

Impulse and Self-Control From a Dual-Systems Perspective

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ABSTRACT—*Though human beings embody a unique ability for planned behavior, they also often act impulsively. This insight may be important for the study of self-control situations in which people are torn between their long-term goals to restrain behavior and their immediate impulses that promise hedonic fulfillment. In the present article, we outline a dual-systems perspective of impulse and self-control and suggest a framework for the prediction of self-control outcomes. This framework combines three elements that, considered jointly, may enable a more precise prediction of self-control outcomes than they do when studied in isolation: impulsive precursors of behavior, reflective precursors, and situational or dispositional boundary conditions. The theoretical and practical utility of such an approach is demonstrated by drawing on recent evidence from several domains of self-control such as eating, drinking, and sexual behavior.*

I can resist everything except temptation.

—Oscar Wilde

If you ever felt an urge to do something forbidden, resisted a while, and failed, read on. If not, you may not be of this world. Everyday life is full of temptations that challenge our capacity for self-control or willpower. Of course, people are often remarkably good at resisting temptation. Sometimes, however, self-control loses the upper hand and people are swayed. Such situations are typically experienced as a conflict between two antagonistic forces that exert incompatible influences: one force calls on us to do what we believe is reasonable, whereas the other urges us to do what pleasure dictates. For example, we may know that the fruit salad is the healthier alternative for dessert, and yet we are tempted to eat the chocolate mousse. To resist temptation and choose to go with the more reasonable alternative, one needs self-control.

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The current article is centered around the idea that most instances of temptation can be described as a tug-of-war or conflict between impulses on one hand and self-control on the other (e.g., Baumeister & Heatherton, 1996; Carver, 2005; Freud, 1933/1949; James, 1890/1950). To consider this idea in more detail, we will first narrow down the concepts of *impulse* and *self-control* for our purposes. We will then provide a brief and necessarily selective review about how this idea is reflected in historical and modern treatments of self-control. Our conclusion from this review is that contemporary research has primarily focused on the self-control side of this conflict. In the main part of this article, we suggest that a more balanced framework, derived from contemporary models about two different systems of behavior determination (e.g., Epstein, 1990; Metcalfe & Mischel, 1999; Strack & Deutsch, 2004), should consider both sides of the struggle equally. This framework proposes that two fundamentally different systems may be responsible for impulsive versus self-controlled behavior. We will then spell out a corresponding measurement approach for the prediction of behavioral self-control outcomes. This approach integrates each of the two systems as well as situational or dispositional boundary conditions affecting which of the two systems may prevail. Finally, we review recent empirical evidence that demonstrates the utility of such an approach.

Because everyday self-control typically requires resisting an hedonic impulse in the service of more deliberate evaluations and long-term standards, our article will be framed in terms of a temptation scenario. This covers a great variety of cases ranging from the tasty doughnut in the morning, to the impulse buy on your way home, to the cool beer in the evening. However, there are also cases in which a negatively valenced impulse signals uneasiness, harm, or danger to the organism. This negative impulse has to be overcome for a greater good, such as health (see Trope & Fishbach, 2000). For instance, picture a person who has to resist the impulse to jump off the dentist's chair as he or she is undergoing a necessary medical treatment. Even though such cases will not be in the focus of the present review, we believe that our approach applies to such cases as well.

Moreover, due to its focus on behavioral self-control outcomes, the present framework may apply somewhat less well to

cases in the broader sense of the term *self-regulation*, which includes also the regulation of inner responses such as thoughts and emotions (Baumeister, Heatherton, & Tice, 1994). And lastly, we shall not discuss the complex ethical and moral implications of hedonic lifestyles versus restrained lifestyles for individual well-being and societal functioning, even though these implications may be far ranging and important (e.g., Bogg & Roberts, 2004; Polivy, 1998; Tangney, Baumeister, & Boone, 2004).

DEFINING IMPULSE AND SELF-CONTROL

What exactly do we mean when we speak of an impulse? First, an impulse is specific rather than unspecific (Baumeister & Heatherton, 1996), arising when more global motivations (e.g., thirst) meet specific activating stimuli in the environment (e.g., a glass of lemonade on a hot summer's day). Second, an impulse typically possesses a strong incentive value consisting of a primitive hedonic reaction to the tempting stimulus (e.g., Loewenstein, 1996; Metcalfe & Mischel, 1999).¹ Third, an impulse is immediate in a temporal and a spatial sense—that is, directed toward short-term gratifications—and its incentive value quickly diminishes as temporal or spatial distance increases (Ainslie, 1975). Fourth, an impulse typically carries an inclination to perform a certain behavior, often an urge to approach or act on the temptation at hand. If performed without resistance, behavioral execution may run so smoothly that one is not even consciously aware of it—at least not until it has come to a natural end (like reaching the bottom of the potato-chip bag while watching television). Following our impulses seems to be the simplest and most natural thing in the world.

Following our impulses would be biologically adaptive if we were designed to live only for today and without concern for other people's well-being. However, most unconstrained impulsive behaviors interfere with the attainment of long-term goals or generate interpersonal conflict at some point (Bogg & Roberts, 2004; Freud, 1930; Tangney et al., 2004). Therefore, the capacity for self-control, defined here as the capacity to override or inhibit "undesired behavioral tendencies (such as impulses) and to refrain from acting on them" (Tangney et al., 2004, p. 4), is an important skill for everyday functioning. In fact, a large part of socialization efforts are dedicated to instilling this very capacity in individuals (e.g., Baumeister et al., 1994; McCabe, Cunningham, & Brooks-Gunn, 2004). Self-control becomes particularly manifest in people's restraint standards—that is, (long-term) standards about how behavior should be regulated in a given domain of life (e.g., standards for keeping a healthy diet or for remaining faithful to one's romantic partner). Most important, however, self-control is a strenuous act that

needs our attention and puts our self-discipline or willpower to the test (Baumeister et al., 1994; Metcalfe & Mischel, 1999).

IMPULSE AND SELF-CONTROL IN THE HISTORY OF IDEAS

The idea of a conflict between impulse and self-control can be traced to a large number of historical accounts. For instance, it appears as early as in the discussions of Greek philosophers under the labels of "passion" versus "reason." Socrates and Aristotle, for instance, discussed whether weakness of will (or *akrasia*)—that is, acting against one's better judgment—is possible or not. Socrates, as documented in Plato's *Protagoras*, claimed that weakness of will does not exist because no one would willingly act against his better judgment. Instead, the judgment of an akratic person was seen to be faulty as it would lack the knowledge and the proper perspective of a fully informed and wise individual. In his *Nicomachean Ethics*, Aristotle objected that people may in fact act against their better judgment because they are at times overpowered by their passions. In a timeless example, he discusses the reasons that explain why a person who is being offered sweet but unhealthy food may yield to the temptation. Aristotle argues that such behavior occurs because the "practical conclusion" implied by passion—namely, to consume the sweet—prevents the person from reaching a second conclusion implied by reason—namely, to abstain from consumption.

Most religions, too, deal with the question of how to curb passion (Geyer & Baumeister, 2005; Irvine, 2006). In the Christian Catholic tradition, for instance, a lack of self-control over passions is strongly connected to the concept of sin or vice. Saint Augustine identified human sinfulness, ultimately original sin, as being responsible for inner conflict in man. In his *Confessions*, he described such a conflict as a struggle between two antagonistic motivations: "Thus did my two wills, one new, and the other old, one carnal, the other spiritual, struggle within me; and by their discord, they tore my soul apart" (VIII, 5, 10).

IMPULSE AND SELF-CONTROL IN THE HISTORY OF PSYCHOLOGY

Of course, early pioneers of psychology have not been mute on the struggle between impulse and self-control. In his *Principles of Psychology*, William James (1890/1950) gave an extensive treatment of the different forms of will: Whereas healthy will is characterized by a proper balance between impulsive forces and ideal motives, unhealthy will take the forms of an explosive and an obstructed will. The explosive will is characterized by impulses that "discharge so promptly into movements that inhibitions get no time to arise" (p. 537). In contrast, the obstructed will can be described as an excess of inhibition. Most important for the present purposes, James already saw the balance between impulsive and inhibiting forces to be highly fragile and

¹This criterion distinguishes an impulse that can be described as "hot," from the concept of "habit," which is used to denote hedonically "cold" behaviors acquired through frequent repetition such as twirling one's hair (Strack & Deutsch, 2007).

easily influenced by circumstances—for instance, by mental fatigue (e.g., p. 540).

Sigmund Freud was probably the first scholar who explained human behavior as the result of conflicting inner forces. Specifically, Freud, 1933/1949 described the id as an entity that operates only according to primitive hedonic principles of pleasure and pain and without regard for their feasibility or consequences. It is thus the generator of drives, desires, and impulses whose true origins lie hidden in the unconscious. Acting as its antagonist, the super-ego is seen as the moral watchtower. It contains internalized societal and paternal moral principles, commands, and prohibitions. Finally, the ego is identified as the mental component that is oriented toward reality and strives for a compromise between the often colliding interests of the id and the superego.

SELF-CONTROL IN MODERN PSYCHOLOGY

With the decline of purely rational models of human behavior, recent decades have seen a renewed interest in the problem of self-control from a multitude of disciplines. These include not only psychology, but also economics (e.g., Loewenstein & Elster, 1992; Thaler, 1991), political science (e.g., Schelling, 1984), and philosophy (e.g., Davidson, 1980).

