer, 2008). We are quick to note, however, that the relationship between BIS and improved self-control may be restricted to sharp upticks in inhibitory states following phasic releases of noradrenaline (Aston-Jones & Cohen, 2005; Bouret & Sara, 2005), rather than more global trait differences in behavioral inhibition, which are related to improved attention control but also to difficulties with attentional disengagement (Poy, del Carmen Eixarch, & Avila, 2004).

### Conflict Monitoring and Adaptive Control

Research in cognitive and affective neuroscience has shed light on how self-control is implemented in the brain. As we discussed above, a prominent theory in neuroscience, *conflict-monitoring theory*, posits that self-regulation relies on two separate neural systems (once goals are set): one for the detection of conflict between competing response tendencies and one that operates on these conflicts and implements control (Yeung, Botvinick, & Cohen, 2004). Conflict-monitoring theory suggests that the ACC plays an important role in monitoring moment-to-moment representations of action tendencies for potential conflicts. Upon detection of conflict, other mechanisms may be engaged to inhibit the unwanted tendency and promote effective goal pursuit. The conflict-monitoring func-

tion of the ACC, in other words, appears to signal when control is needed.

Then again, the ACC's signaling of control may be produced not only by the cold detection of conflict but also by the hot reaction to it. The ACC is involved in cognition and control as well as negative affect. For example, the ACC is involved in anxiety, depression, and trait-negative affect (Drevets et al., 1997; Hajcak, McDonald, & Simons, 2004), and is associated with the sympathetic modulation of heart rate (Critchley et al., 2003), skin conductance (Hajcak, McDonald, & Simons, 2003), autonomic control of pupil diameter (Critchley, Tang, Glaser, Butterworth, & Dolan, 2005), levels of basal cortisol (Tops & Boksem, 2011), pain (Rainville, Duncan, Price, Carrier, & Bushnell, 1997), and distress (Eisenberger & Lieberman, 2004).

Shackman and colleagues (2011), along with others (Critchley et al., 2003; Luu & Posner, 2003), have proposed that the anterior midcingulate cortex (aMCC) implements cognitive control by integrating negative affect, pain, and other forms of negative feedback with goal-directed behavior. According to their *adaptive control model* (Shackman et al., 2011), the core function common to negative affect, pain, and cognitive control is the need to determine an optimal course of action in the face of uncertainty. The aMCC is assumed to use affective information to select among alternative courses of action and to bias responding in situations characterized by uncertainty or conflict. Consistent with this view, we suggest that negative affect plays a crucial role in signaling the need for control. And we have found evidence that when negative affect is misattributed to other sources, the alarm function of affect is disabled and control becomes unhinged (Inzlicht & Al-Khindi, in press). The implication is that negative affect allows people to establish control by signaling what needs to be controlled and when.

### Errors, Posterror Adjustment, and the Orienting Response

One of the hallmarks of good self-control is the minimization of errors during goal pursuit. By *errors* we mean instances when one fails to reach a standard or goal and instead succumbs to a prepotent response.

Self-control as the minimization of errors is easy to imagine on reaction time tasks such as the Stroop task, in which control is demonstrated by minimizing the number of times one mistakenly reads a word instead of naming its color. Good self-control is also evident whenever a person minimizes the number of times he or she reaches for unhealthy foods while wanting and trying to lose weight.

It turns out that one must notice and orient to errors when they occur to learn from and thereby minimize them. On reaction time tasks, people typically slow down and improve the accuracy of their performance after errors, displaying what researchers call *posterror slowing* or *posterror adjustment*, which is thought to reflect a strategic response to errors characterized by more careful and deliberate behavior to reduce the probability of further error commissions (Botvinick et al., 2001; Rabbitt & Rodgers, 1977). Posterror slowing may also reflect an orienting response to an infrequent event, which causes attentional capture and inhibits subsequent responses (Notebaert et al., 2009). In either case, people typically slow down after errors; and the more they do, the fewer errors they tend to make overall (e.g., Hajcak et al., 2003) and the better outcomes they experience more generally, including outcomes that reflect better self-control (e.g., Compton et al., 2008; Hirsh & Inzlicht, 2010; Robinson, 2007).

