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And deplete us not into temptation: Automatic attitudes, dietary restraint, and self-regulatory resources as determinants of eating behavior ☆

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Abstract

Linking contemporary models of self-regulation to recent research on automatic attitudes, the present study investigated the impact of automatic candy attitudes, dietary restraint standards, and self-regulation resources on eating behavior. Participants were assigned to either an emotion suppression task (low self-regulation resources) or an emotion flow task (high self-regulation resources), and were then given an opportunity to taste candies. When self-regulation resources were high, candy consumption was uniquely related to dietary restraint standards (but not automatic candy attitudes). In contrast, when self-regulation resources were low, candy consumption was primarily predicted by automatic candy attitudes, with dietary restraint standards showing a tendency for counterintentional effects. These results indicate that the behavioral impact of automatic attitudes and personal standards depends on available control resources. Implications for research on automatic attitudes and self-regulation are discussed.

Keywords: Automatic attitudes; Dietary restraint; Eating behavior; Ego depletion; Impulsive behavior; Self-control; Self-regulation

People are often tempted by their impulses, urges, and cravings. Because giving way to one's immediate hedonic impulses is not always possible or advisable in the light of social or personal constraints, human beings acquired the capacity for *self-control* or *self-regulation* in a historical process of civilization (Elias, 1939/2000; Freud, 1930/1961). This capacity can be defined as the "ability to override or change one's inner responses, as well as to interrupt undesired behavioral tendencies and refrain from acting on them" (Tangney, Baumeister, & Boone, 2004, p. 275).

Obviously, not all impulses require self-control, as acting in line with one's impulses often has no negative consequences (e.g., drinking a cup of water when being thirsty). However, in many circumstances the implications of a certain impulse (e.g., the desire to eat a candy bar) are at odds with personal goals (e.g., "I want to lose weight."). In such cases, the resulting conflict between impulse and self-control can be described as a tug-of-war in which the stronger competitor wins (Baumeister, Heatherton, & Tice, 1994; Mischel, 1996; Muraven & Baumeister, 2000). For example, in their model of *ego depletion*, Baumeister and colleagues argued that the capacity for self-control resembles a muscle that may become "tired" over the course of using it (Baumeister, Bratlavasky, Muraven, & Tice, 1998; Muraven, Tice, & Baumeister, 1998). Thus, engaging in self-regulation often depletes people's subsequent ability to control their

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behavior. Consistent with this assumption, Vohs and Heatherton (2000, Study 3) showed that emotion suppression undermined participants' success in restraining their eating behavior in a subsequent ice-cream tasting task. In a similar vein, Muraven, Collins, and Neinhaus (2002) found a decrease in the control of alcohol consumption when participants had to suppress thoughts of a white bear before. Finally, in the domain of prejudice, Richeson and colleagues demonstrated that controlling one's behavior in interracial interactions led to impaired performance in a subsequent task that required a high level of executive control (Richeson et al., 2003; Richeson & Shelton, 2003).

So far, research on self-regulation has primarily focused on the control aspect of human behavior. However, the determinants of impulsive tendencies are much less clear. In the present article, we make a suggestion to fill this gap by linking the proposed conflict between self-control and impulse to recent research on automatic attitudes (for a review, see Petty, Fazio, & Briñol, in press). Specifically, we argue that impulsive action tendencies can be linked to and often are the consequence of automatically activated evaluations. More precisely, we argue that impulsive action tendencies to approach or avoid a particular stimulus are the result of automatically activated evaluations of this stimulus (Strack & Deutsch, 2004). As such, ego depletion should moderate not only the impact of self-control on human behavior. Rather, the impact of ego depletion should be twofold, such that it determines whether behavior is determined either by automatic attitudes or by personal standards. More precisely, we argue that behavior should be predominantly influenced by automatic attitudes when self-regulation resources are low, but by personal standards when self-regulation resources are high.