Within psychology, Mischel and colleagues' seminal work (e.g., Mischel, 1974; Mischel, Shoda, & Peake, 1988) has established the conditions under which children delay gratification and forgo a smaller immediate reward for a larger future reward. Carver and Scheier (1981) have provided psychology with a broadly applicable framework that explains how people monitor and react to discrepancies between their actual states and their internal goal standards. Since then, a variety of general or domain-specific models of self-control have been proposed (e.g., Eisenberg et al., 2004; Gross, 1998; Kuhl & Beckmann, 1985; Rothbart, Derryberry, & Posner, 1994; for an overview, see Baumeister & Vohs, 2004).

Among these models, the work by Baumeister and colleagues has focused on the failure of self-control and its psychological and behavioral consequences (e.g., Baumeister & Heatherton, 1996; Baumeister et al., 1994). Specifically, Baumeister and colleagues understand the capacity for self-control as a limited resource that works like a muscle. The exertion of self-control depletes this energy, which replenishes after some time (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998; Vohs & Heatherton, 2000). Other research has unraveled the various strategies individuals use to bolster the value of long-term goals in the face of temptation (e.g., Fishbach, Friedman, & Kruglanski, 2003; Gollwitzer & Brandstätter, 1997; Hoch & Loewenstein, 1991; Mischel & Baker, 1975; Trope & Fishbach, 2000) and has described ways in which the capacity for self-control may be improved in the short or long run (Gailliot et al., 2007; Marlatt & George, 1985; Muraven, Baumeister, & Tice, 1999; Oaten & Cheng, 2006; Webb & Sheeran, 2003). Finally, indi-

vidual differences in the capacity for self-control have been identified (e.g., Block & Block, 1980; Bogg & Roberts, 2004; Tangney et al., 2004; for a review, see Carver, 2005).

Somewhat surprisingly, however, past research has focused primarily on the capacity for self-control and the conditions and strategies affecting it. The nature of impulse—the power of the temptation at hand—has received much less attention. In this article, we will suggest how this gap may be reduced. Specifically, we believe that a more complete model of behavioral self-control outcomes should better integrate and specify impulsive influences on behavior. To this end, we will present a dual-systems perspective of impulse and self-control that is explicit about how impulsive and reflective processes may bring about and compete for overt behavior.

A DUAL-SYSTEMS PERSPECTIVE OF IMPULSE AND SELF-CONTROL

The notion that different systems may determine human behavior has a long history in our discipline (e.g., Freud, 1933/1949). In modern psychology, this notion is reflected in numerous dual-system models in cognitive, personality, and social psychology (e.g., Epstein, 1990; Metcalfe & Mischel, 1999; Sloman, 1996; Smith & DeCoster, 2000; Strack & Deutsch, 2004). Even though different terminologies have been used to describe the two systems, these models share the general assumption that structurally different systems of information processing underlie the production of impulsive, largely automatic forms of behavior on the one hand and deliberate, largely controlled forms of behavior on the other. Some authors have also proposed that distinct brain areas may underlie these systems (e.g., Bechara, Noel, & Crone, 2006; Lieberman, 2007). All of these models are applicable to the study of self-control outcomes. Among these models, the reflective impulsive model (RIM; Strack & Deutsch, 2004) is particularly concerned with how the two systems compete to determine behavior (Strack & Deutsch, 2004). We therefore adopt the logic of the RIM to the study of self-control and use the labels *impulsive* and *reflective* to denote the two systems that are assumed to underlie behavior production, even though many of the predictions tested in the research review below could be made by other dual-system models as well.

The Impulsive System

This system, as its name implies, is responsible for generating impulsive behavior. Specifically, impulses are assumed to emerge from the activation of certain associative clusters in long-term memory by perceptual or imagined stimulus input (Metcalfe & Mischel, 1999; Strack & Deutsch, 2004). These associative clusters have been created or strengthened gradually by temporal or spatial coactivation of external stimuli, affective reactions, and associated behavioral tendencies in the learning history of the organism. For instance, through repeated experience with chocolate, an associative cluster may be formed

that links (a) the concept of chocolate, (b) positive affect generated by the organism, and (c) the behavioral schema that has led to the positive affect (putting the chocolate into one's mouth). Once established, associative clusters can be reactivated quickly by perceptual input and by facilitating internal triggering conditions such as hunger, thirst, or other inner states of homeostatic dysregulation (Aarts, Dijksterhuis, & De Vries, 2001; Ferguson & Bargh, 2004; Strack & Deutsch, 2004). These associative clusters endow the organism with a sense of *preparedness*, that is, the ability to evaluate and respond to the environment quickly in accordance with one's needs and previous learning experiences. When, for example, the person encounters the chocolate in a future situation again and he or she is not satiated, the "chocolate cluster" may get reactivated, which will automatically trigger a corresponding impulse, consisting of a positive hedonic value attributed to the chocolate and a corresponding behavioral schema to approach it (e.g., Seibt, Häfner, & Deutsch, 2007).² Furthermore, the associative processes described form gradually over time, need no attentional resources to function, and are independent of whether a person consciously endorses or rejects the implication of an associative link (Gawronski & Bodenhausen, 2006; Strack & Deutsch, 2004).

The Reflective System

The reflective system, by contrast, serves regulatory goals that complement the functions of the impulsive system. It is responsible for higher order mental operations (Strack & Deutsch, 2004). These operations include executive functions such as making deliberate judgments and evaluations, putting together strategic action plans for goal pursuit, and inhibiting or overriding prepotent responses (e.g., impulses or habits). These operations are achieved through relatively slow, controlled processes based on symbolic representations and operations (Smith & DeCoster, 2000). The reflective system thus provides for a flexible, higher order degree of control over decisions and actions through which immediate stimulus control can be overcome.

However, the flexibility achieved by these higher order mental transformations comes at a cost: in accordance with most other dual-systems and dual-mode accounts, it is assumed that the operations of the reflective system are dependent on control resources (Evans, 2008; Fazio & Towels-Schwen, 1999; Vohs, 2006). Specifically, control resources may be crucial for the symbolic representation of both deliberate evaluations that bring about "reasoned action" (Fishbein & Ajzen, 1975) and standards to restrain behavior in accordance with one's self-control goals (e.g., Strack & Deutsch, 2004; see also Baumeister, Gailliot, De Wall, & Oaten, 2006), as well as for the self-monitoring and correction of ongoing behavior in accordance with these reflective representations. If control resources are low,

reflective operations may break down. For instance, if the capacity to mentally represent, shield, and update restraint standards is situationally or chronically reduced, individuals may lack the necessary standards for the self-monitoring of ongoing behavior (Carver & Scheier, 1981).

How does the reflective system influence overt behavior? The RIM assumes that the reflective system generates behavioral decisions that may then activate corresponding behavioral schemas in the motor cortex of the brain (Strack & Deutsch, 2004). For instance, if a discrepancy between restraint standards and the actual situation is detected, a behavioral decision to inhibit or to override the unwanted behavior may be formed, which then leads to the activation of corresponding behavioral schemas (Strack & Deutsch, 2004).

Behavior Determination

In the prototypical self-control dilemma, the behavioral implications of the two systems may be incompatible (Metcalf & Mischel, 1999; Strack & Deutsch, 2004). For example, a person who is being offered a chocolate chip cookie may experience a strong impulse toward the tempting object, but at the same time that person may be motivated to restrain his or her caloric input. Such a struggle between the two systems is often accompanied by a feeling of temptation and internal conflict.

However, the question remains: Which of the two forces will gain control over actual behavior in the end? The RIM can parsimoniously account for impulsive versus self-controlled behavior by assuming that both systems access a common final mechanism for overt behavior execution: the activation of behavioral schemas in the motor cortex (e.g., Strack & Deutsch, 2004). At any time, several different behavioral schemas may become activated as potential candidates for action. The system finally settles on a particular course of action based on a competitive winner-takes-all process (see also Norman & Shallice, 1986). Which behavioral schema wins out over the other in the case of a self-control conflict will depend on the relative strength of activation for competing schemas triggered by the impulsive and the reflective system, respectively. Most important, as the two systems follow differential operating characteristics, certain situational and dispositional boundary conditions or moderators may shift the degree of activation potential in favor of one system, thus rendering it more dominant than the other. For instance, factors that restrict the availability of control resources should selectively impair the reflective system by undermining its ability to symbolically represent restraint standards and to monitor ongoing behavior in accordance with those standards. As a consequence, the reflective system may not succeed in activating behavioral schemas of an inhibiting (e.g., "do not grab the cookie") or overriding tendency (e.g., "take one of those celery sticks instead") so that their activation level exceeds the critical threshold necessary for the execution of self-controlled behavior. With an ineffective reflective system, however,

²Experimental evidence has shown that automatic object evaluations and corresponding behavioral schemas of approach or avoidance are indeed coactivated (e.g., Chen & Bargh, 1999; Neumann et al., 2004).

impulse-triggered behavioral schemas are more likely to exert an influence on overt behavior.

A SUGGESTED FRAMEWORK FOR THE PREDICTION OF SELF-CONTROL OUTCOMES

From this dual-systems analysis, it follows that behavioral self-control outcomes result from the interplay between different processes of behavior determination and key moderators related to the capacity for self-control. Therefore, the predictive validity of models of self-control may be enhanced if such models include both (a) reflective and (b) impulsive precursors of behavior and (c) specify situational and dispositional boundaries that may shift the weight toward one type of precursor (see Figure 1). Depending on the circumstances, people's behavior may thus be better predicted by reflective precursors (restraint standards or deliberate evaluations) or by impulsive precursors (automatic affective reactions toward the source of temptation or automatic tendencies toward approach or avoidance). It is the joint consideration of these three factors that may enable one to more precisely predict self-control outcomes than when each factor is studied in isolation.

