Journal of Research in Personality 43 (2009) 795–805

Contents lists available at ScienceDirect

Journal of Research in Personality

journal homepage: www.elsevier.com/locate/jrp

Control me or I will control you: Impulses, trait self-control, and the guidance of behavior

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ARTICLE INFO

Article history:
Available online 10 July 2009

Keywords:
Trait self-control
Automatic affective reactions
Impulses
Impulsivity
Implicit measures
Eating behavior
Drinking behavior
Alcohol

ABSTRACT

A central assumption in research on self-control is that impulses more strongly influence the self-regulatory behavior of individuals who are low as compared to high in trait self-control. The present research addresses this central assumption directly by assessing individual differences in trait self-control as well as in impulsive precursors of behavior. As expected, impulsive precursors translated into behavior for individuals who were low, but not high in trait self-control. This pattern emerged for the consumption of potato chips (Study 1), and self-reported alcohol consumption (Studies 2a and 2b). The findings persisted when controlling for the related construct of trait impulsivity. The results illustrate the dynamic interplay between impulses and trait self-control in the determination of self-regulatory behavior.

1. Introduction

> My fault, my failure, is not in the passions I have, but in my lack of control of them. Jack Kerouac

If there was one out of a virtually infinite array of potential human faculties that you were allowed to bestow on someone, the ability to practice self-control would be a worthy candidate. Self-control is positively associated with a host of desirable attributes and negatively associated with many characteristics that you would not even wish on your foes. Good self-control has been linked to reduced aggression and criminality, better psychological adjustment, mental health, academic performance, and personal relationships, fewer financial and impulse control problems such as eating disorders and alcohol, nicotine, or other substance abuse (e.g., Bogg & Roberts, 2004; DeWall, Baumeister, Stillman, & Gailliot, 2007; Duckworth & Seligman, 2005; Finkel & Campbell, 2001; Gottfredson & Hirschi, 1990; Herman & Polivy, 2004; Hull & Slone, 2004; Pratt & Cullen, 2000; Romal & Kaplan, 1995; Sayette, 2004; Shoda, Mischel, & Peake, 1990; Tangney, Baumeister, & Boone, 2004; Wiebe, 2006; for overviews see Baumeister, Heatherton, & Tice, 1994; Baumeister & Vohs, 2004). This list could easily be extended. The positive consequences of good self-control abilities are so captivating that some authors even propose that one can never have too much of it—one can only use it in unfavorable ways (Baumeister & Alquist, 2009; Tangney et al., 2004).

What do people control when they self-control? Central to the concept is the idea of overriding by an act of willpower (Baumeister et al., 1994). For example, Tangney and colleagues defined self-control as "the 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" (Tangney et al., 2004, p. 274). Thus, one central assumption is that the behavior of individuals low in self-control is more strongly influenced by impulses compared with those high in self-control. To test this assumption impulsive precursors of behavior need to be assessed and used to predict behavior. Despite the overwhelming theoretical and practical relevance of the construct, this idea has not been pursued directly in prior work. Instead, the influence of impulses on behavior has been inferred indirectly from behavioral outcomes (e.g., more consumption of a tempting food by individuals low in self-control). The present research aims at filling this gap by assessing individual differences in self-control, and, in addition, in impulsive precursors of behavior. Impulsive precursors of behavior should transfer into behavior more readily for individuals low in self-control as compared to those high in self-control. Such a pattern would constitute more direct evidence for the central assumption of an accentuated influence of impulses on the behavior of individuals low in self-control than previous research could provide.

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doi:10.1016/j.jrp.2009.07.004

1.1. Trait self-control, impulses, and impulsivity

The present research focuses on dispositional differences in trait self-control as opposed to temporary fluctuations in self-control strength (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998). The investigation of individual differences in trait self-control is crucial given that they represent a chronic vulnerability for (vs. protection from) a host of problematic behaviors. Even without any extraordinary situational demands, individuals low in trait self-control may be chronically at risk of being swayed by their impulses and urges. In contrast, people high in trait self-control may be tempted just as much and harbor similar impulsive tendencies—they may just be more successful in resisting the urge to act on them.

What do we have in mind when we speak of an impulse as opposed to the trait of impulsivity? Impulses arise when a latent motivation (e.g., one's fondness for potato chips) meets an activating stimulus that is suitable for satisfying this latent motivation (e.g., a bowl of potato chips at a party). They are specific in that they come about as a desire to perform a particular action (e.g., take a handful of potato chips and eat them). Impulses occur automatically and without effort by the individual (Baumeister et al., 1994). According to this view, neither individuals high nor low in trait self-control can prevent their impulses from arising. Rather, those high in trait self-control are good at controlling and overriding them, whereas those low in trait self-control more often act on their impulses (Baumeister & Heatherton, 1996).

In contrast to specific impulses, impulsivity is a general trait that affects an individual's behavior across a wide variety of different situations. Similar to trait self-control, it is related to the control of thoughts and behavior (Barratt, 1994). High impulsivity is associated with a lack of planning, spontaneous decision-making, and acting without thinking (Barratt, 1985; Eysenck & Eysenck, 1977; Whiteside & Lynam, 2001). The construct is thus related to trait self-control and looks at the same coin, but from a different perspective. Whereas trait self-control focuses on control and overriding, trait impulsivity highlights different aspects of a lack of control. It is therefore not surprising that some researchers interpreted measures of impulsivity as indicators of self-control and vice versa (e.g., Duckworth & Seligman, 2005; Tangney et al., 2004). Accordingly, specific impulses that arise in a given situation should translate more readily into behavior for participants high (rather than low) in trait impulsivity.

1.2. The relation between trait self-control and behavior

Trait self-control has been linked with a host of variables as outlined in the introduction of this article. These variables comprise clinical personality patterns, other personality traits such as the big five, or the assessment of general behavioral patterns that are thought to be affected by trait self-control (for an overview, see Tangney et al., 2004). Recent research also found trait self-control to predict actual self-regulatory behavior in the laboratory (e.g., DeWall et al., 2007; Gailliot & Baumeister, 2007). For example, Schmeichel and Zell (2007) observed that high trait self-control participants blinked less often when instructed not to do so and tolerated a painful stimulus longer than participants low in trait self-control.