Automatic attitudes and personal standards

Drawing on Strack and Deutsch's (2004) Reflective-Impulsive Model (RIM), automatic attitudes can be understood as spontaneous evaluations that have their roots in associative processes of spreading activation (see also Gawronski & Bodenhausen, in press). Such automatic evaluations are assumed to predispose the organism to spontaneously approach or avoid relevant stimuli (e.g., Chen & Bargh, 1999; Neumann, Hülsenbeck, & Seibt, 2004), thus providing a quick and efficient means of behavioral orientation in the environment. Consistent with this assumption, Neumann et al. (2004), for example, found that automatic attitudes toward people with AIDS significantly predicted impulsive approach and avoidance tendencies toward these people.

It is important to note, however, that impulsive action tendencies often have only small or minor overlap with one's goals or personal standards (e.g., Devine, 1989; Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005). In Strack and Deutsch's (2004) model, such goals or standards have their origin in reflective processes of higher-order propositional reasoning. Hence, impulsive action tendencies resulting from automatic evaluations are often in conflict with deliberate action tendencies resulting from personal goals or standards, implying a tug-of-war similar to the one proposed by contemporary models of self-regulation (e.g., Baumeister et al., 1994; Mischel, 1996; Muraven & Baumeister, 2000). Moreover, because reflective processes usually require more cognitive capacity than associative processes (Strack & Deutsch, 2004), the behavioral impact of automatic attitudes and personal standards should depend on available resources: if cognitive capacity is high, personal standards (but not automatic attitudes) should influence behavior. However, if cognitive capacity is low, behavior should be influenced by automatic attitudes (but not by personal standards).

Similar predictions can be derived from Fazio's MODE Model of attitude–behavior consistency (e.g., Fazio & Olson, 2003). According to the MODE Model, automatically activated attitudes should guide behavior unless people are motivated and able to control the influence of these attitudes. Applied to eating behavior, for example, one could argue that automatic attitudes toward candies should influence the consumption of candies unless dietary standards motivate people to restrain their consumption of candies. However, because controlling one's attitudes is a cognitively effortful process, reduced cognitive capacity may undermine the impact of dietary restraint standards. In such cases, eating behavior should be influenced by automatic candy attitudes even when people are highly motivated to restrain their candy consumption.

Preliminary evidence for these assumptions can be derived from research showing double dissociations in the prediction of spontaneous versus controlled behavior (Dovidio, Kawakami, & Gaertner, 2002; Dovidio, Kawakami, Johnson, & Johnson, 1997; Fazio, Jackson, Dunton, & Williams, 1995; McConnell & Leibold, 2001; Perugini, 2005). From a general perspective, these studies demonstrated that automatically activated (but not self-reported) attitudes predict spontaneous behavior, whereas self-reported (but not automatically activated) attitudes predict controlled behavior. These results are generally consistent with the assumption that impairing the ability to control one's behavior should increase the impact of automatic attitudes, whereas enhanced control should reduce the impact of automatic attitudes. However, all of these studies were concerned with the impact of automatic attitudes on various behaviors that differ a priori with regard to their controllability (e.g., nonverbal reactions in interactions with Black people vs. judgments of court cases in which Black people are involved). As such, they provide no evidence for the present assumption that *one and the same* behavior can be influenced by either automatic attitudes or personal standards, and that their relative influence depends on self-regulation resources.

The main goal of the present research was to test these predictions with regard to eating behavior as a classic area of self-regulation. Specifically, we investigated whether the rela-

tive impact of automatic candy attitudes and dietary restraint standards on candy consumption is moderated by self-regulatory resources. Drawing on the considerations outlined above, we predicted that candy consumption should be predicted by dietary restraint standards (but not by automatic candy attitudes) when self-regulation resources are high. However, when self-regulation resources are low, candy consumption should be predicted by automatic candy attitudes (but not by dietary restraint standards).