Previous self-control research has focused primarily on situational boundary conditions of self-control failure. For instance, studies on ego depletion have shown that engaging in an initial self-control task disrupts people's ability to regulate their behavior in a subsequent task that requires self-control (e.g., Baumeister et al., 1998). In a related vein, manipulations of cognitive load (e.g., Boon, Stroebe, Shut, & Ijntema, 2002; Ward & Mann, 2000), emotional distress (Herman, Polivy, Lank, & Heatherton, 1987), alcohol (e.g., Bushman & Cooper, 1990; for a review, see Hull & Bond, 1986), and low self-monitoring (J.E.

Collins, 1978) have all been shown to negatively affect self-control in the treatment versus control groups.

A related line of research has investigated how the influence of restraint standards on behavior is moderated by situational manipulations. A well-known example is the "what the hell" effect (Herman & Mack, 1975), which describes the phenomenon of restrained eaters who tend to overeat after they have been given a high calorie preload. The influence of restraint on behavior has also been found to be moderated by self-regulatory resources. Several studies in the domains of eating (Vohs & Heatherton, 2000), drinking (Muraven, Collins, & Neinhuis, 2002), and sexual behavior (Gailliot & Baumeister, 2006) reported that restraint standards guided behavior in a tempting situation effectively under normal conditions, but not when participants were depleted of their self-regulatory resources. These findings clearly suggest that restraint must draw on available self-regulatory resources to be effective (for a discussion, see Baumeister et al., 2006).

In sum, previous research has yielded strong and convincing support for the influence of relevant boundary conditions and their interaction with restraint on self-control outcomes. However, these studies usually lacked a measure of impulsive precursors to behavior, and hence yielded no direct evidence for the impulsive system part of the model. Rather, a heightened influence of impulses on self-control outcomes under certain conditions has been typically inferred from either the observation of group differences in behavioral outcomes (e.g., drunk people behave more aggressively than sober people, so they must act more strongly on impulse) or from the breakdown of the behavior-regulating effect of restraint standards (also referred to as *disinhibition*). However, such data yield only indirect evidence for the above notion that different processes may have

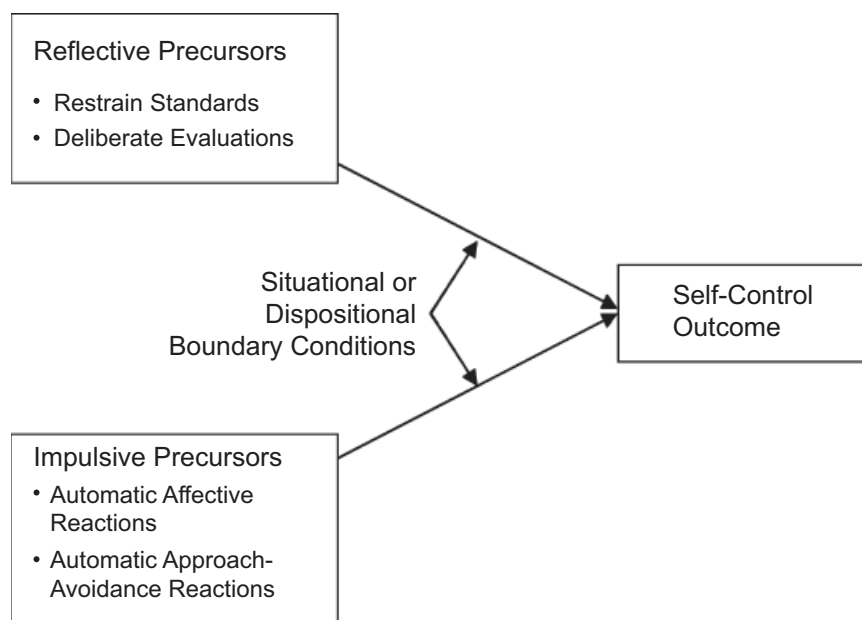


Fig. 1. A suggested framework for the prediction of self-control outcomes.

determined a given self-control outcome as a function of the circumstances. We therefore suggest that a more complete approach should specify and measure impulsive precursors of self-control outcomes.

What are the benefits of such an approach? First, just as individuals clearly differ in their standards of restraint, they are likely to also differ in their impulsive reactions toward tempting stimuli. These differences in impulse may be due to genetic endowment, differences in learning history, and differences in current need states (Seibt et al., 2007; Strack & Deutsch, 2004; Wiers, Dictus, Houben, Van den Wildenberg, & Rinck, 2008). Nothing tempts all the people all the time. Incorporating measures of impulse means that these individual differences in the strength of specific impulses are not treated as error variance but that they can be used for tracing the theoretical operating mechanisms at play. Take, for instance, a finding that individual differences in impulse strength predict candy consumption better in drunk individuals than they do in sober individuals. This constitutes more direct evidence for the theoretical assumption that impulses determine behavior under the influence of alcohol than does a mean difference in candy consumption between the sober and drunk groups.³ Second, using continuous measures that include both impulsive and reflective precursors may enable a more precise prediction of self-control outcomes at the level of the individual. Thus, from a practical point of view, such an approach may yield incremental validity over and above the degree of predictive validity typically achieved with the use of self-report measures. Third, directing attention toward the impulsive determinants of behavior may open up new avenues for the treatment of self-control problems. With this consideration, interventions may be targeted specifically at changing impulsive precursors of problematic behaviors (Wiers et al., 2006).

Measurement of Impulsive Precursors

How should we best go about assessing impulsive precursors? We argue that a good measure of impulse should fulfill at least four criteria. First, the measure should allow for sufficient specificity with regard to the temptation of interest. The correspondence principle (e.g., Ajzen & Fishbein, 1977) implies that one can predict behavior more accurately if the specificity of predictor and criterion match. Hence, if a study is about the prediction of Coca Cola consumption, then measuring a participant's impulses toward Coca Cola will be superior to measuring their impulses toward soft drinks in general. Second, as suggested by dual-systems models (e.g., Metcalfe & Mischel,

1999; Strack & Deutsch, 2004), researchers should design a good measure of impulse that taps into the associative structure underlying impulsive processing. As outlined above, such a measure should capture spontaneously activated hedonic or behavioral reactions upon encountering the stimulus. Third, impulses are assumed to be triggered automatically. Therefore, the measure should be set up in a way that minimizes the possible contaminating influence of conscious control. Fourth, a measure of impulse should be sensitive to both individual differences and state variations in impulse strength due to changes in bodily need states.

We argue that some of the procedures from the new class of implicit measurement tools may fulfill these requirements and therefore serve as good proxies for impulse strength. Recent years have seen a tremendous development of so-called implicit measures (De Houwer, 2006; Fazio & Olson, 2003; Petty, Fazio, & Briñol, 2008). Two prominent measures are the Implicit Association Test (Greenwald, McGhee, & Schwartz, 1998) and the Affect Misattribution Paradigm (Payne, Cheng, Govorun, & Stewart, 2005), both of which have been shown to be internally consistent (e.g., Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005; Payne et al., 2005). These measures can be employed to tap into automatic affective reactions with regard to a stimulus of interest (also referred to as “implicit” attitudes). As such, they may be particularly suited to tap into the hedonic component of an impulse (e.g., Marsh, Johnson, & Scott-Sheldon, 2001; Payne, McClernon, & Dobbins, 2007; Wiers, van Woerden, Smulders, & de Jong, 2002). Alternatively, measures using approach–avoidance reactions toward the temptation of interest may be used to tap into the behavioral component of an impulse (Hofmann, Friese, & Gschwendner, in press; Neumann, Hülsebeck, & Seibt, 2004; Seibt et al., 2007; Wiers, Dictus, et al., 2008). Furthermore, it is generally acknowledged that responses on implicit measures are comparatively difficult to control in a deliberate way (e.g., Asendorpf, Barse, & Mücke, 2002; Egloff & Schmukle, 2002; Steffens, 2004), even though—as is probably true for any measure—they are not completely free of unwanted sources of variance (e.g., Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005; Mierke & Klauer, 2003). Recently, measures of both automatic affective reactions and approach–avoidance tendencies have been shown to be sensitive to fluctuations in bodily need states such as deprivation (Seibt et al., 2007), suggesting that these measures are sensitive enough to capture meaningful state influences on impulse strength over and above a stable trait component (e.g., Schmukle & Egloff, 2004).

Measurement of Reflective Precursors

According to the dual-systems perspective of the RIM, the symbolic content in the reflective system forms the basis of conscious experiences that can be communicated to others (Strack & Deutsch, 2004). For this reason, explicit measures of

³In addition, mean differences between experimental groups need not necessarily emerge for all self-control outcomes under investigation because both impulsive and reflective precursors may sometimes determine behavior across a comparable behavioral range. Without an assessment of both impulsive and reflective precursors in such cases, the absence of a mean behavioral difference between experimental groups may lead to the false conclusion that the processes underlying behavior determination did not differ.

verbal self-reports are suitable for tapping into reflective precursors of self-control behavior such as restraint standards and deliberate evaluations. In sum, a dual-systems perspective on self-control implies that researchers should use different measurement strategies to tap into the respective processes of impulsive and reflective behavior determination.

EMPIRICAL EVIDENCE

In this section, we will briefly review research from our own labs and others in which the proposed framework has been applied to the prediction of self-control outcomes. In these studies, several situational and dispositional moderators have been used in a representative range of self-control domains such as eating, drinking, sexual interest behavior, and other social interactions. All of these moderators were expected to have the potential to shift the relative impact of reflective and impulsive precursors on behavior (see also Friese, Hofmann, & Schmitt, 2008; Hofmann, Friese, & Wiers, in press).

