RUNNING HEAD: Predicting self-regulatory behavior

Unscrambling self-regulatory behavior determination: The role of impulse strength, reflective processes, and control resources

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To appear in:

Forgas, J., Baumeister, R. F., & Tice, D. M. (Eds.). (forthcoming). *The psychology of self-regulation*.

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Whether we get up in the morning and go to work, whether we have one beer or more in the evening after work or whether we surf the Internet in between, self-regulation determines our daily behavior, our success, health and well being. This becomes dramatically apparent when it fails, when we stay home rather than going to work and have five beers instead of one. Not surprisingly, then, an abundance of research has investigated the boundary conditions that influence successful self-regulation (or self-control). For example, children who use strategies to direct their attention away from alluring features of a candy are more successful in delaying gratification than children who are more engaged in these features (Metcalfe & Mischel, 1999; Mischel, 1974). Apparently, distracting oneself from the allure helps. Distraction may also harm when it undermines cognitive resources. Adult individuals who are cognitively busy during a choice between a tasty, but rather unhealthy chocolate cake and a healthy, but affectively less appealing fruit salad, tend to prefer the affectively superior, but unhealthy chocolate cake over the healthy, but affectively less appealing fruit salad (Shiv & Fedorikhin, 1999). In contrast, in situations of no distraction people have more resources to think about their choice, which often leads to a preference for the cognitively superior fruit salad over the affectively superior chocolate cake. Generally, when cognitively busy, people typically appear to be less successful at self-control (see also Boon, Stroebe, Shut, & Ijntema, 2002; Ward & Mann, 2000).

A third important boundary condition for successful self-control is the availability of self-regulatory resources (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Schmeichel & Baumeister, 2004; Tangney, Baumeister, & Boone, 2004). The

model of self-regulation by Baumeister and colleagues (e.g., Muraven & Baumeister, 2000) proposes that self-control depends on a limited resource. Akin to a muscle, this resource can be depleted through exertion of self-control, and it recovers after some time. Interestingly, the resource is domain-unspecific. Any act of self-control, that is, any act of controlling a dominant response independent from the particular behavioral sphere, will draw on this resource and use up some of its precious capacity. If self-regulatory resources are temporarily or chronically low, chances for successful self-control are smaller than for individuals who dispose of plenty of resources. An impressive amount of research from various behavioral domains supporting this model has been accumulated in the last 10 years. For example, individuals low in self-regulatory resources are likely to drink more alcohol (Muraven, Collins, & Nienhaus, 2002), to show more aggressive behavior (DeWall, Baumeister, Stillman, & Gailliot, 2007; Stucke & Baumeister, 2006), and to spend more money compared to individuals with high resources (Vohs & Faber, 2007).

In sum, multiple evidence shows that people low in attention control, low in cognitive capacity, or low in self-regulatory resources show more impulsive behavior, which in turn suggests that these factors lead to an increased impact of people's impulses (rather than reflective processing) on behavior. At closer look, however, it appears that more direct evidence for the underlying assumption of impulses driving behavior under these conditions is scarce. Whereas many studies report mean group differences between experimental conditions of, for example, low versus high resources, and therefore infer the impact of impulses, only few studies directly assessed impulsive precursors of behavior.

The present chapter strives to fill this gap and will present research that particularly aims at *predicting* self-regulatory behavior. We will argue that for the prediction of behavior it may be fruitful to include individual differences in impulse strength as well as reflective precursors of behavior in addition to boundary conditions that influence self-regulatory success. We will show that an approach that incorporates these various components allows for a more fine-grained prediction of behavior than if any of these components were studied in isolation. Theoretically our work is embedded in the current models of self-regulation. Building on the intriguing work of several groups of researchers investigating the boundary conditions of successful self-regulation (e.g., Barrett, Tugade, & Engle, 2004; Baumeister et al., 1998; Polivy & Herman, 1976; Shiv & Fedorikhin, 1999; Tangney et al., 2004) we focus on the role of moderators such as cognitive capacity, self-regulatory resources, and alcohol consumption that can be subsumed under the broad factor of available control resources as a boundary condition of self-regulatory success. Toward the end of the chapter we will broaden the view on the applicability of the presented approach to other factors beyond available control resources.

Individual differences in impulsive and reflective precursors of behavior

Why should individual differences in impulse strength be important? In the studies briefly reviewed above the assumption was that, on average, people have an impulse toward drinking alcohol, eating chocolate cake rather than fruit salad and so forth. Such impulses were implicitly treated as constant across participants as no indicators of impulse strength were assessed. This, of course, can only be an approximation as the strength of impulses differs between individuals. One of the present authors, for example, is indifferent to chocolate and has no problems

whatsoever leaving a piece of chocolate uneaten, whereas other people may find that considerably harder if not impossible. More generally speaking, successful self-control should be more difficult for people with a strong impulse compared to people with a comparatively weak impulse. Moreover, if we assume that impulses drive behavior depending on resources, an individual with a neutral impulsive reaction will probably be less affected in his or her behavior by the low resources because no impulses need to be controlled. Conversely, for an individual with a positive impulsive reaction the urge will be much stronger and considerable self-regulatory resources are required to override the impulse (Baumeister et al., 1998).