Errors thus lead people to take notice, change course, and reestablish control. But why do we notice and orient to them? The answer, we think, is that errors produce negative affect. Errors are not neutral events; rather, errors are distressing because of the negative consequences typically associated with them. Hajcak and colleagues (2003), for example, found that errors prompt rapid changes in autonomic arousal, including increased skin conductance and greater heart rate deceleration. Errors prompt more than an orienting response, however; they are also aversive and anxiety-inducing, with larger startle reflexes—an index of defensiveness—after errors than after correct responses (Hajcak & Foti, 2008). The more aroused people become after they make errors, the fewer errors they tend to make overall (Hajcak et al., 2003). In short, noticing errors contributes to adaptive con-

trol, and the reason people notice errors to begin with is because errors are arousing and aversive. So, here is more evidence that negative affect, in this case, affect associated with errors, signals the need for remediation and control.

### Somatic Marker Hypothesis

The final theory we discuss shares a number of features with our own affect alarm model of control. According to Damasio (1994), emotional processes guide and bias behavior, specifically decision-making behavior. This hypothesis emerged in response to a number of observations of neurological patients with focal lesions to “emotional” parts of the brain, namely ventral and medial prefrontal regions. These patients exhibited severe deficits in personal and social decision making, but otherwise exhibited largely intact intellectual abilities (Damasio, 1996). Furthermore, these patients had compromised abilities to express emotion and experience feelings in situations in which emotions would normally have been expected. In other words, along with normal intellect and abnormal decision making, there were abnormalities in emotion and feeling. Damasio (1994, 1996) predicted and later confirmed that the deficits in emotions and feelings directly contributed to these patients’ deficits in decision making.

The somatic marker hypothesis states that when we make decisions, we assess the reward value of the available options using both cognitive and emotional processes. When facing complex and conflicting choices, we may be unable to decide using only cognitive processes, which may become overloaded and hence ineffective at guiding decision making. In these cases emotions, or somatic markers, can help by directing attention to more advantageous options and simplifying the decision process (Damasio, 1994). In short, this view suggests that emotions help guide decision making by biasing behavior toward one or more of the response options based on past learning and associations.

The notion that emotions adaptively bias decision making is consistent with our own affect alarm model of self-control, especially insofar as decision making also belongs under the umbrella of self-control (Vohs et

reason people notice errors to because errors are arousing. So, here is more evidence that, in this case, affect associated signals the need for remediation.

### er Hypothesis

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that emotions adaptively bias ng is consistent with our own model of self-control, especially decision making also belongs brella of self-control (Vohs et

al., 2008; Zelazo & Cunningham, 2007). Control is important for decision making, and when control is absent, decision making suffers (Masicampo & Baumeister, 2008). So here is more evidence that emotion aids control, albeit control in the service of making effective decisions. Interestingly, others researchers have found that the same kind of lesion patients that inspired Damasio's somatic marker hypothesis also show deficits in inhibiting previously learned associations (e.g., Rolls, Hornak, Wade, & McGrath, 1994). Emotions, then, seem integral not only for making decisions but also for inhibition. It is important to note that our own model deviates from the somatic marker hypothesis by stressing negatively valenced affect—the quick, automatic form of emotion—and the inhibitory form of control.

### Summary and Predictions

We are making only one claim: that emotion, possibly the negative emotion of anxiety and possibly only short-lived, preconscious anxious affect, acts as a kind of alarm that orients people to when self-control is needed. Emotions direct people to motivationally relevant information, and there may be nothing quite as motivating as facing uncertainty about what to do and how to do it, precisely the same kinds of situations where self-control is needed to bias responding in favor of one course of action over another. When we face uncertainty about how to act because goals or response tendencies come into conflict with one another, we have an anxious affective response that directs us to resolve these conflicts by inhibiting ongoing behavior until we settle on a course of action (Gray & McNaughton, 2000).

We have already mentioned that the affect alarm model is largely theoretical at this point, and thus somewhat preliminary. Nonetheless, the model makes a number of predictions that allow it to be distinguished from other theories, including predictions that have now been empirically supported. Space constraints prevent us from listing all predictions and empirical support, so we give only a small sample of them here.

