The Great Disinhibitor: Alcohol Moderates the Influence of Automatic Attitudes and Dietary Restraint on Eating Behavior.

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Abstract

This study shows that alcohol simultaneously increases the influence of automatic candy attitudes and decreases the influence of dietary restraint standards on candy eating behavior. Female participants were assigned to either an alcohol or a control condition, and were then given an opportunity to taste candies. For participants in the alcohol condition, candy consumption was uniquely predicted by previously assessed automatic attitudes. In contrast, candy consumption was primarily predicted by dietary restraint standards in the control condition. Moreover, alcohol intoxication resulted in disinhibited eating on the group level. These results indicate that alcohol increases the influence of impulsive processes on behavior while disrupting the influence of reflective processes and demonstrate the usefulness of an impulse + restraint + situation approach to the study of self-control problems.

Keywords: Alcohol, Automatic Attitudes, Dietary Restraint, Eating Behavior, Disinhibition

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In many circumstances, the implications of a certain impulse (e.g., the desire to eat a delicious piece of cake) are at odds with personal standards (e.g., "I want to keep a slim figure."). In such cases, the person faces a conflict between an impulse on the one hand and restraint on the other, which can be described as a tug-of-war in which the stronger competitor wins. Even though such conflicts are a common part of the human condition (Carver, 2005), the dominance of either side can seriously disrupt normal functioning. For instance, the temporary or chronic failure to resist one's impulses is indicative of a large range of impulse control disorders such as drug abuse, binge- and overeating, pathological gambling, antisocial personality, or sexual harassment and often implies far-reaching costs for individuals and society in large (e.g., Baumeister, Heatherton, & Tice, 1994).

Over and above general differences in impulse and restraint, the outcome of their struggle may also hinge on circumstances. For instance, research on the self-regulation of eating has accumulated knowledge about conditions that disrupt the normal self-control of eating, especially for people who generally limit their food intake (restrained eaters). In a seminal study, Herman and Mack (1975) demonstrated that an initial high calorie preload led restrained eaters to overeat in a subsequent taste and rate task, a finding that has since been replicated multiple times (Herman & Polivy, 2004). Other studies have investigated the role of ego depletion (Vohs & Heatherton, 2000) and low self-monitoring (Collins, 1978) as disinhibiting factors. Furthermore, emotional distress, particularly anxiety, depression, and ego threat appear to disrupt dietary restraint (for a review, see Herman & Polivy, 2004), arguably because eating may serve as a means to regulate negative emotions (Tice, Bratslavsky, & Baumeister, 2001).

This article is concerned with a particular situational moderator, alcohol intoxication. As a great deal of clinical and social psychological research has shown, alcohol acts as a

disinhibitor of impulses across a wide range of domains (for a review, see Hull & Bond, 1986). Most important for the present research, alcohol has been found to disinhibit eating behavior (Polivy & Herman, 1976a, 1976b). Moreover, alcohol abuse frequently co-occurs with eating disorders characterized by impulsive eating such as bulimia nervosa, binge eating disorder, and obesity (e.g., Grilo, Sinha, & O'Malley, 2002), even though the exact causal nature of this link is still unclear. In this article we will provide more direct laboratory evidence for the conjecture that acute alcohol intoxication fosters the impact of people's *impulses* on eating behavior.

So far, research on self-regulatory failure has primarily focused on the interplay between the situation (e.g., alcohol intoxication) and the restraint components (e.g., interindividual differences in dietary restraint). However, the impulse component has largely been neglected (Herman & Polivy, 2004). Instead, the influence of impulses has been inferred post hoc from observed group differences in behavior, leaving unanswered the question: What forces within the person actually *drive* disinhibited behavior? The present study aims to fill this gap by specifying and assessing a crucial determinant of the strength of the impulse component, automatic attitudes (for a review, see Petty, Fazio, & Briñol, in press). More specifically, we argue that the understanding of conflicts between impulse and restraint can be advanced by linking these concepts to dual system models of human information processing (cf. Carver, 2005). Drawing on Strack and Deutsch's (2004) Reflective-Impulsive Model, automatic attitudes are part of the impulsive system and can be understood as evaluations that are triggered automatically upon encounter of environmental stimuli. These automatic evaluations predispose the organism to spontaneously approach or avoid these stimuli, thus providing a quick and efficient means of behavioral orientation.

