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# Stress and self-control: a test of contrasting pathways to health risk behavior

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Stress and self-control: A test of contrasting pathways to health risk behavior

by

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A dissertation submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

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2008

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**ABSTRACT**

The current study investigated the effects of stress and self-control depletion on subsequent risk cognitions. Male college students ( $N = 133$ ) were randomly assigned to complete a stress induction, a self-control manipulation, or a control task. All participants then completed a questionnaire containing measures of behavioral willingness, behavioral intentions, perceived vulnerability, and consideration of negative consequences regarding two risk behaviors: heavy drinking and casual sex. The order of the dependent measures (drinking measures first vs. casual sex measures first) was counterbalanced as a between-subjects factor.

Compared to the control task, it was predicted that both the stress induction and self-control depletion manipulation would lead to greater willingness to engage in the risk behaviors. Intentions were not expected to change as much as willingness in response to either manipulation. Different mediating mechanisms were hypothesized for stress and self-control depletion. The relation between stress and willingness was predicted to be mediated by emotional and physiological variables (negative affect and arousal), whereas the relation between self-control depletion and willingness was expected to be mediated by cognitive variables (perceived vulnerability and consideration of negative consequences).

As predicted, participants in the stress condition reported greater willingness than did those in the control condition. Unexpectedly, the self-control depletion manipulation did not lead to greater willingness. As anticipated, there was very little change in intention due to either experimental manipulation. In general, no effects of the order of the dependent measures (or interactions between order and condition) were detected. There was no evidence that negative affect or physiological arousal mediated the relation between stress and willingness. Instead, results indicated that decreases in perceived vulnerability mediated the effect of stress on willingness.

The experimental manipulations did not affect the level of participants' perceived vulnerability or the extent to which they considered the positive and negative consequences of the risk behaviors. There were differences between conditions, however, in the correlations between considerations, perceived vulnerability, and willingness. The pattern of these correlations suggests that, among stressed participants, perceived vulnerability and consideration of negative consequences were not related to willingness. Perhaps people who are under stress focus on improving their emotional state at the expense of careful consideration of the risks associated with the behavior.

## INTRODUCTION

People cite a variety of reasons for their unhealthy behavior. They may say they engaged in a particular risk behavior because they felt bad, because they could not control themselves, because they were experiencing stress, or because they simply gave in to temptation. Two precursors to risk behavior (namely, stress and lack of self-control) are related to alcohol consumption and, to a lesser extent, risky sexual behavior. What is unclear from the extant literature is whether and how these two states differentially influence risk behavior. The current study explored the different potential mechanisms through which stress and self-control depletion operate to lead to risk behavior.

### **Stress and Risk Behavior**

Measures of stress have been consistently linked to substance use (Tate, Patterson, Nagel, Anderson, & Brown, 2007). In a review of the literature, Wills (1990) concluded that stress is related to substance use across the major phases of use (e.g., initiation, maintenance, and relapse) and across types of substances (e.g., smoking, alcohol, and illicit drugs). For example, controlling for negative mood, subjective stress predicts both smoking and alcohol use initiation among adolescents (Wills, 1986). Importantly, several studies utilizing prospective designs (e.g., Newcomb & Bentler, 1986; Wills, 1986) have consistently ruled out the possibility that stress is primarily a consequence, rather than an antecedent, of substance use initiation. In addition to initiation, stress plays a role in the continuation and intensity of substance use. For instance, negative life events are associated with the intensity (i.e., quantity and frequency) of alcohol use among adolescents (Baer, Garmezy, McLaughlin, Pokorny, & Wernick, 1987) and adults (Neff & Husaini, 1982). Finally, stress is a predisposing factor for relapse. For example, in a longitudinal study of smoking cessation program participants, perceived stress predicted higher smoking rates at one and three-month follow-ups (Cohen, Karmarck, & Mermelstein, 1983).