In the present study, control resources were temporarily depleted with an emotion suppression task that has been successfully employed in prior research (Gross & Levenson, 1997; Vohs & Heatherton, 2000). To assess automatic candy attitudes we employed a variant of Greenwald, McGhee, and Schwartz's (1998) Implicit Association Test (IAT) that involved only a single target category rather than two target categories (Karpinski & Steinman, in press; Wigboldus, Holland, & Van Knippenberg, 2004). Finally, dietary restraint standards were assessed with a standardized self-report measure (Stunkard & Messick, 1985).

Methods

Participants

Participants were 51 (35 female, 16 male) first or third year psychology students at the University of Koblenz-Landau, Germany, who participated in exchange for course credit. Age of participants ranged between 19 and 49 years ($M = 24$). Data from one male participant had to be excluded from analyses because of technical problems during the depletion manipulation (see below).

Procedure

All participants completed the study between 4:00 and 5:00 pm. Sessions were run in parallel with between one and three participants at a time. Upon arrival, participants were greeted by an experimenter and seated at separate desks equipped with a computer. They were told that the study concerned "entertainment and product perception" and that it included a perception task, an entertainment part, and a product testing phase. In the perception task, participants were administered a measure of automatic candy attitudes. In the entertainment part, participants were presented a movie clip and were instructed to either suppress or let flow their emotions while watching the clip. In the product testing phase, participants were asked to test a product often sold in movie theaters and other entertainment places (m&m's). Finally, participants indicated the time since they last consumed food and what they had eaten, and completed the dietary restraint scale. We decided to administer the restraint scale after the product testing phase not to sensitize participants to their eating behavior by presenting the restraint scale beforehand (see Polivy & Herman, 1976). Participants were debriefed collectively via email after the data collection was completed.

Resource depletion manipulation

To temporarily deplete participants' self-regulation resources, we used an emotion suppression task as employed by Gross and Levenson (1997). Participants viewed a 7-min chapter from the movie "City of God." The episode describes a party given by Bene, leader of a criminal street gang in Rio de Janeiro, who wants to quit his criminal life and start a new life with his girlfriend. The episode contains both positive (e.g., dancing, music, love scenes) as well as negative elements (e.g., Bene is finally shot by a member of an opposite gang). Participants in the *depletion condition* ($N = 26$) were told to closely watch the clip but to remain completely neutral by suppressing any feelings that come up while watching. Participants in the *control condition* ($N = 24$) were asked to watch the movie as in a movie theater, letting flow any feelings or responses to it. Immediately after the depletion manipulation, participants completed a 16-item mood questionnaire (e.g., happy, relaxed, sad, nervous, angry) adapted from Gollwitzer (2005) and a manipulation check on how easy it was to suppress their feelings. Mood ratings were assessed with 5-point rating scales; the manipulation check employed a 7-point rating scale.

Measures

Automatic candy attitudes

As a measure of automatic candy attitudes, we assessed participants' automatic evaluations of m&m's with a variant of Greenwald et al.'s (1998) IAT that included only a single target category rather than two target categories (Karpinski & Steinman, in press; Wigboldus et al., 2004). In this task, pictures of m&m's as well as positive and negative pictures or words were presented in the middle of a computer screen. In the first critical block, participants had to respond with a right-hand key to pictures of m&m's. In addition, participants were asked to respond with the same right-hand key to positive pictures or words, and with a left-hand key to negative pictures and words. In the second critical block, the key assignment for m&m's pictures was reversed, such that participants were required to respond with the left-hand key to m&m's pictures and negative pictures and words, and with the right-hand key to positive pictures and words. As target stimuli, we used six different pictures of m&m's; as attribute stimuli, we used three positive pictures (baby, romantic couple, and landscape), three positive words ("fun", "pleasure", and "luck"), three negative pictures (violent act, raging dog, and garbage dump), and negative words ("fear", "disgust", and "disaster").[1] The number of stimuli per response category was determined such that the proportion of right-hand and left-hand

[1] We used both images and words as attribute stimuli to increase task difficulty. Sorting only target pictures versus attribute words would have allowed participants to simplify their responses (e.g., press right key whenever an image appears) without necessarily processing the images as such.

responses was approximately equal in each of the two critical blocks (3:4 in the first critical block; 4:3 in the second critical block). Stimuli were presented randomly. Each critical block consisted of a total of 96 trials. Indices of automatic candy attitudes were based on responses to m&m's pictures, using the D measure proposed by Greenwald, Nosek, and Banaji (2003) for standard IAT applications lacking a built-in error penalty.