Situational Moderators

Self-Regulatory Resources

In a first test of these predictions (Hofmann, Rauch, & Gawronski, 2007), we drew on the work on ego depletion by Baumeister and colleagues (e.g., Baumeister et al., 1998; Vohs & Heatherton, 2000), who have established the importance of self-regulatory resources for self-control outcomes. We chose M&M's chocolate candy as a first temptation worthy to be put to the test. In accordance with the above measurement approach, we assessed both impulsive and reflective precursors of candy consumption in our participants. As impulsive precursors, automatic affective reactions toward M&M's candy were measured with a variant of the Implicit Association Test using pictures of M&M's and positive and negative attribute stimuli (for

more details, see Hofmann et al., 2007; Karpinski & Steinman, 2006). As reflective precursors, dietary restraint standards were assessed with a questionnaire (e.g., "I often stop eating when I am not really full as a conscious means of limiting the amount I eat"; Stunkard & Messick, 1985). After the assessment phase, half of the participants was depleted of self-regulatory resources with an emotion suppression task (e.g., Vohs & Heatherton, 2000), whereas the other half was not. Afterward, participants were given 5 min to test a 125-g package of M&M's candy and rate it on a large number of dimensions such as sweetness, composition, and product design. Actual candy consumption was later determined by calculating the difference between pre- and postconsumption weights (of the candy, not the person, of course). The results from a moderated regression analysis for the prediction of candy consumption are depicted in Figure 2. As expected, candy consumption was predicted primarily by automatic affective reactions in depleted participants but not in control participants. In contrast, candy consumption was effectively regulated in accordance with dietary restraint standards (higher restraint led to less candy intake) in participants who were not depleted of self-regulatory resources. Conversely, restraint standards were slightly positively associated with candy consumption in depleted participants, indicating a counterregulatory effect (e.g., Herman & Polivy, 2004). In sum, by taking individual differences in both impulse and restraint into account, we were able to trace the nature of the processes that determined overt behavior under varying conditions of self-regulatory resources. The obtained pattern of results strongly supports the hypothesis that under low self-regulatory resources, the relative weight of impulsive processes waxes and the relative influence of reflective processes wanes. The moderating role of ego depletion on the influence of impulsive and reflective precursors of consumption behavior was also found in two further studies on potato chip and beer consumption (Friese, Hofmann, & Wänke, 2008, Studies 2 and 3) and in a study on

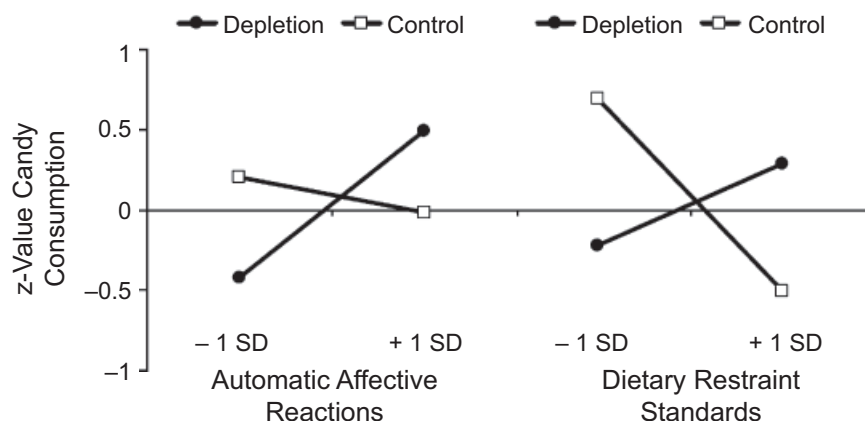


Fig. 2. Moderator effects of ego depletion on the influence of automatic affective reactions (left panel) and on the influence of dietary restraint standards (right panel) on candy consumption. Adapted from Hofmann, Rauch, & Gawronski (2007).

alcohol consumption by Ostafin, Marlatt, and Greenwald (2008), in which an implicit measure of approach–avoidance motivation was applied.

In one of these studies (Friese, Hofmann, & Wänke, 2008, Study 3), both deliberate evaluations of beer and personal standards to refrain from drinking (R.L. Collins & Lapp, 1992) were assessed as reflective precursors. Although both constructs are assumed to rely on reflective processing, they are conceptually and empirically distinct. For instance, it is possible to like beer but at the same time harbor a strong conviction that one should refrain from drinking an excess of it. The question therefore was whether the behavioral impact of deliberate evaluations and restraint standards would be independently moderated by self-regulatory resources. Results showed that ego depletion moderated the influence of all three predictors on behavior. First, automatic affective reactions again predicted beer consumption only for depleted participants. Second, deliberate evaluations predicted beer consumption better for participants in the nondepleted control condition. Third, drinking restraint standards were more effective at regulating beer intake in the nondepleted condition. Hence, deliberate evaluations and restraint standards were identified as two distinct reflective determinants of behavior. These results support the theoretical view that automatic affective reactions on the one hand and deliberate evaluations and restraint standards, on the other hand, “thrive” under different operating conditions (i.e., low vs. high self-regulatory resources, respectively).

Cognitive Capacity

The approach was also applied to cognitive capacity as a situational moderator (Friese, Hofmann, & Wänke, 2008, Study 1). Drawing on research in the cognitive load tradition (Gilbert & Hixon, 1991), we manipulated the amount of cognitive load participants experienced while engaging in a consumer choice task. In an initial mass testing session, participants deliberately evaluated chocolate and fruit on explicit questionnaire measures. In the experimental session that followed, participants completed a chocolate versus fruit Implicit Association Test (IAT) designed to assess their relative preferences on the level of automatic affective reactions. As a reward for their participation, participants were then allowed to choose five items from a selection containing a variety of chocolate bars and fruits. While making their choice, half of the participants had to keep an eight-digit number in mind (low capacity group). The other half of the participants, however, was instructed to keep only a one-digit number in mind (high capacity group). As expected, choice behavior was predicted well by deliberate evaluations (but not automatic affective reactions) for participants who had to remember only a one-digit number. That is, the more participants explicitly preferred chocolate over fruit, the more chocolate bars they picked. However, choice behavior was predicted well by automatic affective reactions (but not deliberate evaluations) for participants in the eight-digit condition. These findings suggest

that cognitive load moderated the relative influence of impulsive and reflective processes on choice behavior. Similar findings emerged in a study in which cognitive capacity was not manipulated by means of concurrent memory load, but by inducing time pressure for the choice between different consumer products (Friese, Wänke, & Plessner, 2006).

Alcohol Consumption

If forced to choose, most people would certainly agree with Tom Waits’ dictum “I’d rather have a bottle in front of me than a frontal lobotomy.” Psychologically speaking, however, both ensuing states may share some commonalities. As everyday experience contests, alcohol saps executive functioning, such as the ability to regulate attention and to inhibit or override prepotent responses (e.g., Easdon & Vogel-Sprott, 2000). These findings are congruent with the basic tenet of alcohol myopia theory (Steele & Josephs, 1990), which states that alcohol narrows the perceptual focus to only the most salient and proximal environmental cues. As a consequence, more abstract concepts such as long-term goals and standards drift out of focus. This analysis leads to the prediction that alcohol may act as another important moderator of the influence of impulsive versus reflective processes on self-control outcomes.

This prediction was tested in a study on eating behavior (Hofmann & Friese, 2008) that closely followed the paradigm in Hofmann et al. (2007). At the beginning of the study, female participants completed a number of screening questionnaires including a measure of dietary restraint standards (Pudel & Westenhöfer, 1989; Stunkard & Messick, 1985). Subsequently, automatic affective reactions toward candy were assessed with a variant of the IAT (Karpinski & Steinman, 2006). Participants then engaged in two different product tests. In the first product test, they consumed either a drink consisting of orange juice with vodka (alcohol condition) or a glass of orange juice (control condition). An intermediate filler task gave the alcohol time to enact its effects. As expected, dietary restraint standards effectively regulated candy consumption in a subsequent task for sober participants, but they were ineffective for intoxicated participants. In contrast, automatic affective reactions predicted candy consumption for intoxicated participants but not for sober participants. These results clearly indicate stronger impulsive influences on behavior under alcohol intoxication.

Terror Management

Terror management theory posits that human beings experience thoughts about their own death as aversive (e.g., Greenberg, Pyszczynski, Solomon, Simon, & Breus, 1994). As part of a cognitive coping process, individuals frequently suppress death-related thoughts or redirect their attention to other topics (Greenberg et al., 1994). Such activities are mentally exhausting (Gailliot, Schmeichel, & Baumeister, 2006), suggesting that impulsive processes should have an increased impact on subsequent behavior. This hypothesis was confirmed in a study in

which automatic affective reactions predicted the total consumption of chocolate in a product test for participants who had recently thought about their own death, but not for participants who had thought about a control topic (Frieze & Hofmann, 2008b, Study 2).

Dispositional Moderators

Working Memory Capacity

Individuals are not only affected by situational circumstances, they also differ dispositionally in central executive functioning components relevant for impulse control (Tangney et al., 2004). A construct that may be particularly central for the study of self-control is working memory capacity (Baddeley, 2007; Baddeley & Hitch, 1974; Barrett, Tugade, & Engle, 2004). Individuals high in working memory capacity are assumed to be more successful in enacting goal-directed processing and in shielding their goals from interference, such as the kind that stems from impulsive processing (Barrett et al., 2004). Therefore, reflective precursors of behavior should predict behavior better for individuals with high working memory capacity. The opposite should hold for impulsive precursors (i.e., they should predict behavior better for those with low working memory capacity).