Although the bulk of this research is consistent with the notion of an enhanced influence of impulses on behavior in individuals low in trait self-control, this central assumption has never been tested directly. Impulses differ between individuals. Precursors of impulses need to be measured on an individual basis to conclusively show that they translate into behavior. If they are not measured, variance in impulses is effectively treated as error variance, which results in the loss of useful information. Consider the following example of an intriguing study by DeWall and colleagues (2007, Study 4). First, participants' self-control strength was temporarily reduced by a prior self-control task. In the main part of the study, individuals low in trait self-control were more likely to respond aggressively in response to an ego-threatening insult than participants high in trait self-control. Apparently, individuals high in trait self-control were more successful in controlling their aggressive impulses than those low in trait self-control. An implicit assumption in this reasoning is that all participants actually had a latent motivation to aggress that was triggered by the insult, leading to an aggressive impulse that they needed to control. It is conceivable, however, that there was variance in the latent motivation to aggress, that some participants were more ready to respond aggressively to the insult than others. For some participants with low latent motivations to aggress, the insult may have elicited confusion or defensiveness rather than aggressive impulses. The results by DeWall and colleagues are consistent with the assumption that *on average* participants had an impulsive tendency to aggress. However, likely *individual differences* in this tendency were not taken into account that may have shed further light on how behavior regulation differed between participants high and low in trait self-control.

1.3. Measurement of impulsive precursors

Several theoretical models in psychology provide a conceptual framework for the emergence of impulsive behavior (e.g., Metcalfe & Mischel, 1999; Strack & Deutsch, 2004; see also Kuhl & Kraska, 1989). For instance, the reflective-impulsive model (RIM; Strack & Deutsch, 2004) postulates that impulses originate in an associative network of long-term memory. Upon encountering an object, affect associated with the object is automatically activated. These affective associations serve as precursors of impulsive behavior because they in turn activate behavioral schemata that are related to the object. Thus, the impulsive system offers a behavioral path of action in an effortless and fast manner. Whether or not the suggested behavior is realized depends on the reflective system, which is capable of overriding the behavioral tendencies provided by the impulsive system given sufficient resources and motivation (Strack & Deutsch, 2004). Thus, according to the RIM, resources such as self-control strength are a decisive factor for the regulation of the relative influence of impulsive and reflective processes in behavior determination.

How can impulsive precursors of behavior be measured? Such a measure has to fulfill at least three criteria: first, depending on the measurement goal, they need to be flexible in terms of the specificity of the temptation they are intended to capture (e.g., when interested in potato chip consumption, impulsive tendencies toward potato chips rather than snacks in general are more adequate, and vice versa). Second, because impulses are triggered automatically (Baumeister et al., 1994), the measurement outcome should be influenced by automatic processes and as few conscious, controlled processes as possible. Third, the measure needs to be reliable to capture stable individual differences.

In recent years a number of implicit measurement tools have been introduced that may be suitable for the assessment of impulsive precursors of behavior (for overviews see Fazio & Olson, 2003; Wittenbrink & Schwarz, 2007). These measures are assumed to tap into the associative network of the impulsive system and thus provide an index of the associations that trigger impulsive behavior (Strack & Deutsch, 2004). Two of the most prominent measures are the implicit association test (IAT, Greenwald, McGhee, & Schwartz, 1998) and the affect misattribution procedure (AMP, Payne, Cheng, Govorun, & Stewart, 2005). These measures possess a number of beneficial attributes for present purposes: They capture automatic affective reactions toward certain target objects

(Gawronski & Bodenhausen, 2006; Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005) and are therefore appropriate for the assessment of hedonic impulsive tendencies. They are greatly influenced by automatic processes (Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005; Payne, 2005) and research has shown that it is much more difficult to strategically influence these measures than traditional self-report measures (Egloff & Schmukle, 2002; Steffens, 2004). Finally, they mostly capture stable individual differences as evidenced by latent state-trait analyses (Schmukle & Egloff, 2005) and predictive validity for several social behaviors over a time span of several weeks (e.g., Friese, Hofmann, & Wänke, 2008; Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008).

In previous research, automatic affective reactions have been found to predict self-regulatory behavior under conditions that enhance the influence of impulses on behavior, but less so under conditions that make the control of impulses easier (Friese & Hofmann, 2008; Friese, Hofmann, & Wänke, 2008; Hofmann & Friese, 2008; Hofmann, Rauch, & Gawronski, 2007; for an overview see Friese, Hofmann, & Schmitt, 2008). In these studies, impulse control was hampered by - for example - cognitive distraction during behavioral execution, a temporary depletion of self-regulatory resources, and alcohol intoxication. Hence, there is good evidence to assume that automatic affective reactions will also reflect the impulsive precursors that are assumed to translate into behavior for individuals low in trait self-control.

1.4. The present research

In the present research we set out to directly scrutinize the idea that impulsive precursors influence self-regulatory behavior for low trait self-control individuals more strongly than for high trait self-control individuals. To this end, we assessed trait self-control and automatic affective reactions as impulsive precursors of behavior and used these to predict potato chip consumption in a taste-and-rate task (Study 1), and self-reported alcohol consumption (Studies 2a and 2b). To generalize our findings, we used two different implicit measures to assess automatic affective reactions, a variant of the IAT (Karpinski & Steinman, 2006; Studies 1 and 2a) and an AMP (Payne et al., 2005; Study 2b). We hypothesized automatic affective reactions to predict self-regulatory behavior better for participants low as compared to high in trait self-control. In addition, we investigated the contribution of trait self-control for behavior regulation when trait impulsivity was controlled for (Studies 2a and 2b).

2. Study 1

Participants were invited to participate in a study on "personality and taste perception." After completing a measure of automatic affective reactions they tasted and rated a serving of potato chips, a task that we hypothesized would draw on self-control, because potato chips are very tasty, but also unhealthy.

2.1. Method

2.1.1. Participants and procedure

Thirty-eight psychology students (33 female; $M_{age} = 23.21$ years, $SD_{age} = 4.50$) of the University of Basel participated for course credit. In a first mass testing session participants filled out a number of questionnaires including the trait self-control scale. A second session took place 2–10 days later ($M = 5.79$, $Mdn = 4.00$, $Md = 8.00$, $SD = 2.70$) with up to 4 persons per session between 2 pm and 6 pm. After signing an informed consent form, the participants were informed that this study was concerned with "personality and taste experiences." First, participants completed a measure of automatic affective reactions relating to potato chips. To bolster the cover story, the experimenter told the participants that after the product-testing phase they were going to judge some personality characteristics of a person presented in a job interview. In fact, this task was not realized. Next followed the product-testing phase in which participants tried and rated a serving of potato chips. They were informed that they were free to eat as much or as little as they wanted. Finally, participants provided demographic information and answered several control questions. After all data collection was completed, the participants were debriefed via e-mail.