Given the importance of affect in alerting us to the need for control, the affect alarm model of control predicts that temporary

increases in integral affect should enhance self-control. A recent study by Moser, Most, and Simons (2010) lends support to this view. When participants in this study "up-regulated" their negative emotions, they experienced both more negative affect and improvements in control, suggesting that negative affect helps to enhance cognitive control.

Negative affect is not enough, however; the affect alarm model suggests that people need to attribute their affect to the correct source; otherwise, negative affect will be unmoored from the instigating event (e.g., goal conflict) and will not appropriately alert people to the need for self-control. A recent study supports this view (Inzlicht & Al-Khindi, in press): When people incorrectly attributed the natural, albeit mild, anxiety produced by taking an executive control task, the brain signals related to performance monitoring ceased predicting cognitive control. Self-control, in other words, is thrown off course without negative affect acting as a guide.

The affect alarm model of control further predicts that people who are attuned and aware of their own affective states will show enhanced self-control. Conversely, people who are unaware of their emotions or have difficulty identifying and differentiating between them should show marked decrements in self-control. *Alexithymia* refers to deficiencies in identifying and differentiating emotions, and preliminary research suggests that alexithymia is associated with executive function deficits (Henry, Phillips, Crawford, Theodorou, & Summers, 2006).

In addition to emotional awareness, emotional acceptance may also be important for prompting self-control. Those who acknowledge and approve of their feelings—as opposed to those who judge, reject, and suppress them—may be more inclined to "listen" to what their emotions are trying to say and, as a result, be better attuned to when self-control is required. In support of this view, new research indicates that people who practice mindful meditation show enhanced executive control and enhanced brain-implemented performance monitoring (Teper & Inzlicht, in press). Together, these findings indicate that emotional awareness and acceptance play key roles in improving self-control and are consistent with the

affect alarm model of control. Future studies will need to move beyond correlational designs to explore if state enhancements in emotional awareness and acceptance improve self-control.

### **Integrating Research on the Incidental and Integral Effects of Emotions on Self-Control**

Before concluding, we would like to issue a call for future research to integrate the literatures on the incidental and integral effects of emotions on self-control. If subtle twinges of negative affect trigger self-control, as we have proposed, then how do full-blown, conscious emotional states influence these twinges? Why, if negative affect triggers self-control, do full-blown negative emotions tend to impair rather than improve dieting and delay of gratification?

One possibility is that full-blown negative emotions (including long-term negative emotional states such as depression) overwhelm the subtler affective signals that cue the need for self-control. When a person experiences fear at the prospect of receiving an electric shock or receives negative feedback challenging his or her most cherished self-views, perhaps the conflict between consuming fatty foods and sticking to a diet recedes in importance or fails to trigger control because the relevant mechanisms are preoccupied with the more pressing, more intense emotional context. This hypothesis is speculative, but experiments testing it promise to elucidate the relationship between emotions and self-control.

And how do positive emotions alter the affect alarm bell for self-control? One possibility is that, under the influence of positive emotional states, response conflicts cause less or weaker negative affect. In this view, self-control is less likely to occur under positive emotional states because the alarm bell rings too softly. As we saw, however, positive emotions sometimes enhance self-control (particularly in children), so this view is not wholly satisfying. Much more research is needed on the relationship between positive emotions and self-control, particularly as this relates to the affect alarm model we have proposed. As a second possibility, per-

haps highly arousing emotions of either positive or negative valence can drown out the affect alarm system, making self-control less likely. Insofar as both positive and negative emotions can disrupt delay of gratification, arousal may help to explain the patterns.

In conclusion, we have reviewed evidence that incidental emotional states are powerful determinants of self-control outcomes, and we have proposed that negative affect can be seen as an integral component of the process of self-control. Research and theory on the integral versus incidental effects of emotions on self-control have lived largely separate lives, much like they did in this chapter. It is high time to integrate them, as the integration promises a more complete picture of the role of emotions in shaping self-control.

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using emotions of either positive or negative valence can drown out the executive control system, making self-control less effective. Both positive and negative emotions can disrupt delay of gratification, and help to explain the patterns. In this chapter, we have reviewed evidence that emotional states are powerful predictors of self-control outcomes, and that negative affect can be a central component of the process. Research and theory on the incidental effects of emotions have lived largely separate lives; we did in this chapter. It is time to integrate them, as the integrative approach provides a more complete picture of the role of emotions in shaping self-control.

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