Although representing a much smaller body of work, there is also evidence that stress is related to risky sexual behavior. Traumatic events, such as sexual or physical abuse, are associated with increased sexual risk-taking (e.g., high number of sexual partners), especially among women (Browning & Laumann, 1997; Luster & Small, 1997). Similarly, there is evidence that some traumatic experiences (e.g., assault, natural disasters) are related to the number of casual sexual partners an adolescent reports having had in the past year (Kaufman, Beals, Mitchell, Lemaster, & Fickenscher, 2004). Composite scores of stressful events (e.g., failing grades, relationship problems, divorce in the family) are also positively related to sexual behavior among both male and female adolescents (Harvey & Spigner, 1995).

#### Mediators of the Relation between Stress and Risk Behavior

The primary mediator of the relation between stress and risk behavior seems to be negative affect or distress. In one study, depression partially mediated the relation between negative life events (e.g., death of a family member, being the victim of a crime) and both frequency and quantity of alcohol use among adolescents (Hussong & Chassin, 1994). In this study, neither anger nor anxiety were significant mediators, indicating that the specific type of negative affect caused by the stress may be an important factor in determining whether stress leads to alcohol use. In contrast, another study that examined a specific stressor (workplace abuse and harassment) found support for the mediating role of depression, anxiety, and hostility in explaining the relation between stress and alcohol consumption (Richman, Shinsako, Rospenda, Flaherty, & Freels, 2002). Anger and hostility also have been shown to mediate the effect of another specific stressor (racial discrimination) on substance use among both adults and adolescents (Gibbons et al., 2008). Thus, though the extant literature is somewhat inconsistent in regard to specific mediators, it was hypothesized in the current study that stress would influence willingness to consume alcohol through its impact on measures of negative affect. Because evidence of negative

affect mediation may depend on the specific type of negative affect examined, the study included a wide variety of dimensions of negative affect (e.g., anxiety, anger, sadness, panic).

Little is known about what mediates the relation between stress and risky sex. Similar to stress and alcohol use, it is possible that one mediator is negative affect. There is a substantial minority of men who report increased sexual interest during negative mood states, and these men report higher levels of risky sexual outcomes (i.e., number of sexual partners in the past year, number of lifetime one night stands) than other men do (Bancroft et al., 2004; Bancroft, Janssen, Strong, & Vukadinovic, 2003). A minority of women also experience increased sexual interest when depressed or anxious; however, this study did not include measures of sexual risk, so it remains unclear if this translates into increased risky sexual behavior among women (Lykins, Janssen, & Graham, 2006). More generally, people in experimentally-induced negative moods tend to be more risk-taking (e.g., report more willingness to have unsafe sex) than are people in good moods (Pomery, 2004). The present study attempted to replicate this finding and examined the hypothesis that negative affect mediates the relation between stress and willingness to engage in risky sex.

#### Risk Behavior as Coping and Affect Regulation

Given the relations among stress, negative affect, and risk behavior, many researchers have investigated the hypothesis that people engage in risk behavior as a way to manage or cope with their stress. Across numerous studies, substance use has been related to maladaptive coping. For example, Wills, Sandy, Yaeger, Cleary, and Shinar (2001) found that from seventh to ninth grade, disengagement coping (e.g., anger, avoidance, helplessness) was related to more initial substance use and a greater rate of growth in substance use among adolescents than was engagement coping. Not only are poor coping strategies and substance use related, but there is evidence that avoidance coping (i.e., denial, mental disengagement) moderates the relation between stress and

substance use. Specifically, greater use of avoidant coping strategies is associated with stronger relations between stress and substance use (Hussong & Chassin, 2004).

Furthermore, disengagement coping has larger risk-promoting effects for people reporting high numbers of negative life events than those reporting low numbers of negative events (Wills et al., 2001).