2.1.2. Measures

2.1.2.1. Automatic affective reactions. To measure automatic affective reactions we used an SC-IAT (Karpinski & Steinman, 2006) relating to potato chips. IAT measures are among the most widely used and validated implicit measures (for recent overviews, see Lane, Banaji, Nosek, & Greenwald, 2007; Nosek, Greenwald, & Banaji, 2006). In the SC-IAT, the stimuli of three different categories (e.g., pleasant, unpleasant, chips) appear on the screen that participants need to sort with just two response keys. In one critical block, the pleasant and chips stimuli share one response key. In a second critical block, this assignment is reversed such that the unpleasant and chips stimuli share one response key. Response latencies are recorded for each trial. Most importantly, it is assumed that the automatic affective reaction toward chips is more positive the faster the average response latencies are in the block in which the pleasant and chips stimuli share one response key (compared to the block in which the unpleasant and chips stimuli share one response key).

Category labels in the SC-IAT were *pleasant*, *unpleasant*, and *chips*. Evaluative stimuli were positive and negative words and pictures (taken from the International Affective Picture System, IAPS; Lang, Bradley, & Cuthbert, 2005) used successfully in previous research (Friese, Hofmann, & Wänke, 2008). Target stimuli were pictures of potato chips of the same brand as used in the product-testing phase. Each category was represented by five stimuli. In a first training block of 20 trials, participants sorted pleasant and unpleasant stimuli on two different response keys. In the first (second) combined block, the target category chips shared one response key with the attribute category (un)pleasant. Each combined block contained 70 trials in a predetermined random order. Block order was held constant across participants, because the primary interest of this study was on individual differences and not on mean SC-IAT effects (Egloff & Schmukle, 2002; Gawronski, 2002). The proportion of left and right key responses was 3:4 in the first combined block and 4:3 in the second combined block. SC-IAT scores were calculated using the D-algorithm (Greenwald, Nosek, & Banaji, 2003) such that more positive values indicated a more positive reaction to potato chips. The mean error rate for the SC-IAT was 7.83%. To calculate internal consistency we created four mutually exclusive subsets of trials and calculated SC-IAT scores separately for each subset. Cronbach's alpha across these four scores was .85.

2.1.2.2. Trait self-control. Trait self-control was assessed using the short version of the scale provided by Tangney et al. (2004). The 13 items were combined to form an index of trait self-control with a possible range between 0 (low trait self-control) and 5 (high trait self-control; $\alpha = .80$).

2.1.2.3. Potato chip consumption. Each participant was served the content of a 90 g bag of potato chips of the best-known brand of potato chips in Switzerland. During the product test participants answered several questions referring to the size of the chips, their color, packaging, and the like to bolster the cover story. After 8 min, the experimenter removed the potato chips from participants' desks. Following the session, the amount eaten by each participant was determined with a scale by subtracting the final weight from the initial weight. Consumption served as the dependent variable.

2.2. Results

2.2.1. Preliminary analyses

To reduce the skewness of the distribution of potato chip consumption we log-transformed this variable (Vohs & Heatherton, 2000). For ease of interpretation, raw mean values are shown in Table 1 and in Fig. 1. Means, standard deviations, and correlations are depicted in Table 1. No significant relationships between variables emerged. These zero-order correlations should, however, be interpreted in the context of the interactions reported below.

2.2.2. Potato chip consumption

To investigate the assumption that trait self-control moderates the impact of automatic affective reactions on eating behavior, we ran a multiple regression analysis. To arrive at the correct beta weights we z-standardized all variables before the multiple regression analysis (Aiken & West, 1991). Potato chip consumption served as the dependent variable, and automatic affective reactions, trait self-control, and their two-way interaction were entered as predictors ($R^2 = .18$). Neither the main effect of automatic affective reactions, nor the main effect of trait self-control reached significance ($\beta = .21$, $t(34) = 1.35$, $p = .185$ for automatic affective reactions, and $\beta = -.14$, $t(34) = -.87$, $p = .392$ for trait self-control). As expected, the interaction between automatic affective reactions and trait self-control was significant, $\beta = -.31$, $t(34) = -2.32$, $p = .026$. Simple slope tests (Aiken & West, 1991) revealed that automatic affective reactions significantly predicted potato chip consumption for participants scoring one standard deviation below the mean of trait self-control $\beta = .52$, $t(34) = 2.50$, $p = .017$, but were unrelated to consumption for participants scoring one standard deviation above the mean of trait self-control, $\beta = -.10$, $t(34) = -0.51$, $p = .616$ (see Fig. 1).

2.3. Discussion

In line with the hypotheses, automatic affective reactions as precursors of impulsive behavior predicted consumption of potato chips in a product test well for participants low in trait self-control, but was unrelated to behavior for participants high in trait self-control. This result suggests that participants high, but not low in trait self-control, were able to counteract their impulsive tendencies. Notably, the zero-order correlation between trait self-control and consumption was not significant ($r = -.11$, $p = .51$). In the absence of an individual difference measure of impulsive precursors of behavior, one would have had to conclude that in this study, trait self-control did not affect the eating behavior of a tempting, but unhealthy food. A closer examination with consideration of individual differences in automatic affective reactions revealed that trait self-control was indeed quite effective in guiding behavior. However, this guidance was not necessarily reflected in low consumption rates. Instead, consistent with the theoretical embedding of the construct, individuals high in trait self-control were less influenced by their impulses compared to individuals low in trait self-control. In other words, an increased impact of impulses on behavior resulted in little consumption for participants with comparatively negative automatic affective reactions, but it resulted in high consumption for participants with comparatively positive automatic affective reactions toward potato chips. This result suggests that individual differences in impulsive precursors of behavior may convey important insights about the dynamics of self-regulatory behavior determination.

Table 1
Means, standard deviations, and zero-order correlations between variables in Study 1.

	1	2	3
1. Automatic affective reactions (SC-IAT)	–	.07	.19
2. Trait self-control		–	−.11
3. Potato chip consumption			–
M	.43	2.49	21.18 g
SD	.47	.72	12.32 g

Note: $N = 38$.