One representative study (Hofmann, Gschwendner, Frieze, Wiers, & Schmitt, 2008, Study 1) was concerned with self-control conflicts in the domain of sexual temptation. Clearly, a proximal indicator of sexual behavior is difficult to obtain in a laboratory setting (but see Gailliot & Baumeister, 2006, for a solution that builds on retrospective self-reports of sexual interaction in a private laboratory room). We therefore focused on sexual interest behavior as a distal indicator. Male heterosexuals were brought into a tempting situation by letting them watch on the computer a series of erotic slides of sexually attractive women collected from the resourceful Internet. As comparison stimuli, an equal number of intermixed art pictures were shown. It is important to note that participants could watch each slide for as long as they wanted before having to answer a couple of questions about each erotic (e.g., “How much would you like to talk to this woman?”) or art picture (e.g., “How much would you like to hang this painting up in your living room?”). We recorded participants’ viewing time of erotic pictures relative to art pictures as a dependent variable. As an impulsive precursor, we assessed automatic affective reactions toward different erotic pictures of women with a variant of the IAT (Karpinski & Steinman, 2006). As a reflective precursor, participants’ deliberate evaluations of erotic material were collected via self-report. Participants also completed a measure of working memory capacity (Oberauer, Süß, Schulze, Wilhelm, & Wittmann, 2000). Results indicated that deliberate evaluations predicted viewing time well for high working memory capacity individuals. The opposite pattern emerged with regard to the impulsive precursor: more positive affective reactions on the IAT were related to

longer relative viewing times of erotic material for only low working memory capacity individuals.

Comparable results were obtained when this approach was applied to predict alcohol use in heavy drinkers (Thush et al., 2008), eating behavior (Hofmann, Gschwendner, et al., 2008, Study 2), and anger expression in a provoking situation (Hofmann, Gschwendner, et al., 2008, Study 3). One notable modification of the latter study was that impulsive precursors were assessed with a variant of the IAT designed to capture the association between the *self* and the concept of *angriness* (rather than an object evaluation as in the previous studies). This measure predicted the degree of negative feedback returned to a provoking interaction partner in participants with low working memory capacity. Finally, a recent study (Grenard et al., 2008) showed analogous moderator effects for the prediction of drug use among high school students from an implicit measure of spontaneous memory associations (Stacy, 1997). Taken together, these various findings suggest that the hypothesized moderator effect of working memory capacity appears to be quite robust and generalizable across self-regulatory domains, samples, and measures of impulsive precursors.

Trait Self-Control

We have used the present approach to investigate the potential moderator role of trait self-control (Tangney et al., 2004). Trait self-control is positively related to a host of desirable variables such as academic achievement, psychological adjustment, and self-esteem. It is negatively related to undesirable variables such as eating disorders, substance abuse, and other psychological disorders of impulse control (Tangney et al., 2004). Three studies investigated the moderating role of trait self-control on the influence of impulsive precursors on behavior (Frieze & Hofmann, 2008a). In one study, we used a variant of the IAT (Karpinski & Steinman, 2006) to predict actual potato chip consumption in a product test. In two further studies in the domain of drinking, we measured automatic affective reactions again with a variant of the IAT (Karpinski & Steinman, 2006) or an affect misattribution procedure (Payne et al., 2005) and predicted self-reported alcohol consumption. In all three studies, we found that automatic affective reactions were significantly related to self-regulatory behavior for individuals with low trait self-control.

CONCLUSIONS

Humans often face a conflict between impulse and self-control, and the outcome of such a conflict hinges on situational or dispositional circumstances. Building on a dual-systems perspective (e.g., Metcalfe & Mischel, 1999; Strack & Deutsch, 2004), we have suggested a framework for the prediction of self-control outcomes. This framework may improve our understanding of self-control by integrating three important elements into one model: (a) reflective precursors such as restraint standards or deliberate evaluations, (b) impulsive precursors such as

automatic affective or behavioral reactions, and (c) situational and dispositional moderator variables of self-control success. By specifying and assessing both reflective and impulsive precursors as predictors—rather than treating individual differences in these constructs as error variance—the present framework offers a flexible measurement approach for tracing the nature of the processes that influence a given self-control outcome of interest. The studies reviewed above illustrate the utility of such an approach. Taken together, the pattern of results shows that the behavioral impact of impulsive precursors increases under conditions of ego depletion, cognitive load, time pressure, alcohol intoxication, mortality salience, low working memory capacity, or low trait self-control. In a complementary manner, the impact of reflective precursors is hampered under such circumstances.

From a theoretical stance, this reemerging pattern of findings offers strong support for a dual-systems perspective of impulse and self-control. Such a conception views these two clashing forces in self-control situations as being produced by fundamentally different psychological systems rather than being subjected to the very same operational principles of, for instance, reasoned behavior. From a measurement perspective, it becomes clear that a joint consideration of the three factors in our model enables a more precise prediction of self-control outcomes than when each of these factors is studied in isolation. This becomes particularly obvious when the present approach is contrasted with an approach that focuses exclusively on situational boundary variables: Whereas the latter approach is limited to the discovery of between-groups differences in self-control outcomes, the proposed integration of individual differences in impulsive and reflective precursors as continuous variables provides markers of underlying processes, enhances predictive validity of individual self-control outcomes, and allows for a test of interactions (i.e., moderation) among variables.

Taking a more general view at human behavior, the present research program hints at the tug-of-war between impulse and self-control. Specifically, these two forces complement each other such that one of the two systems appears to gain access to behavior whenever the other system is weakened by circumstances or other factors. However, it is important to note that the picture does not appear to be as symmetrical as the tug-of-war metaphor might suggest. That is, under default circumstances, individuals appeared to be quite effective at regulating their behavior in accordance with self-regulatory goals or consciously held values and beliefs. This attests to the remarkable capacity of humans to control themselves. Willpower failed to guide behavior and keep impulses in check only when risk factors such as ego depletion, cognitive load, or alcohol were introduced or when individuals lacked self-regulatory abilities.

Do these risk factors share a common denominator? At first glance, there are obvious differences between the moderators under investigation. For example, after a depletion of self-regulatory resources by a strenuous task, the organism is clearly in a

different state than it is after a supply of alcohol. Yet, in terms of the relative weight of reflective and impulsive precursors on behavior, results were comparable for these diverse manipulations. This raises the question of whether there may be a common element among these moderators that is responsible for producing functionally equivalent results. It is possible that the connecting element lies in the impairment of working memory functioning: self-regulatory resources, cognitive load, and alcohol consumption all dovetail insofar as they have been shown to disrupt working memory functions (Baddeley, 1996; Fillmore, Vogel-Sprott, & Gavrilescu, 1999; Giancola, 2000; Govorun & Payne, 2006; Hull & Slone, 2004; Schmeichel, Vohs, & Baumeister, 2003). Without support from working memory functions, reflective operations break down, whereas impulsive processes are left unaffected (Barrett et al., 2004; Strack & Deutsch, 2004). Consequently, reflective processes lose weight and impulsive processes gain weight in determining the outcome of a self-control conflict.

AVENUES FOR FUTURE RESEARCH

There are a number of straightforward avenues for future research into the dynamics of impulse and self-control. First, the present framework can be extended to other domains, such as aggression, addiction, or impulse buying, and to other potential moderators, such as intuitive thinking style (Epstein, Pacini, Denes-Raj, & Heier, 1996), mindfulness (Brown & Ryan, 2003; Langer, 1989), or regulatory focus (Higgins, 1998).

Second, if it is correct that a temporary or chronic impairment of working memory caused the reported results, future research should attempt to discern its processes into more specific components (e.g., Miyake, Friedman, Emerson, Witzki, & Howerter, 2000) and should elucidate their specific contribution for the modulation of impulsive and/or reflective influences on self-control outcomes (see Hofmann, Friese, & Roefs, in press, for initial findings along these lines).

A third exciting avenue is research that relates the present work to the literature on automatic goal pursuit (e.g., Bargh, Gollwitzer, Lee-Chai, Barndollar, & Troetschel, 2001), implicit self-control (Fishbach et al., 2003), or implicit working memory (Hassin, 2005). These diverse areas of research indicate the existence of nonconscious, automatized forms of self-control. They raise the question of how such automatic modes of self-control may interact with or complement the more intentional and effortful notion of self-control that has been the focus of traditional research as well as the present article.

Fourth, as alluded to above, the present approach has only been applied to factors reducing the effectiveness of the reflective system. To balance this asymmetry, factors strengthening the resilience of the reflective system should receive more attention. For instance, to what extent does reflective processing dominate if self-regulatory strength is increased in the short run (Masciampo & Baumeister, 2008) or in the long run (Oaten &

Cheng, 2006)? What is the role of control motivation in recruiting or maintaining reflective processing (Muraven & Slessareva, 2003)? And how may mental strategies of self-control, such as cognitively transforming the temptation (Mischel & Baker, 1975) or forming implementation intentions (Gollwitzer & Brandstätter, 1997), aid self-control by interfering with impulsive processing (Achtziger & Gollwitzer, 2008; Hofmann, Deutsch, Banaji, & Lancaster, 2008)?