These reflections imply the interesting insight that mean behavioral differences between groups with low versus high available control resources are a sufficient, but not a necessary condition to infer increased impact of impulses on behavior. If impulsive reactions vary between persons, reactions of some persons in a given sample may be positive, others may be neutral, and yet others may even be negative. If impulsive reactions do on average not carry a clear valence in a given sample, mean behavioral differences between groups may not be big enough to lead to significant effects. Indicators of impulse strength on the individual level may provide interesting insights in these situations. Such indicators could be used to predict self-regulatory behavior. Based on the assumption that self-regulation is resource dependent (e.g., Muraven & Baumeister, 2000) their predictive validity should be rather low under conditions of full resources when individuals are able to effortfully control their behavior. However, predictive validity of indicators of impulse strength should be higher under conditions of low resources when effortful control is difficult and impulses are assumed to more strongly influence behavior determination. Note that this pattern of varying predictive

validity may even show up in the absence of mean differences between experimental conditions.

The inclusion of individual differences in impulse strength should allow for a more precise prediction of behavior. Yet we can still improve predictions. Whether or not impulses drive behavior does not only depend on (a) control resources and (b) impulse strength, but also on (c) the strength of the antagonist, such as control motivation, personal standards, goals, deliberative evaluations and so forth. In contrast to the impulsive precursors of behavior these are thought as more reflective in nature. But similar to impulses, in many cases these reflective precursors of behavior are treated as constant if not assessed on an individual basis. It is assumed that, generally, people will like a supposedly tempting product (e.g., candy, chocolate cake, alcohol, and so forth) and that they will restrict their intake of this product as long as they have the resources to do so. However, again one can expect such reflective precursors of behavior to vary situationally or chronically between individuals. There may be individuals who try to restrict their intake of, for example, beer due to situational demands or due to dispositional personal standards. These individuals should show increased consumption under conditions of low (compared to high) resources that likely lead to a breakdown of self-control. At the same time, there may be individuals who do not even try to restrict their intake of beer. For those, increased consumption under conditions of low resources is less obvious because they drink as much or as little as they desire anyway, independent from available control resources.

In sum, these considerations suggest a complex interplay between impulsive and reflective precursors of behavior with available control resources that moderate the

impact of these tendencies on behavior determination. How can this dynamic interplay be more closely understood and framed theoretically?

The reflective-impulsive model

The reflective-impulsive model (RIM, Strack & Deutsch, 2004) proposes that human behavior is a joint function of reflective and impulsive processes that originate in distinct psychological systems. The reflective system activates behavioral schemata that are in line with a person's knowledge, personal standards and deliberate evaluations. For an efficient functioning the reflective system needs control resources such as cognitive capacity or self-regulatory resources (Vohs, 2006). In contrast, the impulsive system works comparatively effortless. It is understood as an associative network in which the encountering of an object leads to an automatic evaluation that activates a motivational approach or avoidance tendency (Chen & Bargh, 1999; Hofmann, Friese, & Gschwendner, 2007) that in turn activates behavioral schemata that are associated with the object. The behavioral schemata that are activated by the reflective and the impulsive system may or may not converge (e.g., a spontaneous approach toward beer, but an avoidance reaction on second thought because of personal restraint standards). If they diverge the reflective system can "overrule" the impulsive system in this conflict about behavioral control as long as the necessary resources for its efficient operation are available. If these resources are not available, impulsive tendencies will be more influential in guiding behavior. Thus, the impulsive system is more concerned with the present needs of the organism, the here and now of the situation. In contrast, by incorporating an individual's goals and long-term standards, the reflective system is able to transcend the situation (Baumeister, Heatherton, & Tice, 1994).

Taken together, models of self-regulation (e.g., Muraven & Baumeister, 2000) and social cognition (e.g., Strack & Deutsch, 2004) converge in the assumption that conditions of low resources are associated with an increased impact of impulsive processes compared to conditions of full resources. Conversely, reflective processes are assumed to be more influential when sufficient resources are available. This observation fits well with a recent argument by Carver (2005) who more generally pointed out conceptual similarities between various models in personality and social psychology that incorporate the ideas of impulse and restraint in combination with the assumption that both impulsive and reflective processes contribute to behavior determination.

