

Self-Control and Alcohol Restraint: An Initial Application of the Self-Control Strength Model

Mark Muraven

University at Albany, State University of New York

R. Lorraine Collins and Kristen Nienhaus

University at Buffalo, State University of New York

Individuals whose self-control strength is depleted through the prior exertion of self-control may consume more alcohol in situations that demand restraint. Male social drinkers either exerted self-control by suppressing their thoughts or did not exert self-control while doing arithmetic. They then sampled beer. Participants expected a driving test after drinking and therefore were motivated to limit their intake. Individuals who suppressed their thoughts consumed more and achieved a higher blood alcohol content than those who did arithmetic. The groups did not differ in mood, arousal, or frustration. Individuals higher in trait temptation to drink consumed more after suppressing their thoughts relative to those lower in trait temptation. Alcohol intake may be a function of temptation to drink and self-control strength.

A group of young men drive to a bar for a night of drinking. They nominate one of their peers to be the designated driver, and he agrees to remain sober for the evening. When the pitcher of beer arrives, he is tempted to drink and decides to drink some, rationalizing that he can stick to his limits and remain sober if he drinks slowly enough. Will he be sober when he drives his friends home?

Social drinkers face dilemmas such as this on a regular basis: Can I enjoy myself and drink without consuming too much? How much can I drink and still drive safely? Participants in programs that try to reduce drinking also ask similar questions, especially when faced with situations that encourage drinking. The ability to restrain one's drinking is critical to sticking to self-imposed drinking limits in such situations.

Drinking restraint has been defined as the preoccupation with control over alcohol intake (Collins, 1993). Restrained drinkers try to maintain a balance between their desire to drink (temptation) and their need to regulate or limit their alcohol intake (Bensley, 1991; Collins, 1993). When the impulse to drink is stronger than the individual's capacity to override that impulse, the individual is likely to drink more (Bensley, 1991). On the other hand, if the individual has the ability and desire to regulate his or her alcohol intake, then he or she may consume less alcohol.

Evidence supports this response-conflict (Berlyne, 1960; Miller, 1944) view of drinking restraint. For example, heavy drinkers report significantly stronger impulses to drink as well as stronger

inhibitions against drinking compared with moderate or abstinent drinkers (Bensley, 1991). More precisely, Bensley (1991) found that heavy drinkers reported more craving for alcohol, thoughts about alcohol during the day, and positive expectations for alcohol relative to their public commitment to drinking goals, negative expectancies for drinking, and self-reported negative feelings associated with violating drinking limits. This relationship was reversed for light-drinking individuals. Similarly, Collins and Lapp (1992) found that social drinkers who self-reported (using the Temptation and Restraint Inventory, their measure of drinking restraint) being high in preoccupation with alcohol and low in trait control over alcohol consumption consumed more alcohol than those who were high in preoccupation with alcohol and also high in trait control over alcohol.

Situations such as drinking restraint that involve conflict between goals typically require the use of self-control (Barkley, 1997; Mischel, 1996; Shallice & Burgess, 1993; Skinner, 1953). In particular, *self-control* is the processes by which urges, desires, emotions, or behaviors that are in conflict with long-term goals (Kanfer & Karoly, 1972; Mischel, Ebbesen, & Zeiss, 1972) or prevailing rules (Hayes, Gifford, & Ruckstuhl, 1996) are overridden or inhibited. Self-control is therefore critical to the successful regulation of alcohol intake (e.g., Brown, 1998; Hodgson, 1989; Marlatt & Parks, 1982). For example, a designated driver might have the desire to drink but also have the goal of driving safely. These goals are in conflict. Thus, to reach the goal of being a safe driver, the individual must inhibit the intention to drink (i.e., to maximize safe driving, the individual should not drink). When individuals' ability to regulate their alcohol consumption is weakened in such situations, greater drinking is likely to ensue. Hence, any factor that reduces their ability to exert self-control may lead to increased drinking among individuals who are trying to regulate their drinking.

A recently developed model of self-control strength (Baumeister, Heatherton, & Tice, 1994; Muraven & Baumeister, 2000) suggests that certain factors may reduce individuals' ability to exert self-control. After inhibiting an urge, emotion, thought, or

Mark Muraven, Department of Psychology, University at Albany, State University of New York; R. Lorraine Collins and Kristen Nienhaus, Research Institute on Addictions, University at Buffalo, State University of New York.