In contrast, the reflective system is a higher-order mental system which guides behavior in accordance with explicitly endorsed attitudes and long-term goals and standards. Often, impulsive action tendencies from the impulsive system are in conflict with deliberate

action tendencies resulting from explicit attitudes or personal standards (Strack & Deutsch, 2004). Although the reflective system is capable of monitoring and overriding these competing impulsive action tendencies under normal conditions, its operation may be easily impaired by situational influences that reduce available control resources or otherwise disrupt its normal functioning (Strack & Deutsch, 2004), allowing the impulsive system to take over control of behavior determination. Therefore, a breakdown of the reflective system's capacity to inhibit the impulsive system should result in behavior that can be predicted significantly by behavioral precursors in the impulsive system such as automatic attitudes.

In this research, we hypothesized that alcohol impairs the controlling influence of the reflective system, thus leading to a stronger impact of automatic food attitudes on eating behavior. Within the present framework, there are at least four reasons for this conjecture: First, it is possible that alcohol consumption leads to weaker representations of personal standards in the reflective system (Baumeister et al., 1994). For instance, otherwise strongly represented intentions to diet may become temporarily suppressed in drunken people. Without a clear representation of standards, the reflective system will not be able to effectively guide behavior in the first place, allowing automatic attitudes to influence behavior unhamperedly.

Second, intoxicated people may lose the ability to successfully attend to and monitor their behavior (Hull, Levenson, Young, & Sher, 1983). That is, discrepancies between the implications of an impulse to consume sweets and relevant standards to diet may simply go unnoticed. This view is also reflected in attentional myopia theory (Mann & Ward, 2004; Steele & Josephs, 1990), according to which alcohol narrows the focus of attention to the most salient environmental attractions at the expense of potential long-term intentions and standards.

Third, even though intoxicated persons may still be aware of existing conflicts between their impulses and their personal standards to some degree, they may nevertheless

lack the cognitive resources for behavioral control necessary in order to stop impulsive action tendencies from becoming transformed into action (e.g., Fillmore, 2003).

While the previous accounts help to explain the heightened impact of impulses in intoxicated people by the reduced potential of the reflective system to monitor and inhibit impulsive action tendencies, a fourth possibility holds that alcohol may directly boost impulse strength without necessarily reducing the capacity for restraint. In other words, alcohol may lead to an amplification of preexisting impulses in the person, making controlled behavior more difficult, even with an intact reflective system. Again, the result would be the same: disinhibited behavior.

In recent years, quite a number of so-called implicit measurement tools such as the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) have been developed. These implicit measures can be employed to assess automatic attitudes toward specific objects of interest (e.g., Teachman, Gregg, & Woody, 2001). Because implicit measures do not necessarily hinge on participants' introspective ability and their willingness to self-report, these new measures may be ideally suited to tap into the associative network of the impulsive system (Greenwald et al., 1998). In the present research, we assessed automatic attitudes toward candies with a variant of the IAT (Greenwald et al., 1998), and explicit attitudes as well as dietary restraint standards with traditional self-report measures. Before performing a taste and rate task of candies, half of the participants received a moderate alcohol dose. We expected automatic attitudes to exert a relatively stronger influence on candy consumption in intoxicated than in sober participants. Conversely, we hypothesized that restraint standards and explicit attitudes should have a relatively stronger influence on eating in sober participants.