Finally, the present framework may be extended to more systematically investigate long-term and short-term determinants of impulse and self-control. At present, too little is known about impulse strength as a dependent variable of interest. We need a better understanding of the organismic, social, and developmental factors that shape the power of temptation experienced by an individual in a given situation of interest. With such knowledge, new ways to change and treat impulse-related disorders may be discovered and successfully applied. Given that impulsive processes appear to be crucial predictors of self-regulatory behavior in many everyday circumstances, attempts to directly change impulse strength may be a worthwhile endeavor. Such attempts may focus on changing automatic affective reactions elicited by a tempting stimulus or automatic approach-avoidance reactions triggered by that stimulus (or both). For instance, researchers have begun using evaluative-conditioning procedures to change automatic affective reactions toward tempting stimuli (e.g., Dwyer, Jarratt, & Dick, 2007; Lascelles, Field, & Davey, 2003). Wiers and colleagues (Wiers, Rinck, Kordts, Houben, & Strack, 2008) targeted automatic approach-avoidance reactions and found promising initial results for an intervention designed to reduce the degree of approach motivation triggered by impulsive processing (see Kawakami, Phillips, Steele, & Dovidio, 2007, for related findings in the domain of prejudice reduction). Specifically, Wiers, Rinck, et al. (2008) have developed a retraining version of an approach-avoidance task in which half of participants (heavy drinkers) were trained to avoid alcohol-related pictures by pushing a joystick away from themselves and the other half were trained to pull the alcohol pictures toward themselves. Results showed less actual beer consumption in a test-and-rate task among the heavy drinkers trained to avoid alcohol as compared with those who were trained to approach it.

We believe, however, that such impulse-oriented treatments should best be viewed as complements to traditional treatments intended to improve self-control. From the standpoint of the present framework, self-control interventions may be most effective if they simultaneously (a) change people's reasoned attitudes, beliefs, and control standards (e.g., through common interventions of cognitive restructuring, education, or persuasion), (b) create situational and dispositional circumstances that are conducive for effective self-control (e.g., by increasing self-monitoring, self-efficiency, coping skills, control capacity, and control motivation), and, in addition, (c) change problematic impulsive precursors of behavior.

CONCLUDING REMARKS

In contemporary science, philosophers, economists, and political theorists alike show strong interest in the phenomenon of self-control (e.g., Davidson, 1980; Schelling, 1984; Thaler, 1991). Yet it is psychology's privileged task to illuminate the processes that lie at the heart of everyday self-control conflicts. Such psychological knowledge may enrich other disciplines and, in turn, benefit from their theoretical and practical achievements. We believe that the joint consideration of two behavioral forces, impulse and self-control, and their boundaries offers a useful framework for such purposes, and it is our hope that such a conception, where needed, leads to new insights and applications that help people fail . . . to act against their better judgment.

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REFERENCES

- Aarts, H., Dijksterhuis, A., & DeVries, P. (2001). On the psychology of drinking: Being thirsty and perceptually ready. *British Journal of Psychology*, *92*, 631.
- Achtziger, A., & Gollwitzer, P.M. (2008). Implementation intentions and shielding goal striving from unwanted thoughts and feelings. *Personality and Social Psychology Bulletin*, *34*, 381–393.
- Ainslie, G. (1975). Specious reward: A behavioral theory of impulsiveness and impulse control. *Psychological Bulletin*, *82*, 463.
- Ajzen, I.T., & Fishbein, M. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychological Bulletin*, *84*, 888–918.
- Asendorpf, J.B., Banse, R., & Mücke, D. (2002). Double dissociation between implicit and explicit personality self-concept: The case of shy behavior. *Journal of Personality and Social Psychology*, *83*, 380–393.
- Baddeley, A.D. (1996). Exploring the central executive. *Quarterly Journal of Experimental Psychology*, *49*, 5–28.
- Baddeley, A.D. (2007). *Working memory, thought, and action*. Oxford, United Kingdom: Oxford University Press.
- Baddeley, A.D., & Hitch, G.J. (1974). Working memory. In G.A. Bower (Ed.), *The psychology of learning and motivation* (Vol. 8, pp. 47–90). New York: Academic Press.
- Bargh, J.A., Gollwitzer, P.M., Lee-Chai, A., Barndollar, K., & Trötschel, R. (2001). The automated will: Nonconscious activation and pursuit of behavioral goals. *Journal of Personality and Social Psychology*, *81*, 1014.
- Barrett, L.F., Tugade, M.M., & Engle, R.W. (2004). Individual differences in working memory capacity and dual-process theories of the mind. *Psychological Bulletin*, *130*, 553–573.
- Baumeister, R.F., Bratslavsky, M., Muraven, M., & Tice, D.M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology*, *74*, 1252–1265.
- Baumeister, R.F., Gailliot, M.T., De Wall, C.N., & Oaten, M. (2006). Self-regulation and personality: How interventions increase

- regulatory success, and how depletion moderates the effects of traits on behavior. *Journal of Personality*, 74, 1773–1801.
- Baumeister, R.F., & Heatherton, T.F. (1996). Self-regulation failure: An overview. *Psychological Inquiry*, 7, 1–15.
- Baumeister, R.F., Heatherton, T.F., & Tice, D.M. (1994). *Losing control: How and why people fail at self-regulation*. San Diego, CA: Academic Press.
- Baumeister, R.F., & Vohs, K.D. (Eds.). (2004). *Handbook of self-regulation: Research, theory, and applications*. New York: Guilford.
- Bechara, A., Noel, X., & Crone, E.A. (2006). Loss of willpower: Abnormal neural mechanisms of impulse control and decision making in addiction. In R.W. Wiers & A.W. Stacy (Eds.), *Handbook of implicit cognition and addiction* (pp. 215–232). Thousand Oaks, CA: Sage.
- Block, J.H., & Block, J. (1980). The role of ego-control and ego-resiliency in the organization of behavior. In W.A. Collins (Ed.), *Development of cognition, affect, and social relations* (Vol. 13, pp. 39–101). Hillsdale, NJ: Erlbaum.
- Bogg, T., & Roberts, B.W. (2004). Conscientiousness and health-related behaviors: A meta-analysis of the leading behavioral contributors to mortality. *Psychological Bulletin*, 130, 887–919.
- Boon, B., Stroebe, W., Shut, H., & Ijntema, R. (2002). Ironic processes in the eating behavior of restrained eaters. *British Journal of Health Psychology*, 7, 1–10.
- Brown, K.W., & Ryan, R.M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, 84, 822–848.
- Bushman, B.J., & Cooper, H.M. (1990). Effects of alcohol on human aggression: An integrative research review. *Psychological Bulletin*, 107, 341–354.
- Carver, C.S. (2005). Impulse and constraint: Perspectives from personality psychology, convergence with theory in other areas, and potential for integration. *Personality and Social Psychology Review*, 9, 312–333.
- Carver, C.S., & Scheier, M.F. (1981). *Attention and self-regulation: A control-theory approach to human behavior*. New York: Springer-Verlag.
- Chen, M., & Bargh, J. (1999). Consequences of automatic evaluation: Immediate behavioral predispositions to approach or avoid the stimulus. *Personality and Social Psychology Bulletin*, 25, 215–224.
- Collins, J.E. (1978). Effects of restraint, monitoring, and stimulus salience on eating behavior. *Addictive Behaviors*, 3, 197–204.
- Collins, R.L., & Lapp, W.M. (1992). The temptation and restraint inventory for measuring drinking restraint. *British Journal of Addiction*, 87, 625–633.
- Conrey, F.R., Sherman, J.W., Gawronski, B., Hugenberg, K., & Groom, C.J. (2005). Separating multiple processes in implicit social cognition: The quad model of implicit task performance. *Journal of Personality and Social Psychology*, 89, 469.
- Davidson, D. (1980). How is weakness of will possible? In J. Feinberg (Ed.), *Moral concepts* (pp. 43–72). Oxford, United Kingdom: Oxford University Press.
- De Houwer, J. (2006). What are implicit measures and why are we using them? In R.W. Wiers & A.W. Stacy (Eds.), *The handbook of implicit cognition and addiction* (pp. 11–28). Thousand Oaks, CA: Sage.
- Dwyer, D.M., Jarratt, F., & Dick, K. (2007). Evaluative conditioning with foods as CSs and body shapes as USs: No evidence for sex differences, extinction, or overshadowing. *Cognition & Emotion*, 21, 281–299.
- Easdon, C.M., & Vogel-Sprott, M. (2000). Alcohol and behavioral control: Impaired response inhibition and flexibility in social drinkers. *Experimental and Clinical Psychopharmacology*, 8, 387–394.
- Egloff, B., & Schmukle, S.C. (2002). Predictive validity of an Implicit Association Test for assessing anxiety. *Journal of Personality and Social Psychology*, 83, 1441–1455.
- Eisenberg, N., Spinrad, T.L., Fabes, R.A., Reiser, M., Cumberland, A., Shepard, S.A., et al. (2004). The relations of effortful control and impulsivity to children’s resiliency and adjustment. *Child Development*, 75, 25–46.
- Epstein, S. (1990). Cognitive-experiential self-theory. In L.A. Pervin (Ed.), *Handbook of personality: Theory and research* (pp. 165–192). New York: Guilford.
- Epstein, S., Pacini, R., Denes-Raj, V., & Heier, H. (1996). Individual differences in intuitive-experiential and analytical-rational thinking styles. *Journal of Personality and Social Psychology*, 71, 390–405.
- Evans, J.S.B.T. (2008). Dual-processing accounts of reasoning, judgment, and social cognition. *Annual Review of Psychology*, 59, 255–278.
- Fazio, R.H., & Olson, M.A. (2003). Implicit measures in social cognition research: Their meaning and uses. *Annual Review of Psychology*, 54, 297–327.
- Fazio, R.H., & Towels-Schwen, T. (1999). The MODE Model of attitude-behavior processes. In S. Chaiken & Y. Trope (Eds.), *Dual-process theories in social psychology* (pp. 97–116). New York: Guilford.
- Ferguson, M.J., & Bargh, J.A. (2004). Liking is for doing: The effects of goal pursuit on automatic evaluation. *Journal of Personality and Social Psychology*, 87, 557–572.
- Fillmore, M.T., Vogel-Sprott, M., & Gavrilesco, D. (1999). Alcohol effects on intentional behavior: Dissociating controlled and automatic influences. *Experimental and Clinical Psychopharmacology*, 7, 372–378.
- Fishbach, A., Friedman, R.S., & Kruglanski, A.W. (2003). Leading us not unto temptation: Momentary allurements elicit overriding goal activation. *Journal of Personality and Social Psychology*, 84, 296–309.
- Fishbein, M., & Ajzen, I. (Eds.). (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.
- Freud, S. (1930). *Civilization and its discontents*. London: Hogarth.
- Freud, S. (1949). *New introductory lectures on psychoanalysis*. London: Hogarth. (Original work published 1933)
- Friese, M., & Hofmann, W. (2008a). *Control me or I will control you: Impulse, trait self-control, and the guidance of behavior*. Manuscript submitted for publication.
- Friese, M., & Hofmann, W. (2008b). What would you have as a last supper? Thoughts about death influence evaluation and consumption of food products. *Journal of Experimental Social Psychology*, 44, 1388–1394.
- Friese, M., Hofmann, W., & Schmitt, M. (2008). When and why do implicit reaction time measures predict behavior? Empirical evidence for the moderating role of motivation, opportunity, and process reliance. *European Review of Social Psychology*, 19, 285–338.
- Friese, M., Hofmann, W., & Wänke, M. (2008). When impulses take over: Moderated predictive validity of implicit and explicit attitude measures in predicting food choice and consumption behaviour. *British Journal of Social Psychology*, 47, 397–419.