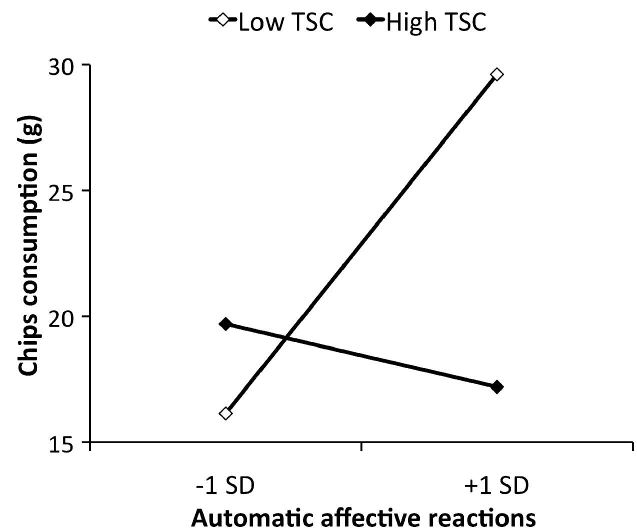

Fig. 1. Consumption of potato chips in grams as a function of automatic affective reactions (as measured with a SC-IAT) and trait self-control (TSC; low vs. high) in Study 1 (estimated slopes).

3. Study 2a

In the second study we aimed to replicate the results from Study 1 in a different domain and for a self-regulatory behavior across a much longer time period than a laboratory taste-and-rate task. Specifically, we investigated the influence of impulsive precursors of behavior on self-reported alcohol consumption as a function of trait self-control. As measures of alcohol consumption we employed the consumption of beer, wine, and hard liquor for: (a) an ordinary drinking occasion and (b) the week before participation in the study. In addition, we investigated the unique contribution of trait self-control when controlling for trait impulsivity as a related construct (see above).

3.1. Method

3.1.1. Participants

One hundred fifty-six individuals (112 female) participated in the study. We excluded six participants who committed 25% or more errors in the SC-IAT (Karpinski & Steinman, 2006; see below). The mean age of the remaining sample was 24.63 years ($SD = 5.23$). Ten participants did not provide any information about their alcohol consumption during the previous week. Another six participants were outliers on this variable according to box plot analyses and were therefore excluded from all analyses involving this variable. As compensation, participants were offered entry into a lottery to win a portable music player, which was raffled after data collection was complete.

3.1.2. Procedure

Data collection was carried out over the Internet using Inquisit Web 3.0.2 (2008). First, participants completed a measure of automatic affective reactions towards alcohol. Next, we asked several questions about their alcohol consumption on an average drinking occasion in general, and during the previous week more specifically. After this, participants completed the trait self-control measure, an impulsivity questionnaire, and provided demographic information and their e-mail address if they wanted to enter the lottery for the portable music player.

3.1.3. Measures

3.1.3.1. Automatic affective reactions. To assess automatic affective reactions towards alcohol we used an SC-IAT (Karpinski & Steinman, 2006) that was similar to the one used in Study 1 with the following exceptions: The label *alcohol* replaced the label *chips*. Target stimuli were ten words and pictures relating to alcohol (e.g., the words beer or wine, pictures of beer, wine, or hard liquor). The mean error rate was 6.49%. Cronbach's alpha was .79.

3.1.3.2. Trait self-control and trait impulsivity. Trait self-control was again assessed using the short version of the scale by Tangney et al. (2004; α = .80). Individual differences in trait impulsivity were assessed with an adapted version of the German I_7 scale by Eysenck and colleagues (Eysenck, Daum, Schugens, & Diehl, 1990; Eysenck, Pearson, Easting, & Allsopp, 1985). The questions that were used in the original form of this scale were transformed into statements, and participants indicated their degree of agreement on a scale ranging from 1 (strong rejection) to 7 (strong affirmation). Sample items of the 17-item scale are "I am an impulsive individual" and "In general, I do and say things without thinking about them first." Internal consistency was α = .84.

3.1.3.3. Alcohol consumption on an ordinary drinking occasion. First, participants indicated the size of the beer glasses they usually use, because sizes vary greatly in Switzerland and Germany. Next, they were asked "When you drink beer, how many glasses/cans of the indicated size do you usually consume?" Response options ranged from 1 to 15, "more," and "I don't drink beer." Similar questions followed for wine consumption (glasses of 0.2 l) and hard liquor like Vodka or Whiskey (shots of 0.02 l). To compute the dependent measure we transformed the data into alcohol units. The following amounts were set as equivalent to 1 alcohol unit: a 0.25 l glass of beer, a 0.1 l glass of wine, and a 0.02 l glass of hard liquor (European Commission, 2006). The sum of consumed alcohol units in terms of beer, wine, and hard liquor served as the dependent measure. This was most appropriate because automatic affective reactions as the proposed primary predictor of alcohol consumption referred to alcohol in general, and not to specific alcoholic beverages.

3.1.3.4. Alcohol consumption during the previous week. To assess participants' alcohol consumption during the previous week we asked them to carefully think back and to jot down in a textbox, separately for each day, how many glasses of beer (0.33 l), wine (0.1 l) and hard liquor (1 drink/shot) they had consumed. Again, we transferred these numbers into alcohol units and summed them to form the dependent measure.

The assessment of self-reported alcohol use has been found valid given that participants are sober at the time of participation and assured confidentiality (Sobell & Sobell, 1990). Both Studies 2a and 2b fulfilled these requirements. Similar assessment procedures have been successfully used in previous research (e.g., Wiers, Hoogeveen, Sergeant, & Gunning, 1997; Wiers, van Woerden, Smulders, & de Jong, 2002).

3.2. Results and discussion

3.2.1. Preliminary analyses

Means, standard deviations, and correlations for all variables are depicted in Table 2. Trait self-control was significantly negatively related to both alcohol consumption on an ordinary drinking occasion and consumption during the previous week. Automatic affective reactions were related to both dependent variables such that more positive automatic affective reactions were associated with more alcohol consumption. As could be expected on theoretical grounds, trait self-control and trait impulsivity were highly negatively related, but not so highly related as to suggest completely redundant concepts. Again, these correlations should be interpreted in the context of the multiple regression analyses reported below.