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Correspondence concerning this article should be addressed to Mark Muraven, Department of Psychology, University at Albany, State University of New York, Albany, New York 12222. E-mail: muraven@albany.edu

behavior, individuals' subsequent self-control performance suffers. For example, as compared with participants who solved simple arithmetic problems, participants who suppressed the thought of a white bear were less able to subsequently inhibit signs of amusement while watching a humorous videotape (Muraven, Tice, & Baumeister, 1998, Experiment 3). Although participants reported that suppressing the thought of a white bear required more inhibition than solving simple arithmetic problems, suppressing thoughts was no more difficult, unpleasant, frustrating, or arousing than solving simple arithmetic problems.¹ Research also has shown that the effects of inhibiting one's behavior are specific to subsequent tasks that require inhibition: Difficult tasks that do not require inhibition have no effect on subsequent performance (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Vohs & Heatherton, 2000). Similarly, inhibiting an urge has no effect on later tasks that do not require self-control (Muraven & Slessareva, 2001). In sum, self-control performance (and only self-control performance) suffers after the exertion of self-control. Negative emotions, frustration, effort, and arousal cannot account for these results; the critical feature appears to be whether the initial task required the individual to override a thought, behavior, or emotion.

The exertion of self-control may lead to poorer subsequent self-control performance, because self-control may draw on a limited resource or energy (*self-control strength*) that is necessary for the success of self-control (Baumeister et al., 1994; Muraven & Baumeister, 2000). This model of self-control proposes that self-control strength is necessary for any attempt at self-control. Whenever an individual inhibits a thought, urge, emotion, desire, or behavior, he or she uses self-control strength. In addition, the model proposes that the exercise of self-control reduces the amount of strength available to the individual, much as physical exertion reduces the amount of physical strength the individual is capable of exerting (he or she is *depleted*). The magnitude and duration of the loss of self-control strength should be proportional to the degree of inhibition required. Finally, individuals lower in self-control strength should perform more poorly on tasks that require inhibition. Individuals who exert self-control should have less self-control strength and therefore may perform more poorly on a subsequent self-control task than individuals who did not previously exert self-control. The self-control strength model thus predicts that individuals who recently exerted self-control should be less able to inhibit their behavior subsequently. Indeed, previous research has shown that regulating emotions leads to poorer control over physical stamina (Muraven et al., 1998), and resisting the temptation to eat cookies reduced participants' subsequent persistence on a difficult task (Baumeister et al., 1998). However, the self-control strength model has not been applied to the regulation of alcohol intake.

In this study we tested the applicability of the self-control strength model to alcohol consumption in a situation that called for the regulation of alcohol intake. Following previous studies of depletion (Muraven et al., 1998), we randomly assigned social drinkers to one of two conditions that differed in how much inhibition was required and thereby created conditions that differed in the potential to deplete self-control strength. In the high-depletion condition, participants were asked to suppress the thought of a white bear. In the low-depletion condition, participants solved simple arithmetic problems. Participants in both conditions subsequently completed taste ratings of beer. Participants

believed that they would take a driving simulator test after making the taste ratings. Alcohol consumption would result in poorer performance on the driving test; hence participants should be motivated to limit how much they consumed. That is, the situation called for as little consumption as feasible, and therefore greater drinking is reflective of a loss of self-control (see, e.g., Barkley, 1997; Hayes et al., 1996).

On the basis of the self-control strength model, we predicted that individuals whose self-control strength was depleted would consume more in this situation, which called for regulation of alcohol intake, than individuals who were not depleted. More specifically, individuals who suppressed the thought of a white bear would consume more alcohol and achieve higher blood alcohol content (BAC) than individuals who did simple arithmetic. The increased alcohol consumption among individuals who suppressed their thoughts should not be mediated by mood, arousal, irritation, or frustration. We also predicted that the more self-control individuals exerted, the more they would consume subsequently.

Drinking restraint theory suggests that the amount consumed is a function of the trait temptation to drink and the ability to override that temptation (Bensley, 1991; Collins, 1993). Thus, individuals' trait temptation to drink may interact with their ability to exert self-control to determine how much is consumed. Once inhibition breaks down because of the depletion of self-control strength, individuals who are high in temptation to drink should consume more than individuals who are lower in trait temptation to drink, suggesting an interaction between trait temptation and depletion. Individuals who suppressed their thoughts and who are high in trait temptation to drink should consume more alcohol than individuals who suppressed their thoughts and who are lower in trait temptation to drink. On the other hand, trait measures of behavioral control seemed to be unrelated to the amount of alcohol consumed in laboratory settings (Collins, Gollnisch, & Izzo, 1996); thus, this factor should not predict alcohol consumption in the present experiment.

Method

Participants

Fifty-eight male volunteers were recruited from advertisements placed in newspapers in the Buffalo, New York, metropolitan area. Participants between 21 and 35 years of age ($M = 25.2$ years, $SD = 4.11$) were selected to ensure legal drinking age and similar drinking habits. The sample was largely European American (91%), with some representation of persons reporting an African American (3.4%) and Hispanic American (3.4%) background. A majority reported Roman Catholic religious beliefs (57%), with a smaller percentage reporting Protestant (12%), Jewish (5%), and no religious beliefs (21%). Ninety-seven percent of the sample was single. Forty-three percent of the sample was currently in school. The majority of participants were employed (74% reported at least part-time work).