The relation between less adaptive forms of coping and substance use can be explained in terms of affect regulation. Many people perceive that substances provide pleasurable feelings, relieve anxiety, and distract them from their problems, and there is some evidence of these effects. In particular, a meta-analysis revealed that alcohol consumption tends to improve mood (Hull & Bond, 1986). People who tend to cope by focusing on their distress or attempting to avoid their problems may turn to substances to obtain these perceived affect regulation effects. Endorsement of coping motives for drinking (e.g., "I drink because it helps me to escape problems with my family") is associated with both alcohol use and alcohol problems (Windle & Windle, 1996). More recently, it has been shown that high stress is associated with coping motives for drinking among people who exhibit high levels of physiological reactivity to a negative mood induction (Colder, 2001).

Although perhaps less common than using alcohol to cope with stress, some people engage in risky sexual behavior for coping or affect regulation purposes. Cooper, Shapiro, and Powers (1998) identified six motives for engaging in sex, two of which are linked to affect regulation: enhancement motives (e.g., having sex for the enjoyment and pleasure) and coping motives (e.g., having sex to relieve stress; see also Meston & Buss, 2007). In general, men are more likely to endorse these motives, which are related to greater risk-taking. In particular, coping motives are related to more promiscuous sex (both cross-sectionally and over time) but are not related to failure to use condoms (Cooper et al., 1998). Furthermore, in a sample of gay and bisexual men, unprotected intercourse was positively associated with using sex to help cope with stress (although it was not related to

stress itself; Folkman, Chesney, Pollack, & Phillips, 1992). In another study, unprotected intercourse was associated with avoidant coping style among men and women (Gil, 2005).

In sum, in the current study, it was hypothesized that stress would be related to greater willingness to engage in risky behavior (both heavy drinking and casual sex). In contrast, intentions were not expected to change as much in response to the stress induction. This pattern of results would indicate that people engage in risky behavior because of their relatively immediate reaction to a stressful situation, rather than as a pre-planned coping strategy. It was also hypothesized that negative affect would mediate the relations between stress and willingness to engage in risk behavior. Furthermore, because there are individual differences in the extent to which people believe that risk behavior has affect regulation effects, measures of these beliefs were included in the current study (i.e., measures of the extent to which participants believe that drinking / having sex improves their moods and relieves their stress). This allowed for an examination of the effect of the stress induction while controlling for individual differences in affect regulation beliefs as well as for testing for moderation of the stress effect by affect regulation level (i.e., high or low endorsement of affect regulation beliefs). The current study was also designed to investigate different possible considerations (e.g., stress relief, health concerns, having fun) that people think about when they are (and are not) under stress and examine how these considerations relate to willingness and intention to engage in risk behavior.

### **Self-control and Risk Behavior**

In addition to stress, risk behavior is also related to self-control. Self-control is defined as the exertion of control over the self by the self – i.e., an attempt to regulate or change how one thinks, feels, or behaves (Muraven & Baumeister, 2000). Thus, people utilize self-control when they exert effort to override or inhibit their impulses. High self-control is positively associated with a plethora of desirable outcomes, including academic achievement, psychological adjustment (e.g., fewer symptoms of depression and anxiety,

high self-esteem), and interpersonal relationships (e.g., family cohesion, secure attachment style; Tangney, Baumeister, and Boone, 2004). In contrast, low levels of self-control are often correlated with negative outcomes, including some health-compromising behaviors, such as binge eating, alcohol abuse, and drug use (Gerrard, Gibbons, Houlihan, Yeh, et al., 2008; Tangney et al., 2004; Vazsonyi, Trejos-Castillo, & Huang, 2006; Wills, Sandy, & Yaeger, 2002). Low self-control is also associated with sex-related cognitions and behavior (e.g., inability to inhibit sexual thoughts, willingness to be unfaithful to a sexual partner, unprotected sex, multiple sexual partners; Gailliot & Baumeister, 2007; Vazsanyi et al., 2006); however, the relation between self-control and risky sexual behavior is typically weaker than that between self-control and substance use.