3.2.2. Alcohol consumption during an ordinary drinking occasion

As in the previous study, we z-standardized all variables prior to the multiple regression analyses (Aiken & West, 1991). In a first step, we ran a multiple regression analysis with alcohol consumption during an ordinary drinking occasion as the dependent variable, and automatic affective reactions, trait self-control, and their interaction as predictors (R^2 = .14). The main effect of automatic affective reactions was significant, β = .27, t(146) = 3.41, p = .001, indicating that more positive automatic affective reactions were associated with higher alcohol consumption. The main effect of trait self-control was not significant, $\beta = -.09$, $t(146) = -1.09$, p = .276. Most importantly, the interaction between automatic affective reactions and trait self-control was highly significant, $\beta = -.26$, $t(146) = -2.83$, p = .005. Simple slope analyses revealed that, as expected, automatic affective reactions were related to alcohol consumption during an ordinary drinking occasion for participants low in trait self-control, β = .53, t(146) = 4.16, p < .001, but were unrelated to alcohol consumption for participants high in trait self-control, β = .01, t(146) = 0.09, p = .927 (see Fig. 2).

Table 2
Means, standard deviations, and zero-order correlations between variables in Study 2a.

	1	2	3	4	5
1. Automatic affective reactions (SC-IAT)	–	−.20*	.16	.27***	.30***
2. Trait self-control		–	−.58***	−.18*	−.18*
3. Impulsivity			–	.13	.01
4. Alcohol consumption on an ordinary drinking occasion (au)				–	.59***
5. Alcohol consumption last week (au)					–
M	.10	2.64	3.09	3.36 au	7.12 au
SD	.44	.72	.79	1.94 au	7.29 au

Note: N = 150, for analyses involving "Alcohol consumption during the previous week" N = 134. au = alcohol units.
* p < .05.
*** p < .001.

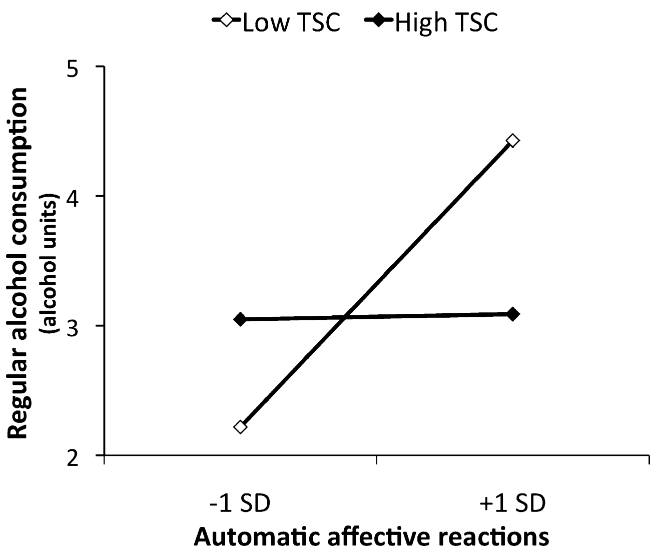

Fig. 2. Self-reported alcohol consumption on an ordinary drinking occasion in alcohol units as a function of automatic affective reactions (as measured with the SC-IAT) and trait self-control (TSC; low vs. high) in Study 2a (estimated slopes).

Next, we inspected the moderating role of trait impulsivity for the influence of automatic affective reactions on behavior in a multiple regression analysis, with automatic affective reactions, trait impulsivity, and their interaction serving as predictors, and alcohol consumption during an ordinary drinking occasion as the dependent variable ($R^2 = .14$). Automatic affective reactions were again a significant predictor of alcohol consumption during an ordinary drinking occasion, $\beta = .27$, $t(146) = 3.33$, $p = .001$, whereas trait impulsivity was not, $\beta = .10$, $t(146) = 1.22$, $p = .226$. Although there was a tendency for an interaction between automatic affective reactions and trait impulsivity in the expected direction, it was clearly not significant, $\beta = .10$, $t(146) = 1.42$, $p = .159$. In a multiple regression model including automatic affective reactions, trait self-control, trait impulsivity, and all possible two-way interactions, only automatic affective reactions ($p = .001$) and the interaction between automatic affective reactions and trait self-control ($p = .017$) emerged as significant predictors; all other $ps > .51$.

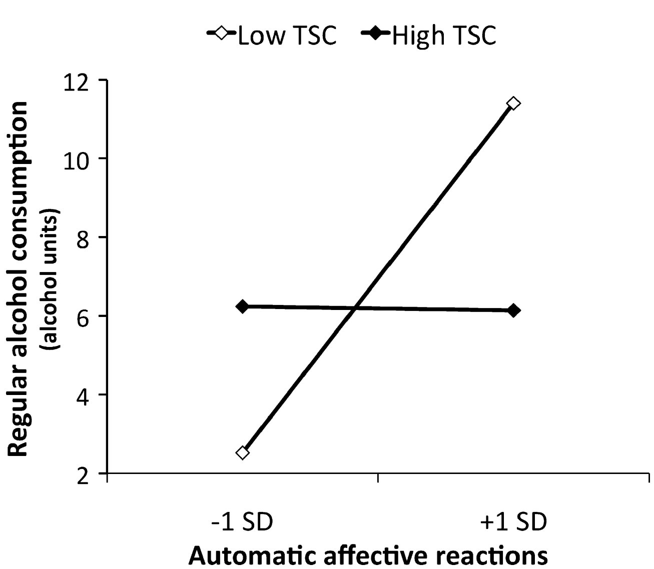

Fig. 3. Self-reported alcohol consumption during the previous week in alcohol units as a function of automatic affective reactions (as measured with the SC-IAT) and trait self-control (TSC; low vs. high) in Study 2a (estimated slopes).

3.2.3. Alcohol consumption during the previous week

Regarding the dependent variable alcohol consumption during the previous week, we followed the same procedure. A first multiple regression analysis investigated the interplay of trait self-control and automatic affective reactions with regard to drinking behavior ($R^2 = .16$). The main effect of automatic affective reactions was significant, $\beta = .28$, $t(130) = 3.46$, $p = .001$, whereas the trait self-control main effect was not, $\beta = -.07$, $t(130) = -.85$, $p = .402$. Most importantly, trait self-control moderated the effect of automatic affective reactions on drinking behavior during the previous week, $\beta = -.29$, $t(130) = -3.08$, $p = .002$. Simple slope analyses (Aiken & West, 1991) confirmed that automatic affective reactions were highly influential for individuals low in trait self-control, $\beta = .57$, $t(130) = 4.49$, $p < .001$, whereas their behavioral impact was close to zero for individuals high in trait self-control, $\beta = -.01$, $t(130) = -0.56$, $p = .955$ (see Fig. 3).