The RIM offers a theoretical framework on how reflective and impulsive processes may originate and operate. How can these processes be measured? Questionnaire measures that directly ask an individual for deliberate evaluations and personal standards typically serve as reflective precursors of behavior. In contrast, so-called implicit reaction time measures such as evaluative priming (Fazio, Jackson, Dunton & Williams, 1995) or the Implicit Association Test (IAT, Greenwald, McGhee, & Schwartz, 1998; for overviews on implicit measures, see Fazio & Olson, 2003; Wittenbrink & Schwarz, 2007) are intended to tap into associations in the associative network of the impulsive system (Strack & Deutsch, 2004). In the theoretical framework of the RIM implicit measures that deliver indicators of the strength of associations between concepts in the associative store of the impulsive system may thus serve as proxies of impulse strength.[1]

Both direct, explicit questionnaire measures and implicit measures should predict behavior to the extent that the processes that influence their measurement outcomes mirror the processes that drive the respective behavior. Explicit questionnaire

measures are believed to be strongly influenced by reflective processes. They should thus be especially valuable in predicting reflective, controlled behavior (e.g., behavior that occurs when plenty of control resources are available). In contrast, implicit measures are influenced more strongly by impulsive processes. They should thus be most valuable in predicting impulsive behavior (e.g., behavior that occurs when control resources are scarce).

Empirical evidence

We tested the theoretical considerations outlined above in a series of studies using a variety of moderators of available control resources (cognitive capacity, self-regulatory resources, alcohol consumption) that we expected to shift the relative weights between reflective and impulsive processes in behavior determination. In a first study, we adopted a situational approach to cognitive capacity by manipulating the difficulty of a concurrent dual task during self-regulatory behavior (Friese, Hofmann, & Wänke, in press-a, Study 1). In an initial mass testing session, participants evaluated chocolate and fruit on explicit questionnaire measures. In the experimental session to follow several days later, participants completed an IAT relating to chocolate and fruit. As a reward for their participation participants were allowed to choose 5 items out of a variety of fruit and chocolate bars. Half of the participants had to keep in mind a one-digit number during the choice task (high cognitive capacity). The other half was instructed to keep in mind an eight-digit number that they reported to the experimenter after the choice task (low cognitive capacity; Gilbert & Hixon, 1991). Thus, participants were confronted with a typical self-regulatory conflict between choice options that are often seen as tasty and tempting, but unhealthy on one side, and other options that are

often seen as healthy, but less tempting. We expected that at least some participants would experience such a conflict between reflective and impulsive processes.

The results of this study are depicted in Figure 1. As expected, the explicit questionnaire measure as a reflective precursor of behavior predicted choice behavior well for participants in the condition with high cognitive capacity. The more participants reported to like chocolate compared to fruit, the more chocolates they picked. Interestingly, this predictive value vanished almost completely in the condition with low resources. Here, what participants chose was almost unrelated to what they reported about their liking of chocolate and fruit. Instead, in line with hypotheses, the implicit measure as an impulsive precursor of behavior predicted choice behavior well. The implicit measure was not reliably related to choice behavior for participants with high cognitive capacity. Interestingly, the groups of high and low cognitive capacity participants did not differ in the mean number of chocolates chosen. Participants in the high cognitive capacity condition picked on average 2.64 out of 5 possible chocolate bars. Participants in the low cognitive capacity condition on average picked almost the same number (2.67). Focusing only on the mean difference between groups in chocolates chosen would have misleadingly suggested that the constraint in cognitive capacity did not increase the impact of impulsive processes on behavior (cf. Shiv & Fedorikhin, 1999). A more fine-grained analysis, which incorporated the varying relations of reflective and impulsive precursors of behavior to participants' choices painted a different picture and allowed us to trace which kind of process dominantly drove behavior as a function of available cognitive capacity (see Figure 1). Hence, even in the absence of mean behavioral differences between groups this study supports the general assumption of several models of self-regulation (Muraven & Baumeister, 2000;

Shiv & Fedorikhin, 1999) that under conditions of low resources impulsive processes drive behavior more strongly.

In a related study, one group of participants had to make their choice between various food products under time pressure while the other group could take as much time as they wanted (Friese, Wänke, & Plessner, 2006). Thus, cognitive load was not manipulated directly, but in the experimental condition participant's ability to process reflectively was restricted by the time pressure manipulation. This manipulation of processing time during the choice task led to similar results as described above in the case of distraction by cognitive load.

We extended the general moderator concept cognitive capacity from a situational to a dispositional level in a series of studies (Hofmann, Gschwendner, Wiers, Friese, & Schmitt, 2007). People not only differ situationally, but also dispositionally in their ability to keep information in working memory and shield this information from internal or external distractions (Barrett et al., 2004; Engle, 2002). Individuals high in working memory capacity are more successful in enacting controlled, goal-directed processing while controlled processing breaks down more easily in individuals low in working memory capacity (Barrett et al., 2004). Based on this literature and the models reviewed in the introduction we hypothesized that reflective precursors of behavior should predict behavior better for individuals with high than low working memory capacity. The opposite should hold for impulsive precursors of behavior.