The majority of work demonstrating a link between self-control and risk behavior is cross-sectional research that correlates measures of trait self-control and various behaviors, thus precluding any causal conclusions. A notable exception is research by Gailliot and Baumeister (2007) in which self-control was manipulated in a series of experiments. These studies showed that participants whose self-control was temporarily depleted, as well as participants who scored low on dispositional self-control, were less likely to exhibit sexual restraint (although these effects were sometimes moderated by individual differences, such as a restricted versus unrestricted sociosexual orientation). The authors concluded that, in general, the effects of low trait self-control and temporary self-control depletion are parallel. Importantly, the self-control manipulation did not interact with dispositional self-control, indicating that experimentally induced self-control depletion affects people in approximately the same way regardless of individual differences in trait self-control. Nevertheless, trait self-control was measured in the present study so that it could be controlled for in the relevant analyses and to test for possible moderation of the experimental self-control manipulation on the dependent variables.

### Strength Model of Self-control

Baumeister, Muraven, and colleagues have proposed a strength model of self-control to describe the nature of self-control and the consequences of exerting self-control (Baumeister, Vohs, & Tice, 2007; Muraven & Baumeister, 2000; Muraven, Tice, and Baumeister, 1998). The model posits that acts of self-control require the strength of some resource and that this resource is limited; thus, people can inhibit a finite number of impulses for a finite period of time. Importantly, exerting self-control depletes a person of this resource and renders him or her less able to exert self-control subsequently. In this way, self-control is similar to a muscle that fatigues with prolonged use. Because all acts of self-control are proposed to draw on the same underlying resource, exerting self-control in one domain is believed to result in poorer self-control in unrelated domains. For example, participants who exerted effort in altering their emotional state were not able (subsequently) to squeeze a handgrip for as long a period of time as participants who did not regulate their emotions (Muraven et al., 1998). Similarly, participants who suppressed specific thoughts gave up more quickly on a subsequent anagram task than did participants who did not suppress their thoughts (Muraven et al., 1998). After depletion, self-control strength is typically replenished. In other words, people generally regain their strength. There is some evidence that rest (especially sleep), meditation, and positive emotions replenish the self-control resource (Twenge & Baumeister, 2002).

There are likely individual differences in capacity to self-regulate. Some people may simply have a larger “reservoir” of the self-control resource than others, although it remains unclear exactly what this resource is or how to define it precisely. Furthermore, the capacity to exert self-control is not necessarily a fixed resource. It is possible that people can increase their self-control strength. Just as physical exercise increases muscular strength, frequent exercise of self-control (followed by periods of replenishment) may increase the individual’s self-control strength gradually over time (Baumeister, Gailliot, DeWall, & Oaten,

2006). For example, participants who engaged in self-regulatory exercises (e.g., tracking their food consumption, improving their posture) for two weeks were less susceptible to the effects of self-control depletion, relative to a control group who did not perform self-regulatory exercises (Muraven, Baumeister, & Tice, 1999).

It should be noted that research does not support several alternative explanations for the effects of self-control depletion. For example, the effects of self-control depletion do not seem to be the result of completing any difficult task. Performing difficult or effortful tasks that do not require self-control (e.g., memorizing words) does not impair subsequent self-control (Muraven & Slessareva, 2003). In addition, several studies have found no evidence that general fatigue, negative mood, or arousal is responsible for the observed declines in self-control (e.g., Gailliot & Baumeister, 2007; Schmeichel, Vohs, & Baumeister, 2003). Poor self-control following a depleting task is not caused by diminished self-efficacy (Gailliot & Baumeister, 2007). Furthermore, data do not support the alternative explanations that participants perform more poorly on the second self-control task because they feel that by completing the first task they have fulfilled their experimental obligation, or because they reward themselves for performing the first task by not trying as hard on the second task (Baumeister et al., 2006). In sum, the most well-supported and parsimonious explanation for self-control depletion is that self-control requires the strength of some (imprecisely defined) resource that becomes diminished after use.