We ran a second multiple regression analysis to investigate the effects of trait impulsivity ($R^2 = .11$). In this analysis, automatic affective reactions again emerged as a good predictor of alcohol consumption during the previous week, $\beta = .30$, $t(130) = 3.63$, $p < .001$, and trait impulsivity did not, $\beta = -.02$, $t(130) = -0.23$, $p = .820$. As anticipated, the interaction between both variables was close to approaching statistical significance, $\beta = .15$, $t(130) = 1.93$, $p = .056$. Automatic affective reactions were related to behavior for highly impulsive individuals, $\beta = .45$, $t(130) = 3.94$, $p < .001$, but not for individuals low in trait impulsivity, $\beta = .15$, $t(130) = 1.35$, $p = .179$.

Finally, in a multiple regression analysis with automatic affective reactions, trait self-control, trait impulsivity, and all possible two-way interactions predicting the previous week's alcohol consumption, only automatic affective reactions ($p = .001$) and their interaction with trait self-control ($p = .021$) remained significant predictors in the model; all other $ps > .19$.

These findings corroborate and extend those from Study 1 in a different behavioral domain and with two related, but distinct dependent variables that: (a) stretched over a longer time span, and (b) also tapped regular consumption tendencies. In addition, the results showed that the theoretically grounded moderating effect of trait self-control for the impact of automatic affective reactions persisted even when statistically controlling for the influence of the conceptually related construct of trait impulsivity.

4. Study 2b

The last study aimed to extend the hitherto existing findings to a different measure of automatic affective reactions. Specifically, Study 2b was closely modeled after Study 2a with the exception that it employed an AMP (Payne et al., 2005) instead of an SC-IAT to assess individual differences in automatic affective reactions.

4.1. Method

4.1.1. Participants

One hundred twenty-nine German and Swiss individuals (94 female) participated in the study. Ages ranged from 17 to 35 with a mean of 23.07 years ($SD = 3.20$). Five participants did not provide any information about their alcohol consumption during the previous week and therefore had to be excluded from all analyses pertaining to this dependent variable. Again, participants were offered entry into a lottery to win a portable music player, which was raffled after data collection was complete.

4.1.2. Procedure

Similar to Study 2a, data were collected on the Internet. The procedure followed that from Study 2a with the following exceptions: As a measure of automatic affective reactions participants completed an affect misattribution paradigm (Payne et al., 2005) instead of a SC-IAT (Karpinski & Steinman, 2006). An additional question in the end of the study asked for Chinese proficiency as this could distort results of the AMP (see below).

4.1.3. Materials

Materials were similar to Study 2a except for the adoption of the measure of automatic affective reactions and a control question referring to Chinese proficiency. Internal consistencies were $\alpha = .77$ for the trait self-control measure and $\alpha = .78$ for the trait impulsivity measure.

4.1.3.1. Automatic affective reactions. We used an AMP (Payne et al., 2005; see also Murphy & Zajonc, 1993) to assess automatic affective reactions. The AMP relies on the assumption that people tend to misattribute their affect from one source to another under conditions that do not allow for a definite attribution to a particular source. In the AMP, prime stimuli are shortly presented before Chinese characters, which participants are instructed to evaluate. Evidence shows that these evaluations are biased by the preceding prime pictures, because people are unable to differentiate between their automatic affective reactions to the primes and to the Chinese characters. Because they lack awareness of the source of their reactions, these are difficult to monitor and to control (Payne et al., 2005).

The AMP was modeled closely after the procedure suggested by Payne et al. (2005). Participants were informed that in the following task Chinese characters would appear on the screen that they were to evaluate as *pleasant* or *unpleasant* by pressing one of two response keys. Further, each character would be preceded by a stimulus from "everyday life" that would serve to signal the onset of another Chinese character. Participants were explicitly told that they should not let the stimuli from everyday life influence their judgment of the Chinese characters.

As prime stimuli we used 20 different pictures depicting glasses or bottles of beer, wine, or hard liquor mostly taken from publicly accessible websites. Additionally, we used 20 neutral stimuli taken from the IAPS (Lang et al., 2005) as primes. Each trial started with a prime picture being presented for 75 ms, which was followed by a white screen for 125 ms. Then 1 of 80 different Chinese characters taken from Payne et al. (2005) appeared for 200 ms and was replaced by a black and white pattern mask until the participant made a response.

The AMP started with 10 practice trials. The main task comprised 80 trials. Each prime stimulus was presented twice whereas each Chinese character appeared only once. AMP scores were calculated on the basis of all responses slower than 350 ms and faster than 1500 ms to correct for responses made prior to perceiving the stimulus or momentary inattention, respectively. Individual difference scores were computed as the proportion of *pleasant* responses in response to alcohol-prime trials. A mean AMP score of .50 thus indicates equal numbers of *pleasant* and *unpleasant* responses to Chinese characters following alcohol primes with higher scores indicating more *pleasant* responses. To calculate internal consistency, four mutually exclusive subsets of alcohol-prime trials were created and AMP scores were calculated separately for each subset. Cronbach's alpha across these four scores was .84.

4.1.3.2. Chinese proficiency. Chinese proficiency was assessed by asking "How well do you speak Chinese?" with response options ranging from 1 (not at all) to 4 (fluently). Chinese proficiency was assessed because for Chinese speakers the characters would not be ambiguous, which is a prerequisite for an affect misattribution to occur. No participants were excluded on the basis of this criterion.

4.2. Results and discussion

4.2.1. Preliminary analyses

Means, standard deviations, and zero-order correlations for all variables are depicted in Table 3. Trait self-control was only correlated with alcohol consumption during the previous week and with trait impulsivity in a similar range as in Study 2a. The data analysis strategy followed that of Study 2a.