One representative study (Hofmann et al., 2007, Study 1) was concerned with self-regulatory conflicts in the domain of sexual interest behavior. We brought male heterosexuals into a supposedly tempting situation by having them watch erotic slides of women and pictures of art for as long as they wanted before answering questions

about the pictures seen. We expected at least some participants to be tempted by the attractive stimuli while at the same time the social situation in the lab was clearly not private and undisturbed, which should exert a restraining influence on viewing time behavior. We reasoned that next to reflective and impulsive precursors of behavior the relative viewing time of sexual stimuli compared to stimuli of art would be dependent on participants' ability to disengage their attention from the erotic material in order to proceed with the task.

Participants were invited to a "study concerning judgments about attractiveness and aesthetics". They first completed an IAT with only one target category (Karpinski & Steinman, 2006; Bluemke & Friese, in press) relating to erotic pictures of women, as an impulsive precursor of behavior, and a standard measure of working memory capacity (Oberauer, Süß, Schulze, Wilhelm, & Wittmann, 2000). We used viewing time as an unobtrusive measure of sexual interest (Gress, 2005; Harris, Rice, Quinsey, & Chaplin, 1996). Participants watched a random series of erotic pictures and pictures of art. Following each picture, participants answered two questions from a randomly assigned set (e.g., "How much would you like to talk to this woman?", "How much would you like to hang this painting in your living room?"). An explicit attitude measure as a reflective precursor of behavior followed at the end of the study. Results indicated that, as expected, the reflective precursor of behavior predicted viewing time well for participants with a high working memory capacity. In contrast, this measure was not significantly related to viewing time for participants low in working memory capacity. In line with our hypotheses, the opposite pattern of results emerged for the impulsive precursor of behavior. The implicit measure was correlated positively with viewing time for participants with low, but not high working memory capacity.

Interestingly, the correlation between working memory capacity and the dependent variable viewing time was not significant (r = -.07, p = .62). That is, similarly to the study described above on situationally manipulated cognitive capacity, there was no main effect of available control resources on behavior. Rather, working memory capacity interacted as hypothesized with reflective and impulsive precursors of behavior. Behavior was driven more strongly by reflective processes for participants high in working memory capacity while impulsive processes were more important for participants low in working memory capacity. The indicators of individual differences in reflective and impulsive precursors of behavior prevented a premature conclusion that working memory capacity was unimportant for the determination of this particular self-regulatory behavior. Comparable results emerged when applying this approach to the domain of eating behavior and anger expression (Hofmann et al., 2007).

In a third set of studies we turned to self-regulatory resources (Muraven & Baumeister, 2000) as a moderator concept (Friese, 2007; Friese et al., in press-a, Studies 2 and 3; Hofmann, Rauch, & Gawronski, 2007). Self-regulatory resources are seen as an important control resource that powers the reflective system (Vohs, 2006). Similar to the situational and dispositional differences in cognitive capacity we reasoned that impulsive precursors of behavior should be more influential in guiding behavior under conditions of low self-regulatory resources. As reflective precursors of behavior we included deliberate evaluations (Friese et al., in press-a, Studies 2 & 3) and personal restraint standards (Friese, 2007; Friese et al., in press-a, Study 3; Hofmann et al., 2007). Both deliberate evaluations and restraint standards rely on higher order cognitive processes. Importantly, in contrast to deliberate evaluations, restraint standards are not necessarily evaluative. It is well possible to like a certain product and yet to restrain

oneself not to consume it (e.g., “I really like beer, but I restrain myself because I don’t want to drink too much alcohol”). That is, typical measures of eating or drinking restraint do not ask how much one likes or dislikes a certain substance. Rather, they ask for efforts to control consumption independently from an evaluation (Collins & Lapp, 1992; Stunkard & Messick, 1985). Depending on one’s attraction to the product it needs a lot of willpower to resist and keep a clean record. Clearly, restraint standards depend on control resources in order to influence behavior, a property they share with deliberate evaluations (see above). If the necessary control resources are scarce, their controlling influence may go awry and impulsive precursors of behavior may take over.

These assumptions were supported in several studies. Situationally manipulated self-regulatory resources moderated the relative impact of both an impulsive and a reflective (deliberate evaluations) precursor of behavior in predicting potato chip consumption (Friese et al., in press-a, Study 2). A similar pattern emerged when using dietary restraint standards instead of deliberate evaluations as a reflective precursor of behavior when predicting candy consumption (Hofmann et al., 2007). A third study on drinking behavior tested whether deliberate evaluations and restraint standards contribute independently to behavioral control (Friese et al., in press-a, Study 3). Participants first completed a SC-IAT (Karpinski & Steinman, 2006) relating to beer as an impulsive precursor of behavior, followed by a questionnaire asking for a deliberate evaluation of beer and a short sequence from the movie American History X. One half of participants were instructed to let flow their emotions during the film while the other half was instructed to suppress all emotions that came up in response to the upsetting film clip. This emotion-suppression task is a standard procedure to deplete self-regulatory resources (e.g., Baumeister et al., 1998). Finally, in a product test

participants sampled two different brands of beer. They were asked several questions irrelevant to our hypotheses such as what they thought about the packaging and how they liked the foam of the two beers. After the session we unobtrusively measured how much participants had actually drunk.