Method

Participants

Participants were 63 normal to slightly overweight female students from the University of Landau, Germany, with a mean age of 21.6 years (*SD* = 2.4) and a mean body mass index of 21.80 (*SD* = 2.18), ranging from 18 to 29. All participants were informed at the time of recruitment that the experiment concerned "tastes and entertainment" and that it may involve the tasting of an alcoholic beverage. Furthermore, they were asked not to eat at least one hour before the study and not to drink alcohol on the same day. All participants indicated that they had adhered to this prerequisite.

Procedure

The study always took place between 2:00 and 5:00 pm. Up to five participants were greeted by a female experimenter and seated at separate cubicles. They were informed a second time about the possibility of alcohol intake and provided their informed consent. Initially, participants completed a "screening questionnaire" containing demographic variables, a measure of alcohol dependency, and the dietary restraint scale (see below). Next, participants performed a measure of automatic candy attitudes, followed by the explicit attitude measure. In a first product test to follow, participants were randomly assigned to taste and rate either an alcoholic or non-alcoholic beverage. In order to ensure the absorption of alcohol in the alcohol group, all participants then watched a 10-minute video clip from the documentary "Deep Blue" describing ocean life, followed by several filler questions on the film and a mood scale. In a second product test, participants were asked to test and rate a 125 grams package of m&m's chocolate candies. Finally, participants were thanked, probed for suspicion, and debriefed. Two participants were excluded from analysis because they uttered suspicion that the study concerned the effects of alcohol on candy consumption. Participants in the alcohol group were tested for breath alcohol concentration (BAC) as measured with a professional breath analyzer. They were informed of their BAC and of legal issues connected with alcohol intake, and given the opportunity to wait, drink water, and eat snacks in order to recover.

Alcohol Manipulation

Participants in both experimental conditions were informed correctly about the content of their drinks. Participants in the control condition received 300 ml of orange juice; those in the alcohol group received a vodka-orange mix in the proportion of 1:3. We used vodka of the brand "Jelzin" with an alcohol concentration of 37.5%. Individual vodka dose was determined adaptively with respect to the weight of the participant with the help of a table indicating the amount of alcohol in the drink necessary to achieve a blood alcohol level of 0.030%, 30 minutes after intake. The computer software "EZ-ALC" (Kuwatch, 1986) was used in order to estimate target amount of alcohol, resulting in doses of approximately 1g/kg. Three participants were excluded from analysis because they failed to consume the vodka mix. The mean BAC in the alcohol group, measured approximately 30 minutes after intake, amounted to $M = 0.033\%$ ($SD = .009$) and differed significantly from zero, $t(28) = 17.89$, $p < .001$, $d = 3.32$.

Measures

Automatic Attitudes. We assessed participants' automatic evaluations of m&m's with a variant of Greenwald, McGhee, and Schwartz's (1998) Implicit Association Test that included only a single target category rather than two target categories (Karpinski & Steinman, 2006). In the first critical block, participants had to respond with a right-hand key to pictures of m&m's. In addition, participants had 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 responded 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. We used six different pictures of m&m's as target stimuli and three positive and three negative pictures and words each as attribute stimuli. Each critical block consisted of 75 trials. An index of automatic candy attitudes was calculated according to the D measure proposed by Greenwald, Nosek, and

Banaji (2003). Higher values indicate faster reactions to m&m's stimuli when paired with positive attribute stimuli. Split-half reliability (.71) was determined by calculating the D-measure for each of two subblocks from an odd-even split of trials.

Explicit Attitudes. Two bipolar 5-point rating scales were used in order to assess explicit attitudes toward m&m's. The poles were "negative" vs. "positive" and "I like it a lot" vs. "I do not like it at all." Because both ratings converged to a great extent they were combined into a single explicit attitude index (α = .80).

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 were combined to form an index of dietary restraint standards, with a value of 0 indicating the lowest and a value of 1 indicating the highest possible score (α = .88).