4.2.2. Alcohol consumption on an ordinary drinking occasion

In a first multiple regression analysis with z-standardized variables, automatic affective reactions, trait self-control, and their interaction predicted alcohol consumption on an ordinary drinking occasion ($R^2 = .09$). The main effect of automatic affective reactions was significant, $\beta = .18$, $t(125) = 2.06$, $p = .041$, whereas the main effect of trait self-control was not, $\boldsymbol{\beta} = -.01$, $t(125) = -0.06$, $p = .953$. Most importantly for the present purposes, and as expected, the interaction between automatic affective reactions and trait self-control was highly significant, $\beta = -.25$, $t(125) = -3.01$, $p = .003$. As expected, simple slope analyses revealed that automatic affective reactions were a significant predictor of alcohol consumption on an ordinary drinking occasion for participants low in trait self-control, $\beta = .43$, $t(125) = 3.38$, $p = .001$, but were largely unrelated to behavior for participants high in trait self-control, $\beta = -.08$, $t(125) = -0.68$, $p = .500$ (see Fig. 4).

In a second step, we ran a similar multiple regression analysis with trait impulsivity instead of trait self-control ($R^2 = .05$). Automatic affective reactions were a marginally significant predictor of alcohol consumption on an ordinary drinking occasion, $\beta = .15$, $t(125) = 1.67$, $p = .097$. Trait impulsivity was not related to behavior, $\beta = .04$, $t(125) = 0.42$, $p = .673$. Supporting the picture that evolved from Study 2b, the interaction between automatic

Table 3
Means, standard deviations, and zero-order correlations between variables in Study 2b.

	1	2	3	4	5
1. Automatic affective reactions (AMP)	–	.00	.04	.15	.12
2. Trait self-control		–	−.60***	.03	−.19*
3. Impulsivity			–	.01	.07
4. Alcohol consumption on an ordinary drinking occasion (au)				–	.45***
5. Alcohol consumption last week (au)					–
M	.53	2.65	3.21	4.04 au	9.73 au
SD	.20	.67	.66	2.79 au	13.80 au

Note: $N = 129$, for analyses involving "Alcohol consumption during the previous week" $N = 124$. au = alcohol units.
* $p < .05$.
*** $p < .001$.

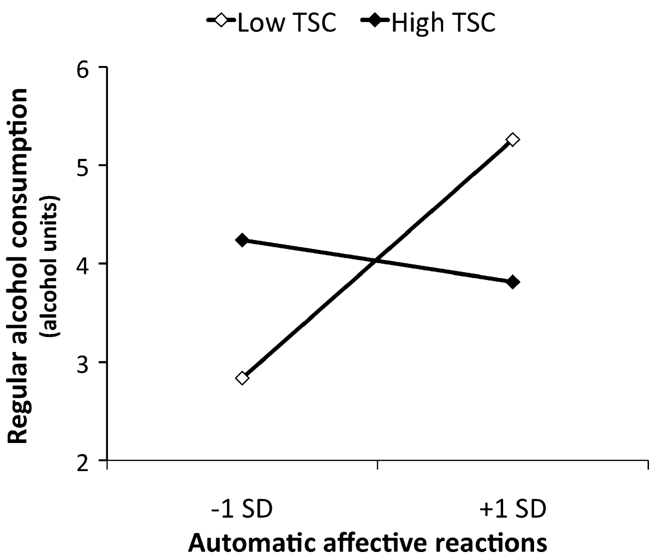

Fig. 4. Self-reported alcohol consumption on an ordinary drinking occasion in alcohol units as a function of automatic affective reactions (as measured with the AMP) and trait self-control (TSC; low vs. high) in Study 2b (estimated slopes).

affective reactions and trait impulsivity was marginally significant, $\beta = .15$, $t(125) = 1.84$, $p = .068$. In a multiple regression model including automatic affective reactions, trait self-control, trait impulsivity, and all possible two-way interactions, only automatic affective reactions ($p = .037$) and the interaction between automatic affective reactions and trait self-control ($p = .018$) emerged as significant predictors; all other *p*s > .27.

4.2.3. Alcohol consumption during the previous week

In a first multiple regression analysis using automatic affective reactions, trait self-control, and their interaction predicting alcohol consumption during the previous week ($R^2 = .05$), only trait self-control contributed significantly to the prediction of behavior, $\beta = -.19$, $t(120) = -2.15$, $p = .034$. Neither the main effect of automatic affective reactions nor the interaction between the two predictors were significant ($\beta = .11$, $t(120) = 1.23$, $p = .212$, for automatic affective reactions, and $\beta = .00$, $t(120) = -0.51$, $p = .959$, for the interaction).

In a second multiple regression analysis involving automatic affective reactions, trait impulsivity, and their interaction ($R^2 = .02$), none of these predictors was significantly related to drinking behavior during the previous week ($\beta = .11$, $t(120) = 1.25$, $p = .214$ for automatic affective reactions, $\beta = .07$, $t(120) = 0.79$, $p = .429$ for trait impulsivity, and $\beta = .06$, $t(120) = 0.65$, $p = .519$, for their interaction).

The results from Study 2b conceptually replicate and extend previous findings. A measure of automatic affective reactions that did not rely on reaction times, but on the misattribution of aroused affect, predicted regular alcohol consumption, and this was true in particular for individuals with low trait self-control. A similar effect emerged for trait impulsivity, a concept that is negatively related to trait self-control. However, when investigating the effects of trait self-control and trait impulsivity simultaneously, the interaction of trait self-control with automatic affective reactions persisted, whereas the interaction of trait impulsivity and automatic affective reactions was clearly not significant.

In contrast to our expectations, neither trait self-control nor trait impulsivity moderated the effect of automatic affective reactions on alcohol consumption during the previous week. This dependent variable focused on a comparatively short time frame compared to the assessment of alcohol consumption during an ordinary drinking occasion. Thus, this measure was more susceptible to temporary fluctuations in alcohol consumption, which may have made it more difficult to predict. Although this reasoning remains speculative, it may account for these null findings.

5. General discussion

One central tenet in research on self-control is that impulses are more influential in guiding behavior for individuals with weak self-control abilities as compared to those with stronger self-control abilities (Baumeister et al., 1994). Although impulses are assumed to arise just as much for individuals high and low in trait self-control, individuals high in trait self-control are expected to more readily override these impulses and reduce their influence on behavior execution (Baumeister & Heatherton, 1996; Tangney et al., 2004).

Impulses vary between individuals. Whereas some people are tempted by, for example, potato chips, others are not. To conclusively test the idea that impulses influence behavior more strongly for individuals low than high in trait self-control, one not only needs a measure of trait self-control, but also of individual differences in impulsive tendencies toward the temptation under investigation.