Dietary restraint standards

Participants' dietary restraint standards were assessed with the *restraint* subscale of the German adaptation (Pudel & Westenhoefer, 1989) of the Three-Factor Eating Questionnaire (Stunkard & Messick, 1985). The 21 items of the scale (e.g., "I often stop eating when I am not really full as a conscious means of limiting the amount I eat") were averaged to form an index of dietary restraint standards, with a value of 0 indicating the lowest possible score and a value of 1 indicating the highest possible score ($\alpha = .86$). Participants with high scores on this scale endorse high standards toward their own body weight, and hence should be strongly motivated to refrain from high-calorie food under default conditions.

Candy consumption

In the product testing phase, a 125 g m&m's chocolate package was cut open and placed on a new serviette in front of each participant. Five minutes were given to taste the product and to rate it on a variety of dimensions such as tastiness, naturalness, healthiness, sweetness, product look, and package design. After time had expired, m&m's were taken out of participants' reach. Candy consumption was later determined by subtracting the amount left of the 125 g preconsumption weight.

Results

Preliminary analyses

Consistent with the intended manipulation, participants in the depletion condition experienced more difficulty in suppressing their feelings ($M = 3.32$) than participants in the control condition ($M = 5.05$), $t(48) = -4.44$, $p < .001$. Participants' mood ratings showed no reliable differences between conditions, irrespective of whether mood items were analyzed separately (all absolute ts < 1.59) or as a compound index of negative mood ($\alpha = .60$), $t(48) = -1.30$, $p = .20$. There was also no significant difference between the two conditions with regard to the time participants last consumed food, $t(48) = -.39$, $p = .70$.

Because the index of candy consumption was positively skewed ($s = 1.25$), we applied a log-transformation to achieve a normal distribution. All statistical analyses were calculated using the transformed data. For ease of interpretation, however, mean values are reported in untransformed grams of candy consumption. Means and standard deviations for the three major variables (i.e., automatic candy attitudes, dietary restraint standards, and candy consumption) are printed in Table 1. None of these variables showed a significant difference as a function of the ego depletion manipulation (all ts < 1.10 and all ps $> .28$).

Table 1
Means and standard deviations of automatic candy attitudes, dietary restraint standards, and candy consumption as a function of experimental condition

		Depletion condition	Control condition
Automatic attitudes	*M*	0.13	−0.25
	SD	0.85	1.45
Restraint standards	*M*	0.41	0.42
	SD	0.12	0.12
Candy consumption	*M*	15.42	17.42
	SD	14.99	17.18

Note: $N = 26$ in the depletion and $N = 24$ in the control condition.

Table 2
Zero order correlations for automatic candy attitudes, dietary restraint standards, and candy consumption as a function of experimental condition

	1	2	3
Depletion condition			
1. Automatic attitudes		−.04	.34*
2. Restraint standards			.29†
3. Candy consumption			
Control condition			
1. Automatic attitudes		.25	−.09
2. Restraint standards			−.48**
3. Candy consumption			

Note: †$p = .07$; *$p < .05$; **$p < .01$ (one-sided).

Candy consumption

To test the prediction that ego depletion moderates the relative impact of automatic attitudes and personal standards, we first calculated zero-order correlations between candy consumption, automatic candy attitudes, and dietary restraint standards as a function of the two experimental conditions (see Table 2).[2] Consistent with our hypotheses, automatic candy attitudes showed a positive correlation to candy consumption in the depletion condition but not in the control condition. That is, candy consumption significantly increased as a function of automatic positivity toward the candy in the depletion condition but not in the control condition. Conversely, dietary restraint standards were negatively associated with candy consumption in the control condition but not in the depletion condition. Specifically, candy consumption significantly decreased as a function of dietary restraint standards in the control condition. In the depletion condition, however, the two variables showed a marginally significant positive correlation, suggesting greater disinhibited eating among restrained eaters

[2] Statistical tests corresponding to directional hypotheses were evaluated with p values from one-sided tests.

due to resource depletion (e.g., Boon, Stroebe, Shut, & Ijntema, 2002; Ward & Mann, 2000).