Participants were carefully screened during the initial telephone interview with the Short Michigan Alcoholism Screening Test (S-MAST;

¹ That is not to say that working on arithmetic does not require self-control. Instead, solving simple addition problems should require less inhibition of goal-irrelevant urges, thoughts, and desires than suppressing a thought. The strength of the goal-irrelevant urges that require inhibiting should be greater for individuals suppressing their thoughts than for individuals doing arithmetic.

Selzer, Vinokur, & Rooijen, 1975) and custom-designed questionnaires. Volunteers who were precluded from drinking alcohol because of alcoholism, health, or psychological concerns were not recruited for this experiment. Participants were social drinkers who consumed at least two alcoholic beverages a day at least three times per week ($M = 17.0$ drinks per week, $SD = 12.2$). Participants received \$25 for their time and effort. All participants were treated in accordance with the American Psychological Association's (1992) Ethical Principles for Human Subject Research.

Measures

Temptation and Restraint Inventory (TRI; Collins & Lapp, 1992). The TRI is a 15-item measure of both aspects of drinking restraint. Each item (e.g., "Is it hard to distract yourself from thinking about drinking?") is rated on a 9-point Likert scale. The TRI has two higher order factors: Cognitive and Emotional Preoccupation (CEP; temptation to drink) and Cognitive and Behavioral Control (CBC; restriction of alcohol intake). The nine items of the CEP higher order factor assess difficulty controlling drinking, negative affective reasons for drinking, and thoughts about drinking. The six items of the CBC higher order factor assess attempts to cut down on drinking and thoughts about limiting drinking. The higher order factors of the TRI are highly reliable (Cronbach's alphas: CEP = .91, CBC = .79; Collins, Koutsky, & Izzo, 2000), and the TRI has proven valid in comparison to measures of conceptually related constructs.

S-MAST (Selzer et al., 1975). The S-MAST is a psychometrically sound measure of alcohol problems that is commonly used in research. Participants respond "yes" or "no" to each of 13 alcohol-related problems (e.g., "Are you always able to stop drinking?"), and positive responses are summed to form a total score.

Brief Mood Introspection Scale (BMIS; Mayer & Gaschke, 1988). The BMIS is a well-validated and reliable instrument used to assess mood valence and arousal. Participants rate their current feelings on 16 adjectives (e.g., *happy, nervous*), using a 7-point Likert scale. These 16 adjectives load on two mood factors: Pleasantness–Unpleasantness (valence) and Arousal–Calm (arousal). The BMIS mood factors have internal consistencies of .76–.83 and have well-established validity.

Postexperimental reactions to the tasks. At various points during the experiment, participants answered a series of questions about their experience, using a 25-point Likert scale. The questions were custom designed to tap into participants' motivation and cognitions while they worked on the experimental tasks (e.g., "How frustrating was the task?", "Did the driving task influence how much you drank?").

Procedure

Participants who met the experiment's screening criteria were scheduled for an appointment in the late afternoon or early evening. Only 1 participant was tested in each session. Participants were told to refrain from eating for 3 hr or drinking alcohol for 24 hr before their appointment. On their arrival at the research setting, participants' IDs were checked, and their pre-experimental BAC was assessed with a breath sample analyzed by an Intoxilyzer (Model 5000, CMI, Owensboro, KY). All participants met the criterion of a BAC of 0 prior to the experiment. Participants signed an informed-consent form and completed a questionnaire to assess demographic characteristics (e.g., age, ethnicity) and typical weekly alcohol consumption. Participants also completed the TRI (Collins & Lapp, 1992), our measure of drinking restraint. Previous research has found that in laboratory settings the CBC (restriction) factor of the TRI is unrelated to the amount consumed (Collins et al., 1996). Hence, we restrict our analysis to the TRI's CEP (temptation) factor.

Participants were told that the purpose of the experiment was to investigate perceptions of intoxication. The experimenter explained that the perception of intoxication is important because people need to judge whether they are capable of driving safely, for example. The experimenter

told participants that they were going to sample the taste characteristics of two different beers and that after they drank the alcohol they would take a driving simulator test. Furthermore, they were told that they could win a prize if they performed well on the driving test (the driving test was not administered—it was a manipulation to increase alcohol restraint in the participants). Hence, participants were encouraged and free to consume the beer but also were given a reason to restrain or regulate their alcohol intake. During the debriefing at the end of the experiment, all participants reported that they believed that they would take a driving test and that they would win a prize if they did well on this test. Similarly, participants thought the primary focus of the study was the ability to perceive their level of intoxication; no participant suspected that his alcohol intake was being measured.