Mood and Alcohol Dependency as Control Variables. State affect was assessed in order to control for possible effects of emotion-regulation on eating (Tice et al., 2001). Immediately before the taste and rate task, participants completed the PANAS (Watson, Clark, & Tellegen, 1988), a 20-item mood state questionnaire with 5-point rating scales. Since ratings from the positive and negative mood subscales were significantly correlated in this sample (r = -.33, p = .013) and since a factor analysis suggested a general factor as indicated by a screeplot, we recoded the negative mood items and combined all 20 items into a global affect score (α = .85). We also controlled for alcohol dependency because dependent persons may be less affected by alcohol due to habituation. The Alcohol Use Disorders Identification Test (German version by Rist, Scheuren, Demmel, Hagen, & Aulhorn, 2003) consists of 10 items tapping into behavioral and social symptoms of alcohol dependency. We averaged responses across all 10 items (each item scored from 0 to 4) with higher values indicating greater alcohol dependency (α = .80).

Candy Consumption. In the product testing phase, a 125 g m&m's chocolate package was cut open and placed on a table napkin 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, and product look. After time had expired, the m&m's were taken out of the participants' reach. Candy consumption was later determined by weighing the amount left with a precision balance and subtracting it from the preconsumption weight.

Results

Preliminary Analyses

In order to correct for a slight positive skew in candy consumption, we applied a log-transformation (Vohs & Heatherton, 2000). Statistical analyses were calculated using the transformed data. For ease of interpretation, means and standard deviations are reported for untransformed grams of candy consumption. The descriptive statistics for the main variables are presented in Table 1. Independent sample *t*-tests were performed in order to detect significant differences between means. As shown, candy consumption was reliably affected by alcohol intake, $t(56) = 2.14$, $p = .037$, $d = 0.57$, such that participants in the alcohol condition consumed significantly more candies than control participants.

Candy Consumption

In order to investigate whether alcohol moderates the relative impact of automatic attitudes, explicit attitudes, and restraint standards on eating, we first calculated zero-order correlations between candy consumption and predictors separately by experimental condition. As can be seen from Table 2, automatic candy attitudes were correlated positively with candy consumption in the alcohol condition, indicating that participants with more positive automatic attitudes toward m&m's consumed more candies. This relationship did not hold in the control condition. Conversely, both explicit attitudes and dietary restraint standards were reliably associated with candy consumption in sober but not in intoxicated participants.

Specifically, candy consumption marginally significantly increased as a function of explicit attitudes and significantly decreased as a function of dietary restraint.

In order to test the differential impact of automatic attitudes, explicit attitudes, and restraint standards as a function of condition more appropriately, we performed a multiple moderated regression analysis on *z*-standardized log-transformed grams of candy consumption as the dependent variable. As predictors we entered the dummy-coded condition factor with the control condition as a reference group, as well as *z*-standardized automatic attitudes, explicit attitudes, and dietary restraint. Affect and alcohol-related problems were entered as covariates.[1] In order to evaluate our hypothesis that the effects of our main predictors differ significantly between conditions we entered all interaction terms between experimental condition and automatic attitudes, explicit attitudes, and dietary restraint. As we had specific predictions regarding the direction of moderator effects, regression weights for these three interaction terms were evaluated with one-sided tests.

The regression analysis ($R^2 = .25$) yielded a main effect of alcohol on eating behavior, $\beta = .54$, $F(1,46) = 4.95$, $p = .031$, confirming that alcohol leads to disinhibited eating on a group level. More importantly, the expected positive interaction between automatic candy attitudes and experimental condition, $\beta = .53$, $F(1,46) = 4.74$, $p = .017$, indicated that the relative influence of automatic attitudes on eating was significantly larger in the alcohol group as compared to the control group (see Figure 1). Simple slope tests showed that candy consumption was positively predicted by automatic attitudes in the alcohol condition, $\beta = .36$, $t(46) = 2.03$, $p = .048$, and slightly negatively but not significantly in the control condition, $\beta = -.17$, $t(46) = -.96$, $p = .343$. Regarding restraint standards, the expected positive interaction with experimental condition emerged, $\beta = .54$, $F(1,46) = 4.11$, $p = .024$. As Figure 2 indicates, candy consumption in the control condition was negatively predicted by dietary restraint standards such that persons high in restraint ate less candy, $\beta = -.50$, $t(46) = -2.90$, $p = .006$. In contrast, dietary restraint standards no longer effectively guided candy consumption in