Although participants with low self-regulatory resources consumed somewhat more beer (452 ml vs. 391 ml), this difference was far from being significant ($p > .30$). More importantly, in line with expectations we found self-regulatory resources to moderate the relation of all three individual difference measures with behavior (see Figure 2). The impulsive precursor of behavior predicted beer consumption only for participants who were depleted of self-regulatory strength. In contrast, deliberate evaluations correlated with consumption only for beer drinkers with full resources. Finally, drinking restraint standards (Collins & Lapp, 1992; Cox et al., 2001) contributed over and above the other two individual difference measures to the prediction of the drinking behavior, but showed otherwise the same pattern as the measure of deliberate evaluations: a stronger impact under full as compared to depleted resources. Thus, the predictive value of one impulsive and two different reflective precursors of behavior was moderated by available control resources.

A further study in the realm of self-regulatory resources dealt with the consequences of being reminded of one's own mortality (Friese & Hofmann, 2007b, Study 2). Thoughts about one's own death are experienced as aversive (Greenberg, Solomon, & Pyszczynski, 1997). Research on Terror Management Theory has revealed that cognitive reactions to such reminders include the suppression of death-related thoughts or the redirection of thoughts to other topics (e.g., Greenberg, Pyszczynski, Solomon, Simon, & Breus, 1994). We reasoned that these effortful processes require

self-regulatory resources and this assumption was confirmed by recent research (Gailliot, Schmeichel, & Baumeister, 2006). As a consequence of reduced self-regulatory resources subsequent behavior should be driven more strongly by impulses. This hypothesis was confirmed in a study in which an impulsive precursor of behavior predicted the total consumption of chocolate in a product test for participants who had thought about their own death before, but not for participants who had thought about a control topic (Friese & Hofmann, 2007b, Study 2).[2]

Again we sought to extend the evidence regarding the moderating role of self-regulatory resources from the situational to the dispositional level. Individuals with dispositionally high self-regulatory resources have a higher "ability to override or change one's inner responses, as well as to interrupt behavioral tendencies (such as impulses) and refrain from acting on them" than individuals dispositionally low in self-regulatory resources (Tangney et al., 2004, p. 274). Trait self-control is positively related to a host of desirable variables such as academic achievement, psychological adjustment, or self-esteem. In turn, it is negatively related to undesirable variables such eating disorders, substance abuse, or other psychological disorders (Tangney et al., 2004; see also Shoda, Mischel, & Peake, 1990, for further evidence on the desirable correlates of high self-control).

In a first session (Friese, 2007) participants filled out the trait self-control scale (Tangney et al., 2004) and a measure of dietary restraint standards that served as a reflective precursor of behavior (Stunkard & Messick, 1985; Pudel & Westenhöfer, 1989). In the experimental session participants worked on an SC-IAT (Karpinski & Steinman, 2006) relating to potato chips. This implicit measure again served as an impulsive precursor of behavior. In a product testing phase participants tried and rated a

serving of potato chips and answered a number of questions that were irrelevant for present purposes (e.g., how much they liked the packaging, how often they consumed potato chips and so forth). The assumption was that at least for some participants this situation would pose a self-regulatory conflict. On one hand, potato chips are tasty and one gets easily tempted to eat quite a lot of them. On the other hand, they are fatty and unhealthy, which is a reason why many people try to control their intake of potato chips. Available control resources, in this case trait self-control, should moderate the impact of reflective and impulsive processes on eating behavior.

They indeed did. Again, the correlation between control resources and self-regulatory behavior was insignificant (r = -.11, p > .50). However, as expected, the impulsive precursor of behavior predicted potato chips consumption well for participants low in trait self-control. It was almost unrelated to behavior for participants high in trait self-control. The pattern was somewhat more complex for dietary restraint standards as a reflective precursor of behavior. Participants low in trait self-control and with low dietary restraint standards ate the most. This seems plausible. However, in contrast to what could have been expected based on the literature on the self-regulation of eating (e.g., Herman & Polivy, 2004) and from studies using situational manipulations of self-regulatory resources (e.g., Friese et al., in press-a, Study 3; Hofmann et al., 2007) restraint standards were effective guides for participants low, but not high in self-control. Previous research would have suggested the opposite pattern: efficient behavior regulation by restraint standards for individuals high, but not low in trait self-control. Future replication studies will hopefully shed more light on the nature of this specific finding relating to the interaction between trait self-control and dietary restraint standards.