Depletion phase. After they completed the questionnaires, participants were randomly assigned to one of two tasks that varied in their requirements for inhibition or self-control: (a) suppressing the thoughts of a white bear (thought-suppression [TS] condition; high inhibition) or (b) solving simple arithmetic problems (simple-arithmetic [SA] condition; low inhibition). The tasks were designed to differ in the amount of inhibition required, but they did not differ on other important characteristics. Half the participants ($n = 29$) were randomly assigned to work on a TS task for 5 min. Participants in this condition were told to track the number of times the thought of a white bear intruded on their thoughts (e.g., Wegner, Schneider, Carter, & White, 1987). They were told to write down thoughts as they came to mind (i.e., a thought listing task) while avoiding thinking about a white bear; they should suppress the thought of a white bear. If a thought of a white bear entered their mind, they should try to think about something else immediately. Suppressing task-irrelevant thoughts, such as the experimenter-primed white bear, requires a great deal of inhibition and therefore should reduce participants' self-control strength (Muraven et al., 1998).

The other half of the participants ($n = 29$) were assigned to the SA condition. Participants in this condition solved addition problems (they added 2 three-digit numbers) for 5 min. Participants were given a large number of problems to solve and hence did not solve all the problems. Similarly, they were not given feedback on their performance, and thus they did not know how successful they were in solving the problems. Participants in previous experiments have reported that doing arithmetic is as unpleasant, frustrating, arousing, and effortful as suppressing thoughts (e.g., Muraven et al., 1998). Working on arithmetic problems should not require overriding strong goal-irrelevant urges, however, and therefore should not be as depleting as suppressing the thought of a white bear (see footnote 1).

After participants suppressed their thoughts or did arithmetic for the required 5 min, the experimenter gave them a short questionnaire to assess their feelings about the task, level of frustration, and amount of effort exerted. Participants also completed the BMIS (Mayer & Gaschke, 1988).

Drinking phase. After completing the depletion task, participants entered Charley O'Toole's, a laboratory bar that closely resembles a real bar, where they took part in the taste-rating task (TRT). The TRT is a frequently used method for measuring alcohol intake in which participants sip alcoholic beverages and rate their taste characteristics (Collins et al., 1996; Marlatt, Demming, & Reid, 1973). The TRT has limitations related to its impact on the topography of drinking but is appropriate in this study because it does not influence the total amount consumed in a laboratory bar and because it provides an unobtrusive measure of drinking (George, Phillips, & Skinner, 1988). The TRT has been used to measure participants' desire to drink (Palfai, Monti, Ostafin, & Hutchison, 2000). Self-control capacity also has been measured using the conceptually similar eating taste rating task (Tice, Bratslavsky, & Baumeister, 2001; Vohs & Heatherton, 2000).

In the bar, each participant was presented with a pitcher of Budweiser beer (3.8% alcohol by weight) and a pitcher of Beck's beer (4.0% alcohol) and two empty glasses. He was instructed to read adjectives (e.g., *sweet*,

bitter) presented on a computer screen, sip as much or as little as he wanted of the beers, and rate the degree to which each beer possessed the taste characteristic. During the 20-min drinking session, the participants used a 7-point Likert scale, presented on a touch screen, to make the taste ratings of the two beers. However, participants were not aware of the number of adjectives to be rated or the amount of time allotted to the task, so they could not modify their drinking to respond to these features of the TRT (cf. Collins et al., 1996). The experimenter left the room during the TRT.

To increase their motivation to restrain their alcohol intake, participants were reminded of the driving test. All participants indicated that they recognized the need to limit how much they consumed in order to win the prize for driving well (see Results section). The situation called for the regulation of alcohol intake; that is, participants should consume as little alcohol as feasible. Thus, in this task, greater drinking is reflective of a loss of self-control. Any factor that interfered with participants' ability to exert self-control therefore should lead to greater consumption of alcohol.

The total consumption of beer was determined by how much beer remained in the pitchers and glasses at the end of the TRT. Participants' postexperimental BAC was obtained 20 min after the TRT ended, to allow time for the alcohol to be absorbed. During that time, participants completed a short manipulation and procedure check and reported on their cognitions during the experiment. Participants were then debriefed and allowed to relax until their BAC reached a safe level (.02). A taxicab took them home.