The strength model of self-control partially explains the relation between self-control and risk behavior. When self-control is depleted, people are more likely to engage in risk behavior because they cannot resist (external) temptations or (internal) impulses. Therefore, people should be more willing to engage in a variety of risk behaviors (e.g., substance use) when they have recently expended energy to control themselves in other ways unrelated to the new demands. The current study tested the hypothesis that self-control depletion leads

to increases in willingness to have casual sex and to drink heavily; however, self-control depletion was predicted to cause less change in intentions to engage in these behaviors.

#### Potential Mediators of the Self-control Depletion Effect

Although there is strong support for the concept of self-control depletion, little is known about the process through which this effect occurs. The specific mediators of the breakdown in self-control have not yet been identified, but some hypothesized mediators have been disconfirmed by the extant literature. For example, correlational analyses and tests for mediation have not supported the hypotheses that emotional and physiological constructs (e.g., negative affect, arousal, fatigue) mediate the effects of self-control depletion on subsequent task performance (Gailliot & Baumeister, 2007; Schmeichel et al., 2003). Although perceived stress and distress are related to self-regulatory failure, in general (e.g., Oaten & Cheng, 2005), there is currently no evidence that stress or distress mediates the effects of self-control depletion on another task. One physiological measure that recently has been shown to be related to self-control is blood glucose level. The brain relies heavily on glucose for energy, and effortful or controlled cognitive processes are more sensitive to fluctuations in blood glucose levels than automatic processes are. For example, decreasing glucose levels are related to impaired performance on complex, but not simple, reaction time tasks (Owens & Benton, 1994). Blood glucose levels decrease after acts of self-control, and low glucose after an initial self-control task is related to poor self-control on a subsequent task (Gailliot & Baumeister, 2008; Gailliot et al., 2007). Thus, it appears that self-control depletion involves a shortage of fuel for the brain's activities.

It seems possible that self-control depletion occurs, at least in part, because of cognitive effects of exerting self-control. There is also support for the notion that self-control depletion affects cognitive processing. For example, self-control depletion leads to impaired cognitive performance (i.e., speed and accuracy in solving Graduate Record Exam questions; Schmeichel et al., 2003). Importantly, self-control depletion affects higher-order

cognitive processes (i.e., reasoning and elaboration, reading comprehension) more than basic functions (i.e., information retrieval from memory, recall of nonsense syllables; Schmeichel et al., 2003).

Additionally, self-control depletion influences decision-making. Self-control depletion causes people to choose the more passive option on subsequent decision tasks even when it is not to their advantage to do so (Baumeister, 2002). The reverse is also true; making decisions (even trivial ones) leads to deficits in subsequent self-control. For instance, people who were asked to make a series of choices about commercial products were subsequently not able to make themselves drink as much of a bitter beverage compared to people who did not make the choices (Twenge & Baumeister, 2002; see also Vohs et al., 2008). Similarly, people who chose freely to make a counterattitudinal speech later gave up more quickly on unsolvable puzzles, compared to people who were simply told to make the same speech (Baumeister, Bratslavsky, Muraven, & Tice, 1998). Thus, Baumeister (2002) argues that the resource that is depleted when self-control is exerted is not limited to self-control but appears to be “central to the self’s executive function generally, including acts of choice, volition, active instead of passive responding, and taking responsibility” (p. 133).

If the self-control resource is the same (or a related) resource underlying other types of cognitive processes, then the mechanism underlying self-control depletion may also be cognitive in nature. Participants who undergo a self-control depletion manipulation may differ from other people in how they process decisions. For example, acts of self-control may prohibit people from processing all of the relevant information. People who are depleted of self-control may not fully consider the consequences of their actions and may not perceive situations as risky. This study tested the hypothesis that the relation between self-control depletion and risky behavior is mediated by risk cognitions: perceived risk, conditional perceived vulnerability, and consideration of negative consequences.