Having studied the effects of situational and dispositional cognitive capacity and self-regulatory resources we investigated alcohol as another factor that influences the availability of control resources. Alcohol affects different control resources and impairs executive functioning in a number of ways, for example, attentional processes, abstract reasoning, self-monitoring, and working memory skills (Fillmore, Dixon, & Schweizer, 2000; Giancola, 2000; Hull & Slone, 2004). These findings are congruent with the basic tenet of alcohol myopia theory (Steele & Josephs, 1990) that alcohol leads persons to perceive only salient and proximal cues in the environment. More abstract concepts such as goals and standards lose impact. This theoretical framework leads to similar predictions like those that we have pursued in the preceding studies. Reflective processes should suffer under the influence of alcohol compared to states of being sober. Conversely, impulsive processes should be more influential in guiding behavior for participants who consumed alcohol than for sober individuals.

We tested this assumption in one study (Hofmann & Friese, in press). Participants completed a couple of screening questionnaires including a measure of dietary restraint standards that served as a reflective precursor of behavior (Stunkard & Messick, 1985; Pudel & Westenhöfer, 1989). Subsequently, the impulsive precursor of behavior followed (an SC-IAT relating to candy, Karpinski & Steinman, 2006) before participants engaged in two different product tests. In the first product test participants tried and rated a drink that either consisted of orange juice with vodka or solely orange juice in the control condition. After some distraction tasks that gave the alcohol time to unfold its impact, the second product test was concerned with candy. In this study, participants with low resources (those who had consumed alcohol) ate significantly more candy than sober participants, as previous research that found increased food

consumption after alcohol intake would suggest (Polivy & Hermans, 1976; Yeomans, 2004). More importantly, as expected, dietary restraint standards as a reflective precursor of behavior limited candy consumption for sober participants with plenty of resources, but were ineffective when people had consumed alcohol. In contrast, the impulsive precursor of behavior predicted candy consumption for participants under the influence of alcohol with diminished resources, but not for sober participants.

Discussion

Building on the seminal work of several groups of researchers that investigated the boundary conditions of successful self-control (e.g., Barrett et al., 2004; Baumeister et al., 1998; Polivy & Herman, 1976; Shiv & Fedorikhin, 1999; Tangney et al., 2004) the research presented in this chapter was concerned specifically with the prediction of self-regulatory behavior. Drawing on models of self-regulation (Metcalfe & Mischel, 1999; Muraven & Baumeister, 2000; Shiv & Fedorikhin, 1999) and contemporary dual-process models in social psychology (Strack & Deutsch, 2004) we argued that the simultaneous investigation of reflective and impulsive precursors of behavior together with the availability of control resources would corroborate and extend previous approaches. It *corroborates* the underlying assumptions of other approaches by more directly showing varying impacts of reflective and impulsive processes on behavior as a function of available control resources. Interestingly, although several studies reported in this chapter did not find mean behavioral differences as a function of control resources, all studies supported the basic tenet of several models of self-regulation (Muraven & Baumeister, 2000) that impulses more strongly drive behavior under conditions of low resources. Our approach *extends* other approaches by simultaneously including individual difference measures of reflective and impulsive precursors of

behavior that allow for a more fine-grained prediction of self-regulatory behavior than an investigation of any of these factors in isolation. The resulting data patterns are a step forward in mapping the dynamic and complex interplay of these different factors in human behavior determination.

Corroborating our reasoning we presented empirical evidence from five studies in which participants were faced with a self-regulatory conflict in a variety of behavioral domains (choice, eating, drinking, sexual interest behavior). As expected, reflective precursors of behavior were more influential in guiding behavior when control resources were high rather than low. The opposite pattern emerged for impulsive precursors of behavior. Variations in several different situational and dispositional factors that shifted the weight between reflective and impulsive processes in behavior determination (cognitive capacity, self-regulatory resources, and alcohol) led to the predicted patterns of results.

One intriguing aspect of the presented research is that distinct and discriminable moderators of the relative weight of reflective and impulsive processes showed functionally equivalent effects across studies. Differences between the moderators are manifold. For example, after situationally reducing cognitive capacity individuals come back to full capacity (and therefore reflective processing) as soon as the cognitive load is taken away. In contrast, depleted self-regulatory resources need more time to recover (Muraven, Tice, & Baumeister, 1998). Also, after drinking alcohol the organism is clearly in a different state than while remembering an eight-digit number or after suppressing emotions for a couple of minutes. The question arises what are the differences and similarities between these moderators. What is the common element that provokes functionally equivalent results despite of many differences? An extensive