Results

Plan of Analysis

We hypothesized that individuals who exerted self-control during the initial phase of the experiment should consume more alcohol and achieve higher BACs during the alcohol-consumption phase than individuals who did not exert self-control prior to drinking. Moreover, we predicted that, as self-control breaks down (e.g., because of the depletion of self-control strength), individuals who are more tempted to drink should consume more and become more intoxicated than individuals who are less tempted to drink. To test these hypotheses, we performed a moderated multiple regression on amount consumed and final BAC. Following Cohen and Cohen (1983), we first entered the two main-effect variables: depletion condition and TRI-CEP (trait temptation to drink). In the next step, the interaction between depletion condition and TRI-CEP was entered.

Alcohol-Related Outcomes

Consistent with the predictions of the self-control strength model, the main effect of participants' initial self-control effort was significantly related to their final BAC based on the regression equation. In particular, participants in the TS condition ($M = .048$, $SD = .018$) had significantly higher BACs than participants in the SA condition ($M = .037$, $SD = .023$), $\beta = .265$, $t(55) = 2.02$, $p < .05$. The overall amount of beer consumed was only marginally significantly related to condition in the regression equation (TS: $M = 870$ ml, $SD = 264$; SA: $M = 760$, $SD = 248$), $\beta = .224$, $t(55) = 1.74$, $p < .10$, possibly because participants did not like the Beck's beer. Indeed, a paired comparison using questions drawn from the procedure check questionnaire indicated that participants liked the Budweiser beer ($M = 17.0$ on a 25-point scale, $SD = 7.44$) much more than the Beck's beer ($M = 12.3$, $SD = 8.42$), $t(57) = 2.92$, $p < .005$. The participants' dislike for the Beck's beer and the marginally significant difference in overall

consumption led us to consider the amount of Budweiser consumed as a better measure of alcohol intake. Consistent with that idea, condition was not related to the amount of Beck's beer consumed, $\beta = .067$, $t(55) = 0.50$, *ns* (TS: $M = 350$ ml, $SD = 177$; SA: $M = 332$, $SD = 152$). However, participants in the TS condition ($M = 520$ ml, $SD = 181$) consumed significantly more Budweiser beer than participants in the SA condition ($M = 428$ ml, $SD = 153$), $\beta = .274$, $t(55) = 2.15$, $p < .05$.

Random assignment led to two groups that did not differ on key variables, including typical weekly consumption (TS: $M = 18.0$ drinks/week, $SD = 14.6$; SA: $M = 16.0$ drinks/week, $SD = 9.52$), $t(56) = 0.63$, *ns*, and temptation to drink as assessed by the TRI-CEP (TS: $M = 25.7$, $SD = 13.8$; SA: $M = 22.8$, $SD = 9.49$), $t(56) = 0.91$, *ns*.

Trait Temptation to Drink and Depletion

We now turn to the interaction between condition and TRI-CEP. Although the main effect of TRI-CEP was not significant for any dependent variables, the interaction between trait temptation and condition was significant for several outcome variables. In particular, the interaction between condition and TRI-CEP was significantly related to total beer consumed, $\beta = .276$, $t(54) = 2.01$, $p < .05$ (the results were similar when only the amount of Budweiser beer was considered). Hence, previous self-control demands and trait temptation to drink jointly predict the amount of alcohol consumed. For final BAC, the interaction between condition and TRI-CEP was not significant for BAC, $\beta = .129$, $t(54) = 0.93$, although the pattern of the interaction was the same as the pattern for consumption.

As shown in Figure 1, after exerting self-control, participants high in trait temptation (TRI-CEP) consumed more alcohol than individuals lower in temptation to drink. To determine when the difference between the two lines became significant, we calculated that the Johnson-Neyman region of nonsignificance ($p > .05$) was between 4.4 and 25.0 (Jaccard, Turrisi, & Wan, 1990; Johnson & Neyman, 1936). Thus, participants who suppressed their thoughts consumed more alcohol than participants who worked on arithmetic problems, providing they had a TRI-CEP score in excess of 25.0. The range of scores on the TRI-CEP was 9–55, and approximately 40% of the sample scored greater than 25. The slopes for the individual groups (TS and SA) did not differ significantly from zero; only the interaction between these slopes was significant. This suggests that trait temptation to drink had no effect on amount consumed when condition was held constant; it matters only when the individual's previous self-control demands are taken into account.