## **Stress and Self-Control**

Not only is self-control strength depleted by acts of self-control, but it can also be depleted by stressful experiences. The strength model of self-control predicts that adapting to stress consumes self-regulatory strength; consequently, self-control often breaks down when people are under stress (Baumeister, Heatherton, & Tice, 1994). Exposure to a variety of stressors, including noise, crowding, and bad odors, is associated with poor subsequent self-control (e.g., poorer frustration tolerance). For example, people who were exposed to unpredictable noise performed more poorly on subsequent proofreading tasks and the Stroop word-color task than those exposed to a predictable noise (Glass & Singer, 1972; Glass, Singer, & Friedman, 1969). Furthermore, stress also leads to failures of self-control related to excessive eating, drinking, and smoking. For instance, dieters are more likely to break their diets following a stressful experience (Wadden & Letizia, 1992), and stress is related to relapse among people trying to quit smoking (Cohen & Lichtenstein, 1990).

The majority of research on stress and self-control is correlational, however, and the extant experimental research includes environmental stressors and generally overlooks more personal stressors (i.e., stressors that implicate the self). One exception is a study by Oaten & Cheng (2005) that examined the effect of real-world stress (i.e., academic exams) on a variety of unrelated regulatory behaviors (e.g., substance use, dietary habits, emotional control). Students' self-regulatory behaviors were more impaired during periods of exams compared to less demanding periods of the semester (e.g., they smoked more, were less able to control their emotions, and ate less healthy food). Moreover, exam stress moderated the effect of a self-control task on subsequent self-control performance. Compared to a control group, participants who were experiencing exam stress displayed greater self-control depletion following a thought suppression task (i.e., participants were instructed to not think about a white bear). These results suggest that stress makes people particularly susceptible to self-regulatory depletion. In sum, consistent with the strength model of self-control,

various measures and manipulations support the hypothesis that stress is related to failures of self-control. Given that stress and self-control are related, one of the goals of the current study was to tease apart the individual effects of stress and self-control depletion on risky outcomes (i.e., willingness to drink heavily and to have unsafe sex).

### Negative Affect and Self-Control

Like stressful experiences, negative affect (e.g., sadness, anxiety) also influences self-control strength. When people are in negative moods, they often temporarily abandon their self-regulatory efforts in order to improve their mood. For example, participants who underwent a negative mood induction were more likely to eat unhealthy snacks and to seek immediate gratification compared to participants who were put in happy moods (Baumeister et al., 1994; Tice, Bratslavsky, & Baumeister, 2001). Furthermore, participants were less likely to eat the unhealthy snacks or to seek immediate gratification if they were first led to believe that doing so would not change their current mood (i.e., they underwent a “mood-freezing” manipulation). Thus, distressed people appear to indulge their impulses for the specific purpose of affect regulation.

Tice and colleagues (2001) argue that negative affect results in a strategic shift in people’s self-regulation priorities in which people choose affect regulation over other forms of self-regulation. Many forms of self-regulation (e.g., dieting) involve resisting the desire for something that makes the self feel good (e.g., dessert). Distress intensifies the motivation to feel good, and so it may increase the urgency or intensity of hedonistic impulses, leading people to engage in behaviors that will bring about short-term pleasure at the potential cost of long-term self-regulatory goals. Thus, these authors assert that it is not the case that negative affect diminishes the overall capacity or the motivation to self-regulate. Simply put, negative affect induces people to choose pleasure over impulse control.

Although it can be unpleasant, exerting self-control does not necessarily lead to negative affect. Generally, participants who exert self-control do not report moods that are

significantly different from those reported by people in control conditions (e.g., Muraven et al., 1998), so it does not appear that self-control exertion causes negative affect. Measures of affect were included in the present study to examine the relations between negative affect and stress, and negative affect and self-control depletion. Specifically, negative affect was not predicted to mediate the effect of self-control depletion on risk cognitions. In contrast, as previously discussed, negative affect was expected to mediate the relation between stress and risk cognitions.