elaboration on this intriguing question is beyond the scope of this chapter (for discussions, see Friese & Hofmann, 2007a; Friese, Hofmann, & Wänke, in press-b). One connecting element between all moderators seems to be the impairment of central executive functioning. The central executive is responsible for information processing and the distribution of cognitive resources. In order to fulfill these functions it depends on controlled, reflective processes (Baddeley, 1990, 1996). Low cognitive capacity, low self-regulatory resources, and alcohol consumption are all associated with less efficient reflective processing while impulsive processes are less affected by these conditions (Baddeley, 1996; Fillmore, Vogel-Sprott, & Gavrilescu, 1999; Govorun & Payne, 2006; Schmeichel, Vohs, & Baumeister, 2003; Giancola, 2000; Hull & Slone, 2004). Thus, although the exact mechanisms differ, all moderators impede the central executive from efficiently fulfilling its regulatory tasks. As a consequence, reflective processes lose impact while impulsive processes gain impact under conditions of low control resources.

In this chapter we focused on the role of available control resources as a general factor underlying behavior determination by reflective versus impulsive processes. Based on dual-process models in psychology (Chaiken & Trope, 1999; Evans, in press; Fazio, 1990) the *motivation* to make use of reflective processing can also be expected to shift the weights between reflective and impulsive processes besides the *opportunity* to do so as a consequence of varying control resources. Increased motivation to reflect should lead to a higher impact of reflective precursors of behavior while low motivation to reflect should allow for impulsive processes to take over control. Dispositional constructs like need for cognition (Cacioppo, Petty, Feinstein, & Jarvis, 1996) or the motivation to control prejudiced reactions (Dunton & Fazio, 1997) as well as situational

factors such as perceived social control (Gabriel, Banse, & Hug, 2007) are factors for which first evidence corroborating this reasoning has been found (see Friese & Hofmann, 2007a).

Finally, several constructs have been shown to be capable of changing the relative weight of reflective and impulsive processes even without changes in the opportunity or the motivation for reflective processing. Preference for intuition (Betsch, 2004) or the regulatory focus of individuals (Pham & Avnet, 2004) are cases in point. Again, a higher impact of impulsive processes in behavior determination can be expected and has been found for conditions that foster impulsive information processing (see Friese & Hofmann, 2007a).

The present findings suggest that situational and personal boundary conditions can influence the relative behavioral impact of reflective and impulsive processes with regard to *one and the same* complex self-regulatory behavior (such as eating). In addition to these insights, previous research has also found that different aspects of behavior appear to be dominantly influenced by either one or the other kind of process. For example, reflective processes have been found to influence a variety of verbal behaviors more strongly than impulsive processes and the opposite is true for a number of non-verbal behaviors (e.g., Asendorpf, Banse, & Mücke, 2002; Dovidio, Kawakami, Johnson, Johnson, & Howard, 1997). One way to integrate these areas of research is to assume that (a) various behaviors may differ by 'default' from each other in the degree to which they are accessed by impulsive versus reflective processing while maintaining that (b) situational and personal boundary conditions may modulate this default value for each specific behavior to a certain extent, adding a more dynamic element to behavioral control.

Elsewhere, we provide an overview of the various situational, dispositional, and behavioral factors that jointly moderate the influence of reflective and impulsive processes and the respective consequences for behavior prediction with impulsive precursors of behavior (Friese & Hofmann, 2007a). This overview puts the research presented in this chapter into a broader framework by integrating research from several different domains in personality and social psychology, investigating the moderating role of available control resources that affect the opportunity to reflect, the motivation to reflect, and factors that moderate the relative weight of reflective and impulsive processes without changes in motivation and opportunity. From the perspective of self-regulation research, a common element of all of the reviewed studies is that they involve experimental setups and situations that can be framed in terms of a self-regulatory conflict between reflective and impulsive processing. As such internal conflicts may precede many manifestations of everyday human behavior from trying to get up in the morning to the last glass of beer in the evening, we hope that the present measurement approach may further our understanding of the nature of such conflicts and stimulate further research into conducive and detrimental conditions of self-regulatory success.

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Figure 1. Number of chocolates chosen as a function of attitude measure (implicit vs. explicit) and capacity manipulation (low vs. high) in Friese et al. (in press-a, Study 1). Reproduced with permission from the British Journal of Social Psychology, The British Psychological Society.