Mood, Frustration, and Other Confounding Variables

We examined several other variables to see whether they mediated the relationship between initial task and alcohol consumption. There was no correlation between mood and final BAC, $r(58) = .10$, *ns*, and no correlation between mood and amount of beer consumed $r(58) = .16$, *ns*. The correlations between arousal and final BAC, $r(58) = .07$, *ns*, and arousal and amount of beer

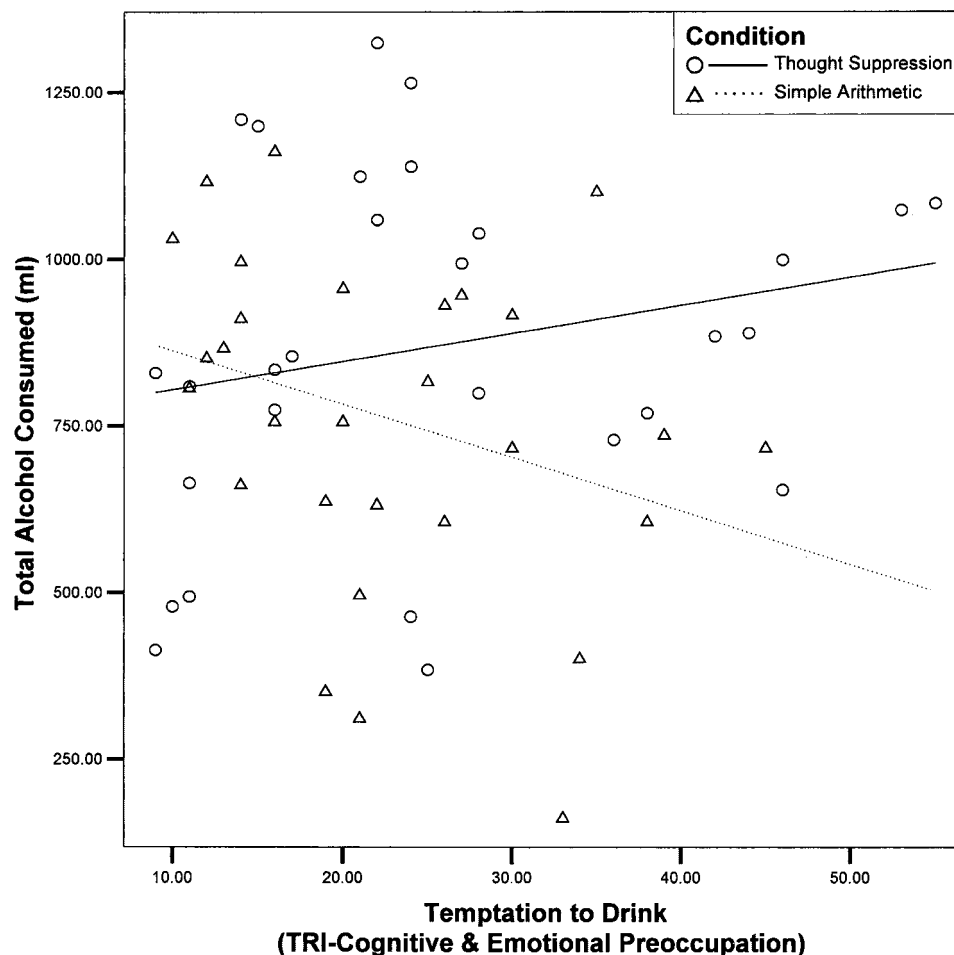


Figure 1. Total amount of alcohol consumed versus temptation to drink for the simple-arithmetic and thought-suppression conditions. TRI = Temptation and Restraint Inventory.

consumed $r(58) = .01$, *ns*, also were not significant.² Thus, overall, mood and arousal do not mediate the relationship between initial task and the alcohol-outcome variables, based on the tests of mediation outlined by Baron and Kenny (1986). Moreover, as assessed by the BMIS, participants who suppressed their thoughts were in the same mood ($M = 19.9$, $SD = 9.94$) as participants who did arithmetic ($M = 17.3$, $SD = 11.5$), $t(56) = 0.92$, *ns*. Similarly, participants in the TS condition were no more aroused ($M = 27.8$, $SD = 5.82$) than participants in the SA condition ($M = 25.8$, $SD = 6.06$), $t = 1.28$, *ns*. Not only did mood and arousal not mediate the results, but also mood and arousal did not differ between conditions. Finally, the differences in final BAC and amount of alcohol consumed (either total amount of beer or only Budweiser beer) between the experimental conditions remained significant after controlling for the effect of mood and arousal through covariate analysis.

The TS condition did not differ from the SA condition on other confounding variables, either. On a 25-point Likert scale, participants in the TS condition ($M = 6.55$, $SD = 6.27$) perceived the task as similar in difficulty as participants in the SA condition ($M = 4.97$, $SD = 6.98$), $t(56) = 0.91$, *ns*. Similarly, the groups did not differ in their ratings of effort required (TS: $M = 12.5$, $SD =$

8.57 ; SA: $M = 15.9$, $SD = 8.92$), $t(56) = 1.52$, *ns*; frustration (TS: $M = 7.72$, $SD = 7.20$; SA: $M = 6.66$, $SD = 7.47$), $t(56) = 0.56$, *ns*; and unpleasantness (TS: $M = 10.2$, $SD = 5.64$; SA: $M = 9.00$, $SD = 6.04$), $t(56) = 0.79$, *ns*. Finally, participants who were instructed to suppress their thoughts ($M = 15.1$, $SD = 4.77$) liked the task as much as participants who solved arithmetic problems ($M = 14.9$, $SD = 6.26$), $t(56) = 0.17$, *ns*. None of these variables mediated the relationship between initial task and the alcohol-consumption variables. Furthermore, the differences in BAC and amount of beer consumed between experimental conditions remained significant when the effects of these variables were covaried out.