intoxicated participants, β = .04, $t(46) = .18$, $p = .86$. Finally, the predictive validity of explicit attitudes was not moderated by experimental condition, β = -.06, $F(1,46) < 1$, and both simple slopes were only slightly positive, β = .16 in the control, and β = .09 in the alcohol condition.

Discussion

The present study demonstrates for the first time that alcohol *simultaneously* moderates the impact of impulsive vs. reflective forces on eating behavior. Specifically, the predictive validity of automatic candy attitudes (as part of the impulsive system) was markedly increased in intoxicated as compared to sober participants. Conversely, dietary restraint standards (as part of the reflective system) guided behavior under normal conditions but significantly less so under the influence of alcohol. In contrast to dietary restraint standards, the impact of explicit candy attitudes on eating was less pronounced. One plausible explanation is that explicit attitudes still need to be transformed into a specific action plan before they can guide behavior whereas restraint standards play a more decisive role because they may function like a "gatekeeper" at the output-stage of the reflective system that is capable of overruling explicit attitudes (e.g., "I like chocolate *but* I have to watch my weight").

In the introduction, we offered four possible explanations for alcohol's bolstering effect on the influence of the impulsive system: suppression of restraint standards, breakdown of monitoring, breakdown of inhibitory control, and amplification of pre-existing impulses. The simultaneous decrease in the predictive validity of restraint standards in the alcohol condition suggests that alcohol releases impulses by impairing inhibitory control from the reflective system as a result of the first three mechanisms, and that an explanation in terms of an amplification of impulses is less plausible. This conclusion is consistent with process dissociation approaches showing that alcohol primarily affects effortful processes of behavioral control but not automatic processes (Fillmore, 2003).

The current findings accord well with neurocognitive approaches stressing the deleterious effects of alcohol on the functioning of the prefrontal cortex, a region that can be mapped to the reflective system and that is responsible for the control of impulses stemming from other regions of the brain such as the amygdala system (Bechara, 2005). Interestingly, in the domain of racial attitudes amygdala activation in response to social stimuli has been shown to correlate with an IAT measure of racial bias (Phelps, O'Connor, Cunningham, Funayama, Gatenby, Gore et al., 2000). Linking implicit measures directly with brain imaging data offers exciting opportunities for understanding the connection between the psychological and physiological explanations of self-regulatory breakdown due to alcohol (or other situational moderators).

Furthermore, our results parallel recent findings on the moderator effect of ego depletion on the influence of impulse and restraint on eating behavior (Hofmann, Rauch, & Gawronski, in press). In this study, participants' control resources were experimentally depleted by an emotion suppression task. Food consumption in a later task was better predicted by automatic attitudes in depleted participants, and by restraint standards in undepleted participants. It is quite remarkable then, that alcohol consumption and emotion suppression appear to exert functionally equivalent moderator effects on the influence of impulsive and reflective forces on behavior, and the parallel pattern supports the notion of two systems (Strack & Deutsch, 2004), one of which is strongly impaired by a number of situational factors such as alcohol or ego depletion.