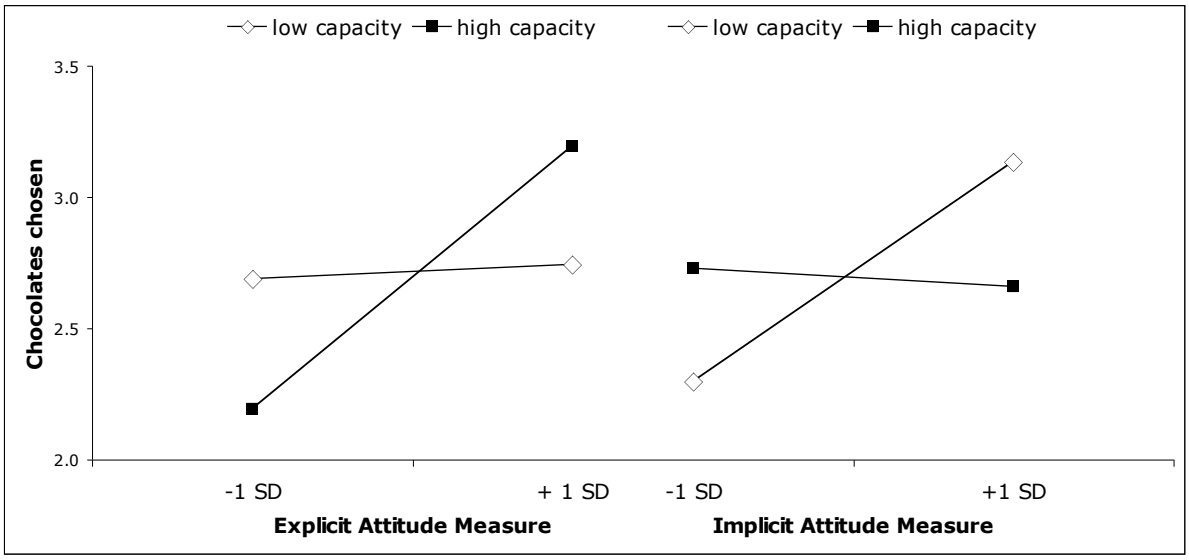
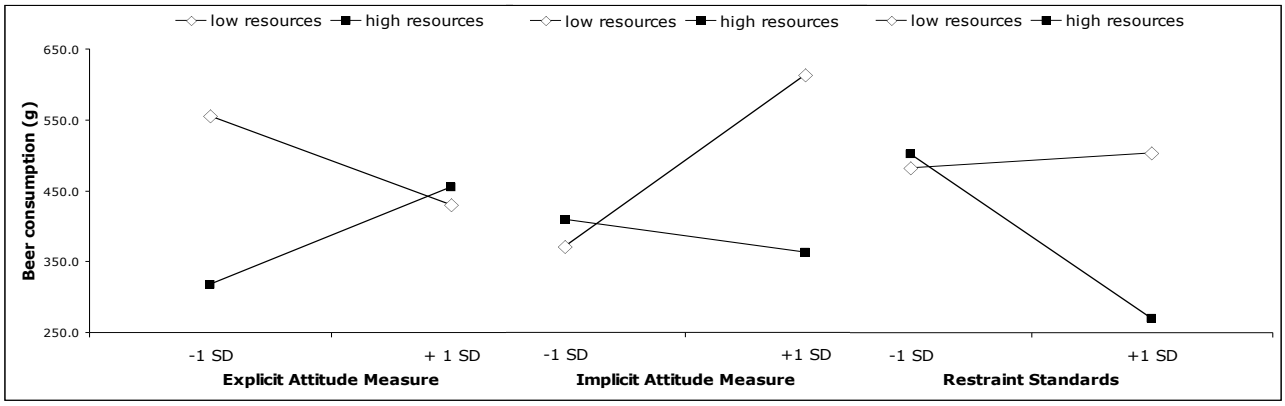


Figure 2. Consumption of beer in grams as a function of attitude measure (implicit vs. explicit) as well as restraint standards and resource manipulation (low vs. high) in Friese et al. (in press-a, Study 3). Reproduced with permission from the British Journal of Social Psychology, The British Psychological Society.



Footnote

[1] It should be noted that although currently widely used in social psychology and other disciplines, implicit measures are not undisputed. Especially the most prominent measure, the IAT and derivates of this procedure with just one target category (Karpinski & Steinman, 2006), have sparked considerable debate (e.g., Blanton, Jaccard, Gonzales, & Christie, 2006; Fiedler, Messner, & Bluemke, 2006; Nosek & Sriam, 2007). A thorough discussion of these warranted and valuable criticisms with regard to the present work is beyond the scope of this chapter (for details, see Friese, 2007). However, it may be worthwhile noting that the empirical patterns presented here emerged despite the identified problems of the measures, not as a consequence of these problems (Friese, 2007).

[2] Less related to the determination of self-regulatory behavior but not any less intriguing the study found that mortality salience also influenced evaluation and consumption of two different brands of chocolate. According to Terror Management Theory people tend to bolster values of their own culture when reminded of their mortality to underline one's belonging to this valuable and lasting group (e.g., Greenberg et al., 1997). Consistent with this reasoning, relative to a foreign chocolate, participants evaluated the domestic chocolate better and consumed more of it in the mortality salience condition than in the control condition.