To test the relative impact of automatic attitudes and personal standards more appropriately, we additionally performed a multiple regression analysis on *z*-standardized log-transformed grams of candy consumption as criterion. As predictors we entered the dummy-coded condition factor with the depletion condition as reference group, automatic candy attitudes, and dietary restraint standards. Additionally, we entered all possible interaction terms among experimental condition, automatic candy attitudes, and dietary restraint standards. All continuous predictor variables were *z*-standardized and interaction terms were computed from these standardized scores (Aiken & West, 1991). Moreover, because candy consumption was positively associated with participant sex ($r = .27$, $p = .06$) as well as with time since last food intake ($r = .23$, $p = .10$), we statistically controlled for the influence of both variables by entering them as *z*-standardized covariates.

Results from the regression analysis ($R^2 = .21$) confirmed the expected interaction between automatic candy attitudes and experimental condition, $\beta = -.57$, $F(1,40) = 3.72$, $p = .030$, as well as the predicted interaction between dietary restraint standards and experimental condition, $\beta = -.85$, $F(1,40) = 9.38$, $p = .002$. As can be seen from Fig. 1, candy consumption in the depletion condition significantly increased as a function of automatic positivity toward the candy, $\beta = .46$, $t(40) = 1.85$, $p = .036$, as confirmed by a simple slope test (Aiken & West, 1991). In contrast, candy consumption in the control condition was unrelated to automatic candy attitudes, $\beta = -.11$, $t(40) = -.66$, $p = .51$. Regarding the predicted interaction of dietary restraint standards and experimental condition, Fig. 2 indicates that candy consumption in the control condition significantly decreased as a function of dietary restraint standards, $\beta = -.60$, $t(40) = -3.03$, $p = .002$. In contrast, candy consumption in the depletion condition showed a positive relation to dietary restraint standards, such that candy consumption tended to increase as a function of dietary restraint standards, $\beta = .25$, $t(40) = 1.30$, $p = .10$. Neither the two-way interaction between automatic candy attitudes and dietary restraint standards nor the three-way interaction between automatic candy attitudes, dietary restraint standards, and experimental condition reached statistical significance (all Fs < 1).

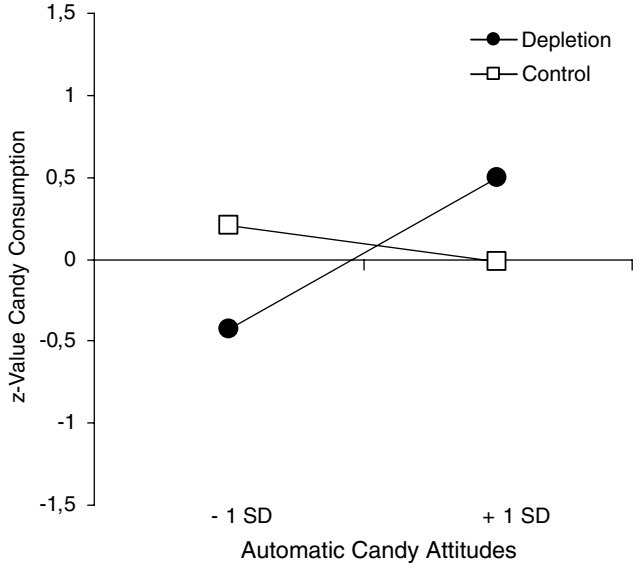

Fig. 1. Candy consumption as a function of automatic candy attitudes and experimental condition.