To increase the reliability of the measure of irritation and frustration, we combined the single-item measures (i.e., "How frustrating was the task?", "How unpleasant was the task?") with items from the mood measure that also tap frustration (i.e., *grouchy*, *frustrated*, *fed up*, *irritated*, and *annoyed*) to create a

² The correlation between mood or arousal and amount consumed remained small ($r_s < .15$, *ns*) when the analysis was restricted to the amount of Budweiser beer consumed (rather than total beer consumed).

general irritation scale. This 7-item scale had an alpha of .62. On this scale of irritation and frustration, participants in the SA condition ($M = 24.7$, $SD = 14.1$) did not score significantly higher than participants in the TS condition ($M = 27.4$, $SD = 13.9$), $t(56) = 0.75$, *ns*. In a test of mediation, final BAC was unrelated to score on the irritation scale, $r(58) = .11$, *ns*, as well as feelings of frustration, $r(58) = .15$, *ns*; perceived unpleasantness, $r(58) = .06$, *ns*; and effort exerted, $r(58) = -.09$, *ns*. Similarly, correlations with the amount of beer consumed were not significant for overall irritation, $r(58) = .08$, *ns*; frustration, $r(58) = -.03$, *ns*; perceived unpleasantness, $r(58) = -.01$, *ns*; or effort exerted, $r(58) = -.13$, *ns* (the correlations remained small, $r_s < .10$, *ns*, when the analysis was restricted to the amount of Budweiser beer consumed). Thus, frustration, irritation, and effort exerted did not mediate the results.

Ruling out alternative explanations is of course difficult; however, a power analysis indicated that we had sufficient power to detect an effect size of $d = .6$ (medium) or a correlation of $r = .28$ approximately 75% of the time. That is, with a standard deviation of 14, we had sufficient power to detect a difference between the means of 8.4 across the seven questions, or a little more than 1 response point per question. The questions used a 25-point Likert scale, so the space between response points was very small. Hence, we argue that we had sufficient power to detect a difference in irritation between conditions had any existed. In short, the TS task was as pleasant, frustrating, irritating, and effortful as the SA task.

Finally, participants in the TS condition ($M = 4.86$, $SD = 5.81$) reported (on a 25-point Likert scale with anchors of 1 = *definitely yes* and 25 = *definitely no*) that the future driving task affected their desire to drink as much as participants in the SA condition ($M = 6.90$, $SD = 7.82$), $t(56) = 1.13$, *ns*. In other words, both groups were similarly aware of the need to regulate their alcohol intake. Moreover, participants' mean response on this question was significantly different than the midpoint of the scale (12.5), $t(57) = 7.31$, $p < .001$, suggesting that the driving test did encourage participants to limit their drinking.

Self-Control Demands

To the extent that participants had to inhibit or override task-irrelevant thoughts, emotions, urges, and impulses, suppressing the thought of a white bear should require more inhibition than doing arithmetic (Barkley, 1997; Hayes et al., 1996; Shallice & Burgess, 1993). This is the first attempt to test these hypotheses, and therefore we broadened our acceptable alpha levels in the interest of not ruling out a finding of potential theoretical importance. As predicted, participants in the TS condition reported marginally significantly more distracting thoughts (on a 25-point Likert scale) during the depletion phase ($M = 9.93$, $SD = 7.69$) than did participants in the SA condition ($M = 6.55$, $SD = 6.17$), $t(56) = 1.85$, $p < .07$. This finding suggests that the TS instructions may have produced more task-irrelevant thoughts that required overriding than did the SA instructions. In other words, the instructions may have differed in the amount of self-control required.

In addition, participants in the TS condition reported that they worked slightly harder to override distracting thoughts ($M = 8.38$, $SD = 7.08$) than participants in the SA condition ($M = 5.38$, $SD = 5.19$), $t(56) = 1.84$, $p < .07$, *did*. This finding suggests that participants in the TS condition exerted more self-control than

participants in the SA condition (see footnote 1). Furthermore, how hard participants worked at overriding the distracting thoughts correlated with how much beer they consumed, $r(58) = .26$, $p < .05$, and their final BAC, $r(58) = .25$, $p < .058$. The more participants suppressed their thoughts during the predrinking task, the more they consumed during the TRT.