- Friese, M., Wänke, M., & Plessner, H. (2006). Implicit consumer preferences and their influence on product choice. *Psychology and Marketing*, 23, 727–740.
- Gailliot, M.T., & Baumeister, R.F. (2006). Self-regulation and sexual restraint: Dispositionally and temporarily poor self-regulatory abilities contribute to failures at restraining sexual behavior. *Personality and Social Psychology Bulletin*, 33, 173–186.
- Gailliot, M.T., Baumeister, R.F., DeWall, C.N., Maner, J.K., Plant, E.A., & Tice, D.M. (2007). Self-control relies on glucose as a limited energy source: Willpower is more than a metaphor. *Journal of Personality and Social Psychology*, 92, 325–336.
- Gailliot, M.T., Schmeichel, B.J., & Baumeister, R.F. (2006). Self-regulatory processes defend against the threat of death: Effects of self-control depletion and trait self-control on thoughts and fears of dying. *Journal of Personality and Social Psychology*, 91, 49–62.
- Gawronski, B., & Bodenhausen, G.V. (2006). Associative and propositional processes in evaluation: An integrative review of implicit and explicit attitude change. *Psychological Bulletin*, 132, 692.
- Geyer, A.L., & Baumeister, R.F. (2005). Religion, morality, and self-control: Values, virtues, and vices. In R.F. Paloutzian & C.L. Park (Eds.), *Handbook of the psychology of religion and spirituality* (pp. 412–432). New York: Guilford.
- Giancola, P.R. (2000). Executive functioning: A conceptual framework for alcohol-related aggression. *Experimental and Clinical Psychopharmacology*, 8, 576–597.
- Gilbert, D.T., & Hixon, J.G. (1991). The trouble of thinking: Activation and application of stereotypic beliefs. *Journal of Personality and Social Psychology*, 60, 509–517.
- Gollwitzer, P.M., & Brandstätter, V. (1997). Implementation intentions and effective goal pursuit. *Journal of Personality and Social Psychology*, 73, 186.
- Govorun, O., & Payne, B.K. (2006). Ego depletion and prejudice: Separating automatic and controlled components. *Social Cognition*, 24, 111–136.
- Greenberg, J., Pyszczynski, T., Solomon, S., Simon, L., & Breus, M. (1994). Role of consciousness and accessibility of death-related thoughts in mortality salience effects. *Journal of Personality and Social Psychology*, 67, 627–637.
- Greenwald, A.G., McGhee, D.E., & Schwartz, J.L.K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology*, 74, 1464–1480.
- Grenard, J.L., Ames, S.L., Wiers, R.W., Thush, C., Sussman, S., & Stacy, A.W. (2008). Working memory moderates the predictive effects of drug-related associations on substance use. *Psychology of Addictive Behaviors*, 22, 426–432.
- Gross, J.J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology*, 2, 271–299.
- Hassin, R.R. (2005). Nonconscious control and implicit working memory. In R.R. Hassin, J.S. Uleman, & J.A. Bargh (Eds.), *The new unconscious* (pp. 196–222). Oxford, United Kingdom: Oxford University Press.
- Herman, C.P., & Mack, D. (1975). Restrained and unrestrained eating. *Journal of Personality*, 43, 647–660.
- Herman, C.P., & Polivy, J. (2004). The self-regulation of eating. In R.F. Baumeister & K.D. Vohs (Eds.), *The handbook of self-regulation: Research, theory, and applications* (pp. 492–508). New York: Guilford.
- Herman, C.P., Polivy, J., Lank, C., & Heatherton, T.F. (1987). Anxiety, hunger, and eating behavior. *Journal of Abnormal Psychology*, 96, 264–269.
- Higgins, E.T. (1998). Promotion and prevention: Regulatory focus as a motivational principle. In M.P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 30, pp. 1–46). New York: Academic Press.
- Hoch, S.J., & Loewenstein, G.F. (1991). Time-inconsistent preferences and consumer self-control. *Journal of Consumer Research*, 17, 492.
- Hofmann, W., Deutsch, R., Banaji, M.R., & Lancaster, K. (2008). *Cooling down the heat of temptation: Mental self-control and the automatic evaluation of tempting stimuli*. Manuscript submitted for publication.
- Hofmann, W., & Friese, M. (2008). Impulses got the better of me: Alcohol moderates the influence of implicit attitudes toward food cues on eating behavior. *Journal of Abnormal Psychology*, 117, 420–427.
- Hofmann, W., Friese, M., & Gschwendner, T. (in press). Men on the “pull”: Automatic approach-avoidance tendencies and sexual interest behavior. *Social Psychology*.
- Hofmann, W., Friese, M., & Roefs, A. (in press). Three ways to resist temptation: The independent contributions of executive attention, inhibitory control, and affect regulation to the impulse control of eating behavior. *Journal of Experimental Social Psychology*.
- Hofmann, W., Friese, M., & Wiers, R.W. (in press). Impulsive versus reflective influences on health behavior: A theoretical framework and empirical review. *Health Psychology Review*.
- Hofmann, W., Gawronski, B., Gschwendner, T., Le, H., & Schmitt, M. (2005). A meta-analysis on the correlation between the Implicit Association Test and explicit self-report measures. *Personality and Social Psychology Bulletin*, 31, 1369–1385.
- Hofmann, W., Gschwendner, T., Friese, M., Wiers, R.W., & Schmitt, M. (2008). Working memory capacity and self-regulation: Toward an individual differences perspective on behavior determination by automatic versus controlled processes. *Journal of Personality and Social Psychology*, 95, 962–977.
- Hofmann, W., Rauch, W., & Gawronski, B. (2007). And deplete us not into temptation: Automatic attitudes, dietary restraint, and self-regulatory resources as determinants of eating behavior. *Journal of Experimental Social Psychology*, 43, 497–504.
- Hull, J.G., & Bond, C.F. (1986). Social and behavioral consequences of alcohol consumption and expectancy: A meta-analysis. *Psychological Bulletin*, 99, 347–360.
- Hull, J.G., & Slone, L.B. (2004). Alcohol and self-regulation. In R.F. Baumeister & K.D. Vohs (Eds.), *The handbook of self-regulation: Research, theory, and applications* (pp. 466–491). New York: Guilford.
- Irvine, W.B. (2006). *On desire. Why we want what we want*. New York: Oxford University Press.
- James, W. (1950). *The principles of psychology* (Vol. 1). New York: Dover. (Original work published 1890)
- Karpinski, A., & Steinman, R.B. (2006). The single category implicit association test as a measure of implicit social cognition. *Journal of Personality and Social Psychology*, 91, 16–32.
- Kawakami, K., Phills, C.E., Steele, J.R., & Dovidio, J.F. (2007). (Close) distance makes the heart grow fonder: The impact of approach orientations on attitudes toward Blacks. *Journal of Personality and Social Psychology*, 92, 957–971.
- Kuhl, J., & Beckmann, J. (1985). *Action control from cognition to behavior*. New York: Springer.
- Langer, E. (1989). *Mindfulness*. Reading, MA: Addison Wesley.
- Lascelles, K.R.R., Field, A.P., & Davey, G.C.L. (2003). Using foods as CSs and body shapes as UCSs: A putative role for associative learning in the development of eating disorders. *Behavior Therapy*, 34, 213–235.