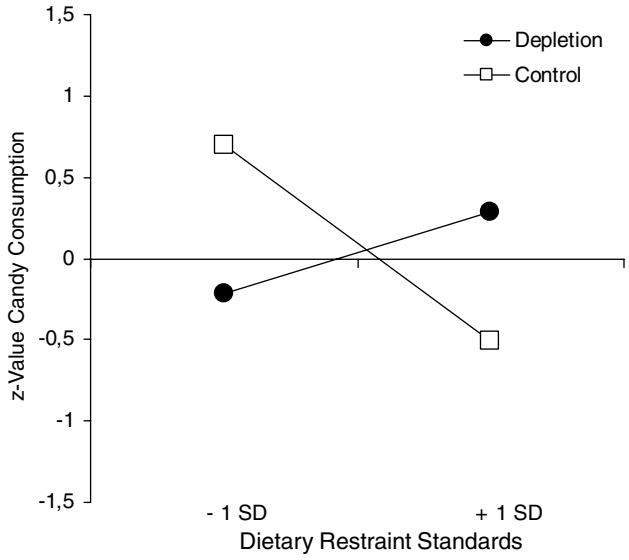

Fig. 2. Candy consumption as a function of dietary restraint standards and experimental condition.

Discussion

The present findings confirm our assumption that self-regulation resources moderate the relative impact of automatic attitudes and personal standards on human behavior. Whereas the behavioral impact of personal standards was reduced by ego depletion, the impact of automatic attitudes was increased. More precisely, candy consumption was strongly related to participants' dietary restraint standards (but not to automatic candy attitudes) when self-regulation resources were high. In contrast, candy consumption was strongly related to automatic candy attitudes when self-regulation resources were low. Interestingly, restraint standards tended to be positively associated with candy consumption in the depletion condition, indicating that resource depletion may lead to counterintentional effects of dietary restraint standards. This finding is consistent with previous research on *counterregulation* or *disinhibition* of eating resulting from situational risk factors such as preload, cognitive load, or emotional distress (e.g., Boon et al., 2002; Herman & Polivy, 2004; Ward & Mann, 2000).

Taken together, our results are consistent with previous research on self-regulation, showing that ego depletion reduces the ability to control one's behavior (Baumeister et al., 1994; Mischel, 1996; Muraven & Baumeister, 2000; Muraven et al., 2002; Richeson et al., 2003; Richeson & Shelton, 2003; Vohs & Heatherton, 2000). In this research,

the conflict between impulse and self-control has often been described as a tug-of-war in which the stronger competitor wins (Baumeister et al., 1994; Mischel, 1996; Muraven & Baumeister, 2000). However, previous research on self-regulation has primarily focused on the control component. As Herman and Polivy (2004) put it, a "truly comprehensive analysis of self-regulatory success and failure,…, will have to include,…, both the ability to resist and the power of the temptation" (p. 505). The present study aimed to fill this gap by specifying a crucial determinant of the impulse component, automatic attitudes, and by identifying the conditions under which the impulse component has a particularly strong influence on behavior. Drawing on Strack and Deutsch's (2004) RIM, we reasoned that impulsive action tendencies are the consequence of automatically activated evaluations, such that automatic attitudes predispose the organism to spontaneously approach or avoid relevant stimuli (e.g., Chen & Bargh, 1999; Neumann et al., 2004). Such impulsive action tendencies are often in conflict with reflective action tendencies resulting from personal goals or standards, implying a tug-of-war similar to the one proposed by models of self-regulation. Moreover, because reflective processes usually require more cognitive capacity than impulsive processes, the relative impact of automatic attitudes and personal standards should depend on available resources. If cognitive capacity is high, behavior should be primarily influenced by personal standards. If, however, cognitive capacity is low, behavior should be primarily influenced by automatic attitudes.