Even though this research should be generalized with caution to clinical populations, our findings may have important implications for understanding the interplay of alcohol abuse and eating disorders such as bulimia or binge eating which often tend to co-occur. It is still not clear whether alcohol abuse can trigger an eating disorder, an eating disorder can trigger alcohol abuse, or whether both can result from common factors such as trait impulsivity or genetic predispositions (Grilo et al., 2002). Nevertheless, the present findings may shed some

light on the micro-dynamics involved once a patient has developed a co-occurring condition. Specifically, our results suggest that acute alcohol intoxication may boost additional impulsive eating in disordered patients by weakening resistance to internal impulses and urges with regard to tempting food. Failure to meet one's dietary standards may in turn trigger emotional distress, which may then call for further alcohol abuse as a coping attempt (Baumeister et al., 1994). Hence, once alcohol enters the scene of eating disorders, it may be best understood as both an integral causal and consequential part in an often vicious cycle of self-regulatory failure. From this perspective, additional research on the short-term effects of alcohol on impulse control in disordered patients may help to identify new avenues for the treatment of patients with a co-occurrence of eating disorders and alcohol abuse, potentially by incorporating treatments aimed at changing automatic attitudes toward tempting stimuli (e.g., Wiers, Cox, Field, Fadardi, Palfai, Schoenmakers et al., 2006).

In previous self-regulation research, the operation of impulses has been inferred indirectly from behavioral outcomes, leaving unanswered what forces within the person actually *drive* disinhibited behavior. The present approach attempts to bridge this gap by specifying a crucial determinant of the impulse component, automatic attitudes. We believe that the incorporation of implicit measures may be a significant advance over self-report assessments of impulses or not assessing impulses at all. The impulse + restraint + situation paradigm pursued in this article is applicable to a variety of domains in clinical, personality, social, and health psychology in which automatic attitudes and personal standards compete for behavior determination, and we hereby hope to disinhibit future research on the far-reaching conflict between impulse and restraint.

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Footnotes

[1] Both focal interaction terms (IAT or restraint × condition) remained significant when the control variables were removed from the regression equation but both interactions were slightly less pronounced.

Table 1

Means and Standard Deviations (Parentheses) of Main Variables by Experimental Condition

	Alcohol condition	Control condition
Automatic attitudes	0.32_a (0.32)	0.27_a (0.31)
Explicit attitudes	3.89_a (0.70)	3.55_a (0.82)
Restraint standards	0.36_a (0.21)	0.34_a (0.20)
Candy consumption	22.82_a (10.96)	17.26_b (13.48)
Affect	3.63_a (0.45)	3.73_a (0.46)
Alcohol dependency	3.93_a (2.34)	4.48_a (4.66)

Note: $N = 29$ in each condition. Row means with different subscripts differ significantly at $p < .05$ (two-tailed).

Table 2

Intercorrelations between Predictors and Candy Consumption by Experimental Condition