- Lieberman, M.D. (2007). The X- and C-systems: The neural basis of reflexive and reflective social cognition. In E. Harmon-Jones & P. Winkelman (Eds.), *Fundamentals of social neuroscience* (pp. 290–315). New York: Guilford.
- Loewenstein, G. (1996). Out of control: Visceral influences on behavior. *Organizational Behavior and Human Decision Processes*, *65*, 272.
- Loewenstein, G., & Elster, J. (1992). *Choice over time*. New York: Russell Sage Foundation.
- Marlatt, G.A., & George, W.H. (1985). Relapse prevention: Introduction and overview of the model. *British Journal of Addiction*, *79*, 261–273.
- Marsh, K.L., Johnson, B.T., & Scott-Sheldon, L.A. (2001). Heart versus reason in condom use: implicit versus explicit attitudinal predictors of sexual behavior. *Zeitschrift fuer Experimentelle Psychologie*, *48*, 161–175.
- Masciampo, E.J., & Baumeister, R.F. (2008). Toward a physiology of dual-process reasoning and judgment: Lemonade, willpower, and expensive rule-based analysis. *Psychological Science*, *19*, 255–260.
- McCabe, L.A., Cunningham, M., & Brooks-Gunn, J. (2004). The development of self-regulation in young children: Individual characteristics and environmental contexts. In R.F. Baumeister & K.D. Vohs (Eds.), *The handbook of self-regulation: Research, theory, and applications* (pp. 340–356). New York: Guilford.
- Metcalfe, J., & Mischel, W. (1999). A hot/cool system analysis of delay of gratification: Dynamics of willpower. *Psychological Review*, *106*, 3–19.
- Mierke, J., & Klauer, K.C. (2003). Method-specific variance in the Implicit Association Test. *Journal of Personality and Social Psychology*, *85*, 1180–1192.
- Mischel, W. (1974). Processes in delay of gratification. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 7, pp. 249–292). San Diego, CA: Academic Press.
- Mischel, W., & Baker, N. (1975). Cognitive appraisals and transformations in delay behavior. *Journal of Personality and Social Psychology*, *31*, 254–261.
- Mischel, W., Shoda, Y., & Peake, P.K. (1988). The nature of adolescent competencies predicted by preschool delay of gratification. *Journal of Personality and Social Psychology*, *54*, 687–696.
- Miyake, A., Friedman, N.P., Emerson, M.J., Witzki, A.H., & Howerter, A. (2000). The unity and diversity of executive functions and their contributions to complex “frontal lobe” tasks: A latent variable analysis. *Cognitive Psychology*, *41*, 49–100.
- Muraven, M., Baumeister, R.F., & Tice, D.M. (1999). Longitudinal improvement of self-regulation through practice: Building self-control strength through repeated exercise. *Journal of Social Psychology*, *139*, 446.
- Muraven, M., Collins, R.L., & Neinhans, K. (2002). Self-control and alcohol restraint: An initial application of the self-control strength model. *Psychology of Addictive Behavior*, *16*, 113–120.
- Muraven, M., & Slessareva, E. (2003). Mechanisms of self-control failure: Motivation and limited resources. *Personality and Social Psychology Bulletin*, *29*, 894–906.
- Neumann, R., Hülsebeck, K., & Seibt, B. (2004). Attitudes toward people with AIDS and avoidance behavior: Automatic and reflective bases of behavior. *Journal of Experimental Social Psychology*, *40*, 543–550.
- Norman, D.A., & Shallice, T. (1986). Attention to action. Willed and automatic control of behavior. In R.J. Davidson, G.E. Schwartz, & D. Shapiro (Eds.), *Consciousness and self regulation: Advances in research* (pp. 1–18). New York: Plenum Press.
- Oaten, M., & Cheng, K. (2006). Improved self-control: The benefits of a regular program of academic study. *Basic and Applied Social Psychology*, *28*, 1–16.
- Oberauer, K., Süß, H.-M., Schulze, R., Wilhelm, O., & Wittmann, W.W. (2000). Working memory capacity: Facets of a cognitive ability construct. *Personality and Individual Differences*, *29*, 1017–1045.
- Ostafin, B.D., Marlatt, G.A., & Greenwald, A.G. (2008). Drinking without thinking: An implicit measure of alcohol motivation predicts failure to control alcohol use. *Behavior Research and Therapy*, *46*, 1210–1219.
- Payne, B.K., Cheng, C.M., Govorun, O., & Stewart, B.D. (2005). An inkblot for attitudes: Affect misattribution as implicit measurement. *Journal of Personality and Social Psychology*, *89*, 277–293.
- Payne, B.K., McClernon, J.F., & Dobbins, I.G. (2007). Automatic affective responses to smoking cues. *Experimental and Clinical Psychopharmacology*, *15*, 400–409.
- Petty, R.E., Fazio, R.H., & Briñol, P. (Eds.). (2008). *Attitudes: Insights from the new wave of implicit measures*. Mahwah, NJ: Erlbaum.
- Polivy, J. (1998). The effects of behavioral inhibition: Integrating internal cues, cognition, behavior, and affect. *Psychological Inquiry*, *9*, 181–204.
- Pudel, V., & Westenhöfer, J. (1989). *Fragebogen zum Essverhalten. Three-Factor Eating Questionnaire (TFEQ; Stunkard, A.J., & Messick, S., 1985): German version*. Göttingen, Germany: Hogrefe.
- Rothbart, M.K., Derryberry, D., & Posner, M.I. (1994). A psychological approach to the development of temperament. In J.E. Bates & T.D. Wachs (Eds.), *Temperament: Individual differences at the interface of biology and behavior* (pp. 83–116). Washington, DC: American Psychological Association.
- Schelling, T.C. (1984). Self-command in practice, in policy, and in a theory of rational choice. *American Economic Review*, *74*, 1–11.
- Schmeichel, B.J., Vohs, K.D., & Baumeister, R.F. (2003). Intellectual performance and ego depletion: Role of the self in logical reasoning and other information processing. *Journal of Personality and Social Psychology*, *85*, 33–46.
- Schmukle, S.C., & Egloff, B. (2004). Does the Implicit Association Test for assessing anxiety measure trait and state variance? *European Journal of Personality*, *18*, 483–494.
- Seibt, B., Häfner, M., & Deutsch, R. (2007). Prepared to eat: How immediate affective and motivational responses to food cues are influenced by food deprivation. *European Journal of Social Psychology*, *37*, 359–379.
- Sloman, S.A. (1996). The empirical case for two systems of reasoning. *Psychological Bulletin*, *119*, 3–22.
- Smith, E.C., & DeCoster, J. (2000). Dual-process models in social and cognitive psychology: Conceptual integration and links to underlying memory systems. *Personality and Social Psychology Review*, *4*, 108–131.
- Stacy, A.W. (1997). Memory activation and expectancy as prospective predictors of alcohol and marijuana use. *Journal of Abnormal Psychology*, *106*, 61–73.
- Steele, C.M., & Josephs, R.A. (1990). Alcohol myopia: Its prized and dangerous effects. *American Psychologist*, *45*, 921–933.
- Steffens, M.C. (2004). Is the Implicit Association Test immune to faking? *Experimental Psychology*, *51*, 165–179.
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, *8*, 220–247.

- Strack, F., & Deutsch, R. (2007). The role of impulse in social behavior. In A.W. Kruglanski & E.T. Higgins (Eds.), *Social psychology: Handbook of basic principles* (pp. 408–431). New York: Guilford.
- Stunkard, A.J., & Messick, S. (1985). The Three-Factor Eating Questionnaire to measure dietary restraint, disinhibition, and hunger. *Journal of Psychosomatic Research*, *29*, 71–83.
- Tangney, J.P., Baumeister, R.F., & Boone, A.L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality*, *72*, 271–324.
- Thaler, R.H. (1991). *Quasi rational economics*. New York: Russell Sage.
- Thush, C., Wiers, R.W., Ames, S.L., Grenard, J.L., Sussman, S., & Stacy, A.W. (2008). Interactions between implicit and explicit cognition and working memory capacity in the prediction of alcohol use in at-risk adolescents. *Drug and Alcohol Dependence*, *94*, 116–124.
- Trope, Y., & Fishbach, A. (2000). Counteractive self-control in overcoming temptation. *Journal of Personality and Social Psychology*, *79*, 493–506.
- Vohs, K.D. (2006). Self-regulatory resources power the reflective system: Evidence from five domains. *Journal of Consumer Psychology*, *16*, 217–223.
- Vohs, K.D., & Heatherton, T.F. (2000). Self-regulatory failure: A resource-depletion approach. *Psychological Science*, *11*, 249–254.
- Ward, A., & Mann, T. (2000). Don't mind if I do: Disinhibited eating under cognitive load. *Journal of Personality and Social Psychology*, *78*, 753–763.
- Webb, T.L., & Sheeran, P. (2003). Can implementation intentions help to overcome ego-depletion? *Journal of Experimental Psychology*, *39*, 279–286.
- Wiers, R.W., Cox, W.M., Field, M., Fadardi, J.S., Palfai, T.P., Schoenmakers, T., et al. (2006). The search for new ways to change implicit alcohol-related cognitions in heavy drinkers. *Alcoholism, Clinical and Experimental Research*, *30*, 320–331.
- Wiers, R.W., Dictus, M., Houben, K., Van den Wildenberg, E., & Rinck, M. (2008). *Strong automatic appetitive action tendencies in heavy drinkers with a g-allele in a Functional Polymorphism of the Mu-Opioid Receptor Gene (OPRM1)*. Manuscript submitted for publication.
- Wiers, R.W., Rinck, M., Kordts, R., Houben, K., & Strack, F. (2008). *Re-training automatic action-tendencies to approach alcohol in hazardous drinkers*. Manuscript submitted for publication.
- Wiers, R.W., van Woerden, N., Smulders, F.T., & deJong, P.J. (2002). Implicit and explicit alcohol-related cognitions in heavy and light drinkers. *Journal of Abnormal Psychology*, *111*, 648–658.