Discussion

Participants who suppressed the thought of a white bear consumed more beer and achieved higher BACs than participants who did arithmetic. Those who solved simple arithmetic problems did not differ in frustration, irritation, mood, or arousal from those who suppressed the thought of the white bear; the two tasks differed only in the amount of inhibition required. Hence, participants who suppressed their thoughts should have exerted more self-control and should have depleted more self-control resources than participants who solved simple arithmetic problems. The loss of self-control resources may lead to poorer self-control. This is significant, because regulating alcohol intake should demand self-control. Therefore, individuals whose self-control is weakened through the depletion of self-control strength tend to consume more and achieve higher BACs in situations that call for restraint.

The results suggest that the amount of alcohol consumed in situations that call for restraint is a function of both temptation to drink (as measured by one's cognitive and emotional preoccupation with alcohol) and ability to exert self-control (as determined by one's previous self-control demands). These findings are consistent with previous work that has shown that the amount of alcohol typically consumed is determined by the individual's trait temptation to drink and his or her typical exertions to not drink (Bensley, 1991; Collins, 1993).

The overall pattern of the interaction between trait temptation to drink and previous self-control demands indicates a potential cognitive mechanism that may account for the results. In particular, the individual slopes for both the TS and SA conditions did not differ from zero; only the interaction between the slopes was significant. We suggest that under certain circumstances individuals can compensate (and may even overcompensate) for their level of temptation (e.g., Fillmore, Vogel-Sprott, & Gavrilescu, 1999; Muraven & Slessareva, 2001; Wilson & Brekke, 1994). Depletion may undermine this corrective mechanism and result in increased consumption. This may explain why the overall interaction between trait temptation to drink and experimental condition was significant but the individual slopes were not. Future research is needed to study this potential cognitive mechanism in greater detail.

The results suggest that any factor that influences self-control may affect individuals' ability to regulate their alcohol intake in situations that call for restraint. Future research may extend these findings to recovering alcoholics, to determine whether a loss of self-control strength is a risk factor for lapsing. For example, recovering alcoholics who experience situations that demand self-control (and therefore deplete their self-control strength) may be at increased risk for a lapse or relapse.

One limitation of this study is that it included only male social drinkers. Men were selected to reduce the variance in the amount consumed. Previous research on depletion found no differences between men and women (Muraven et al., 1998). Therefore, there

should be no differences in how the exertion of self-control affects subsequent alcohol restraint after controlling for gender differences in drinking. This study also did not contain a no-restraint control condition; that is, all participants were led to believe that they would take a driving test after the TRT, and therefore all participants should have been motivated to limit their alcohol intake.

Although the self-control strength model fits the data well, alternative explanations are possible. We attempted to rule out as many alternative explanations as possible. For example, previous research found that depleted individuals will work harder if quitting takes self-control (Baumeister et al., 1998). In addition, depletion affects only tasks that require self-control and has no effect on difficult tasks that do not require self-control (Muraven & Slessareva, 2001). In the present experiment, participants who worked on a task that was designed to deplete their self-control strength were no more frustrated, annoyed, irritated, or aroused than participants who worked on a task that did not deplete their self-control strength. Similarly, the initial tasks did not differ in moods engendered or effort required, which suggests that mood repair or simple cognitive fatigue cannot explain why depleted individuals consumed more beer than nondepleted individuals.

Although ruling out alternative explanations is a difficult and ongoing process, power analysis suggested that we had a sufficient number of participants to find a moderate-sized effect. The failure of negative states to account for the present and previous results (e.g., Baumeister et al., 1998; Muraven et al., 1998) effectively eliminates many alternative explanations. In particular, models such as learned helplessness, negative mood states, and frustration are not compelling interpretations of the results (see Muraven & Baumeister, 2000).

Whereas the evidence from this study is consistent with a limited-strength model of self-control, the methodology for directly assessing self-control strength does not exist at the present time. Hence, the intervening role of self-control strength has to be assumed rather than proven. This study replicates previous research (i.e., Baumeister et al., 1998; Muraven et al., 1998; Vohs & Heatherton, 2000) that has found that after participants work on a task that requires inhibiting a behavior, subsequent self-control performance (as measured with tasks such as persistence on frustrating tasks, ability to regulate emotions, and dieting) suffers. Furthermore, the significant correlation between effort expended in inhibiting task-irrelevant thoughts and amount of alcohol consumed suggests that the amount of self-control exerted in the initial task is an important variable.

We return to the question posed at the beginning of this article: Will a designated driver be able to regulate his or her drinking to remain sober enough to drive? The answer to that question depends on whether he or she has experienced other self-control demands recently and his or her trait level of temptation to drink. A depleted individual who is high in temptation to drink will be at the greatest risk of consuming more alcohol than planned.

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