The obtained results have some resemblance to previous research showing double dissociations in the prediction of spontaneous versus controlled behavior (Dovidio et al., 2002; Dovidio et al., 1997; Fazio et al., 1995; McConnell & Leibold, 2001; Perugini, 2005). However, the present study goes beyond previous research in two important ways. First, whereas previous research on double dissociations was concerned with the prediction of different behaviors varying in controllability (e.g., nonverbal vs. verbal behavior), the present research shows that *one and the same* behavior can be differentially influenced by either automatic attitudes or personal standards as a function of available self-regulation resources. To be sure, the resource model adopted in our research does not contradict the idea that the impact of different behavioral determinants depends on the general level of controllability associated with a given behavior. Rather, our results indicate that the relative impact of impulsive and reflective forces is additionally moderated by situational factors. More precisely, we argue that even behaviors that are typically considered as "controlled" may be influenced by automatic attitudes when self-regulation resources are low (see also Hofmann, Gschwendner, Castelli, & Schmitt, 2006). Thus, the prediction of social behavior may be significantly enhanced over and above the spontaneous/controlled distinction by taking situational factors into account.

Second, previous research primarily used explicit measures that paralleled the employed implicit measure with regard to content and specificity. In the present study, the expected moderator effect was obtained with a relatively broad measure of personal goals: dietary restraint standards. Although this measure does not directly correspond to the employed implicit measure of automatic candy attitudes, it seems particularly suited for the prediction of eating behavior due to its behavior-oriented nature. Drawing on these considerations, we speculate that measures of personal goals may even outweigh explicit attitude measures in predicting behavior as the former may tap more directly into the output-stage of the reflective system whereas explicit attitudes still need to be transformed into a specific action plan before they can effectively guide behavior (Fishbein & Ajzen, 1975).

A possible limitation of the present study is that dietary restraint standards were assessed after rather than before candy consumption. Even though this sequence is functional in the sense that it does not sensitize participants to their eating behavior prior to food intake (e.g., Polivy & Herman, 1976), it introduces the risk that participants' responses on the restraint scale might have been influenced by the depletion manipulation at the beginning of the study. In addition, the employed order implies some ambiguity with regard to causal direction of the obtained relations. Concerning potential influences of the depletion manipulation, it is important to note that dietary restraints did not show any difference between depleted and control participants, suggesting that depletion was not a contaminating factor. Concerning the causal direction of the obtained relations, there seem to be at least two possible mechanisms by which subsequently assessed restraint standards might have been influenced by eating behavior. First, participants may have inferred their level of restraint from the amount of candies eaten during the product testing phase (Bem, 1972). Second, participants who consumed larger amounts of candies may have formed stronger intentions to diet afterwards.

Both of these explanations are at odds with the diverging correlations between candy consumption and restraint standards (see Table 2). If restraint standards were inferred from the amount of candies eaten, the correlations between the two constructs should be uniformly negative, which is contrary to the obtained positive relation under depletion conditions. If, on the other hand, enhanced candy consumption enhanced the intention to diet afterwards, correlations should be uniformly positive, which is contrary to the obtained negative relation between dietary restraints and eating behavior under control conditions. Thus, unless one has a strong hypothesis for why self-perception and intention setting might have interacted with our ego depletion manipulation in producing the obtained pattern of results, it seems more parsimonious to assume that dietary restraint standards differentially influenced the amount of candy eaten rather than the other way round. Nevertheless, future research assessing dietary restraint standards prior to the predicted behavior seems desirable to rule out alternative

explanations in terms of self-perception or intention setting.

In summary, we believe that research on self-regulation may benefit from incorporating the notion of automatic attitudes by linking it to concepts such as *impulse*, *desire*, or *urge*. The situational moderator approach adopted in the present article can be applied to any domain in which automatic attitudes and personal standards may compete to influence behavior, such as stereotyping (e.g., Rudman & Glick, 2001), aggression (Uhlmann & Swanson, 2004), sexual behavior (e.g., Czopp, Monteith, Zimmerman, & Lynam, 2004), or drug use (e.g., Field, Mogg, & Bradley, 2004). In a similar vein, research on automatic attitudes may gain important insights into the limits of controlling one's attitudes from applying basic findings obtained in self-regulation research. The present study was intended as a first step in this direction and we hope to stimulate future research at the intersection of automatic attitudes and self-regulation.

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