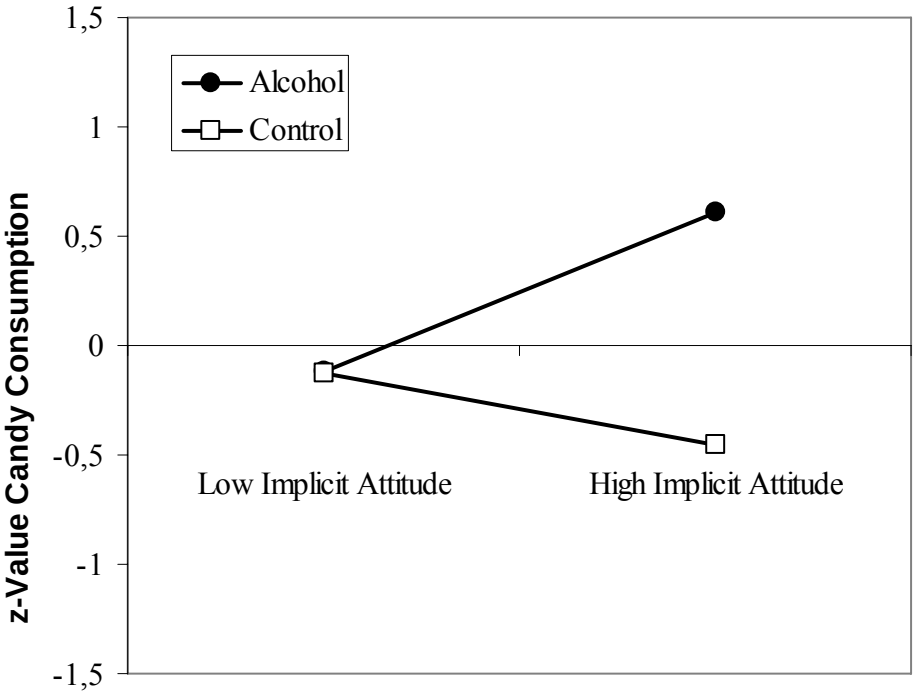
	1	2	3	4
		Alcohol condition		
1. Automatic attitudes	—	-.15	-.26	.40*
2. Explicit attitudes		—	-.29	.13
3. Restraint standards			—	-.25
4. Candy consumption				—
		Control condition		
1. Automatic attitudes	—	-.07	-.02	-.19
2. Explicit attitudes		—	-.25	.33†
3. Restraint standards			—	-.47*
4. Candy consumption				—

Note: †p =.08 *p < .05 (two-tailed)

Figure Captions

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

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


1,5
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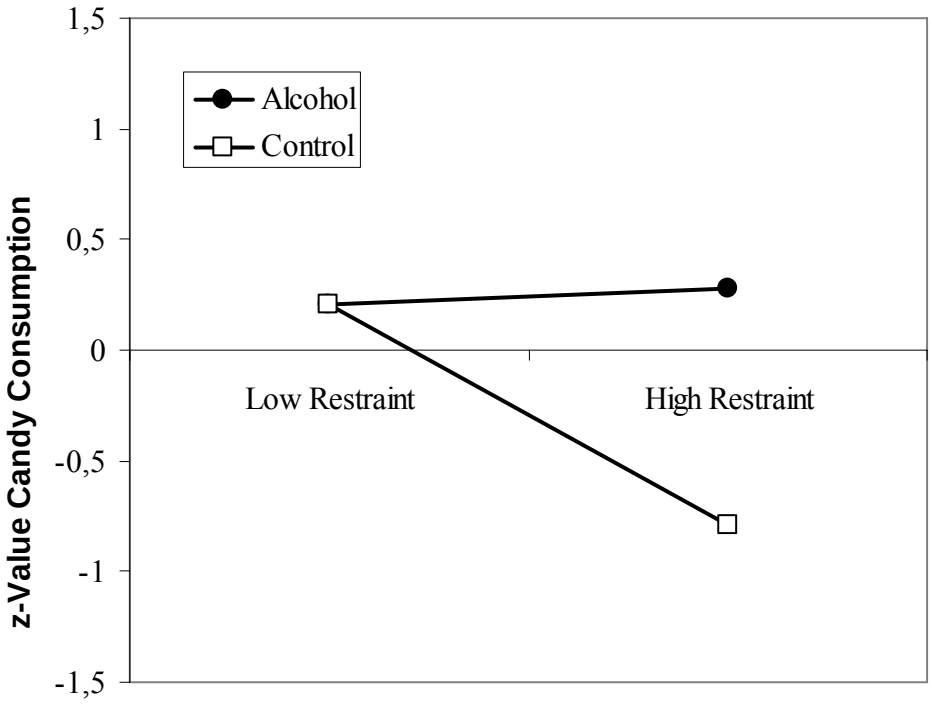
-0,5
-1
-1,5
Alcohol
Control
z-Value Candy Consumption
Low Implicit Attitude
High Implicit Attitude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0,5
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-1,5
z-Value Candy Consumption
Alcohol
Control
Low Restraint
High Restraint