The present research provides evidence for this reasoning in three studies. Following previous research (e.g., Friese, Hofmann, & Schmitt, 2008; Hofmann, Friese, & Strack, 2009), we argued that individual differences in automatic affective reactions represent impulsive precursors of behavior that may translate into self-regulatory behavior toward the temptation under investigation. Substantiating this analysis, automatic affective reactions were related to behavior more strongly for individuals low than high in trait self-control. Individuals high in trait self-control prevented their impulses from influencing behavior. This pattern emerged for several different, typical self-regulatory behaviors: potato chip consumption in a taste-and-rate task (Study 1), alcohol consumption on an ordinary drinking occasion (Studies 2a and 2b), and alcohol consumption during the week prior to participation in the study (Study 2a). We found converging evidence not only over different self-regulatory behaviors, but also over different measures of automatic affective reactions (SC-IATs and an AMP). This is noteworthy in light of the fact that the SC-IAT represents a response interference task (De Houwer, 2001, 2003) whereas the AMP does not (Gawronski, Deutsch, LeBel, & Peters, 2008). Conceptual replications of empirical effects with both types of measures are particularly compelling as task-specific influences can be ruled out with greater confidence than if the results relied on one type of measure only (Gawronski et al., 2008).

Further bolstering confidence in the moderating role of trait self-control for the impulse–behavior consistency, the effects persisted when controlling for the related construct trait impulsivity (and the respective interactions) in Studies 2a and 2b. Although in several cases trait impulsivity exerted moderating effects as well when considered independently from trait self-control, these disappeared when trait self-control was controlled for. These findings imply that in conjunction with automatic affective reactions, trait self-control accounted for unique variance in self-regulatory behavior whereas the unique variance of trait impulsivity in conjunction with automatic affective reactions was negligible.

Previous research has found main effects of trait self-control on various kinds of self-regulatory behaviors (i.e., significant correlations between trait self-control and behavior; Schmeichel & Zell, 2007; Tangney et al., 2004). In the present research we did not always find such main effects, but we did find interactions with automatic affective reactions that explained behavioral variance. Is this partial lack of trait self-control main effects problematic for the interpretation of the present findings? We think it is not. In contrast, it underlines the value of the approach taken in the present research. Because there is variance in impulses, an increased reliance on impulses may result in increased or decreased consumption of a supposedly tempting product. The crucial point is that nothing tempts everybody. Positive and negative impulsive tendencies by different individuals may level each other out, leading to similar overall amounts of consumption for individuals high and low in trait self-control. Main effects of trait self-control will only emerge if in a given sample individuals on average are clearly "tempted by the temptation" under investigation. However, even a person with low trait self-control is unlikely to dig into the potato chip bag if she or he has no impulse to do so.

5.1. Resources vs. motivation

An intriguing question pertains to the relative roles that a lack of resources on one hand and a lack of motivation to control prepotent responses on the other hand have for the increased influence of impulses in individuals low in trait self-control. Unfortunately, the present data do not speak to this question. However, research on the temporary depletion of self-regulatory resources suggests that even individuals with low resources can "pull themselves together" provided a sufficient motivation to do so (Muraven & Slessareva, 2003). That is because the self-control model (Muraven & Baumeister, 2000) assumes a *relative* depletion in the sense that after exerting self-control, individuals possess fewer resources, but still have some left. The increased influence of impulses on behavior is thus partly due to an actual reduction of resources, and partly due to a motivational tendency to conserve the remaining resources (Muraven, Shmueli, & Burkley, 2006). Exerting self-regulatory strength under conditions of relative depletion will thus especially increase the likelihood of subsequent self-control failure.

Applied to the dispositional level these findings suggest that individuals high in trait self-control can "afford" to make use of their self-control strength more regularly in daily life without running in danger of expending resources to a worrisome extent. Corroborating this reasoning, individuals high in trait self-control (following a self-control training) were more resistant to the debilitating effects of self-control tasks than individuals low in trait self-control (who did not receive a training; Oaten & Cheng, 2006a, 2006b, 2007). Thus, high trait self-control seems to work like a buffer against self-regulatory depletion, allowing for more generous exertion of self-control than low trait self-control. Although this reasoning could explain the current data, it remains speculative until it is empirically tested.

5.2. Training self-control

The lack of overriding of potentially disadvantageous impulses leads to undesirable outcomes in many personal spheres, as noted earlier. In fact, many of the most prevalent contemporary societal problems result from deficits in self-control (Baumeister et al., 1994; Tice & Ciarocco, 1998). The investigation of possible interventions to improve trait self-control is therefore not only consequential from a scientific point of view, but also of potentially high practical relevance for society at large. Self-control programs have a long history, especially in clinical psychology where impulsive behaviors lead to a variety of problematic behaviors including alcohol and nicotine abuse, or unsatisfactory psychological adjustment (e.g., Bergin, 1969; Delahunt & Curran, 1976; Kendall & Braswell, 1993; Squires, 2001; Walters, 2000). More recent programs build on the idea that exercising self-control in one domain will in the long run lead to improvements in self-control in other domains as well, just like a muscle that is trained by frequent exercise and that may be used for various purposes (Muraven & Baumeister, 2000). Indeed, these programs found increased stamina in response to self-control challenges compared to control groups who did not receive self-control trainings (Gailliot, Plant, Butz, & Baumeister, 2007; Muraven, Baumeister, & Tice, 1999; Oaten & Cheng, 2006a, 2006b, 2007).

Future research should start to combine these promising findings with the recent knowledge gained about automatic processes that are involved in self-control (Palfai, 2004). For example, interventions may attend to various stages of impulsive behavior determination (Strack & Deutsch, 2004) such as attentional biases (Fadardi & Cox, 2007; Friese, Bargas-Avila, Hofmann, & Wiers, 2009), evaluative associations that form the basis of automatic affective reactions (Gibson, 2008), or automated behavioral motor tendencies (Kawakami, Phills, Steele, & Dovidio, 2007; Wiers, Rinck, Kordts, Houben, & Strack, 2008, in press).

6. Conclusions

Trait self-control moderates the impact that impulses have on people's behavior. Because impulses vary between individuals it is helpful to assess these individual differences to conclusively show how they guide the behavior of individuals with weak self-control abilities and that they are overridden by those with strong self-control abilities.

Acknowledgement

We thank Jane Thompson for helpful comments on an earlier version of this manuscript. Preparation of this article was supported by a grant from the German Science Foundation (DFG) to Wilhelm Hofmann (Hofm 4175/3-1).

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