### **Prototype / Willingness Model**

The current study utilized the prototype/willingness model of adolescent health risk behavior. This is a modified dual-processing model that describes two pathways to risk behavior (Gibbons & Gerrard, 1995; 1997; Gibbons, Gerrard, & Lane, 2003). The reasoned pathway reflects the fact that some adolescents make a conscious decision to engage in risk behavior or are guided by intentions to avoid risk behavior. The second pathway, the social reaction path, is more reactive and less deliberate than the first. It acknowledges that adolescent risk behavior is often a reaction to a risk-conducive situation rather than a preplanned action. At the heart of the model is the construct of behavioral willingness. Willingness represents an openness to risk opportunity and an acknowledgement that one might engage in an (unplanned) behavior under certain circumstances. Of course, willingness is correlated with intention, but the two are distinct constructs. Willingness is generally a better predictor of health risk behavior than intention for younger people and for people inexperienced with the behavior (Gibbons & Gerrard, 1997; Gibbons, Gerrard, Blanton, & Russell, 1998; Pomery, Gibbons, Reis-Bergan, & Gerrard, 2008).

### Dual Process Models

The prototype/willingness model is associated with a larger class of social psychological dual process models that posit that people process information and respond to situations using two different cognitive modes or systems: a rational mode and a heuristic

mode. The rational mode is conscious, deliberate, analytic, and rule-based. In contrast, the heuristic mode is more automatic, reactive, holistic, and image-based. The heuristic system tends to be less effortful and more influenced by affect than the rational system is.

Behavioral intention is assumed to be a product of the more reasoned, deliberate processing of the rational system. On the other hand, willingness is characterized as a product of heuristic processing, as it is more reactive affect-based, and image-based (Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008).

### Perceived Risk / Vulnerability and Consideration of Consequences

Another important distinction between intention and willingness is that intention, more so than willingness, is associated with an acknowledgement of risk. In other words, people who intend to engage in risk behavior typically acknowledge that there are potential negative consequences of that behavior. Moreover, people who intend to engage in risk behavior tend to consider the consequences of that behavior when reporting their intentions (i.e., the risk of potential negative consequences factors into their decision-making).

However, people who engage in risk behavior via the social reaction path do not necessarily acknowledge the corresponding risks and tend to report lower perceived vulnerability to negative consequences than do people who follow the reasoned path. People who follow the social reaction path are not oblivious to the negative consequences (i.e., they do not deny the risks), but, rather, tend to minimize them or avoid thinking about them (Gerrard, Gibbons, Benthin, & Hessling, 1996; Gerrard, Gibbons, Houlihan, Stock et al., 2008).

Because measures of perceived risk often confound expectations, intentions, and current risk behavior, two distinct measures are often employed. Absolute perceived risk measures refer to the perceived likelihood that a negative event will occur or to general perceptions of how risky a behavior (e.g., "What is the risk that you will contract an STD in the future?" or "How risky do you think it is to have unprotected sex?"). People who are not intending or expecting to engage in the risk behavior typically (and logically) report low

perceived risk (Gibbons, Gerrard, Ouellette, & Burzette, 1998; Weinstein, Rothman, & Nicolich, 1998). One solution to this problem is the use of conditional perceived vulnerability measures, which are designed to elicit consideration of expected and intended future behavior (thus avoiding the confounding that occurs with absolute measures). Conditional perceived vulnerability measures are usually phrased in the subjunctive (e.g., “*If you were to have unprotected sex, what is the risk that you will contract an STD in the future?*”). Both types of measures were used in the current study to better capture participants’ perceptions of risk.

One way that self-control depletion was hypothesized to be related to willingness is through (a lack of) consideration of consequences and perceived risk. Because depletion causes deficits in cognitive processing (Schmeichel et al., 2003), it was hypothesized that the self-control-depleted participants would fail to thoroughly consider the risks associated with casual sex and heavy drinking. Their relatively impaired processing was predicted to lead to less consideration of consequences of the risk behaviors and lower perceived risk / conditional perceived vulnerability, both of which were predicted to lead to greater willingness.

### The Role of Emotion

The social reaction path acknowledges that people’s emotional states can play a role in their risk cognitions and decision-making. Affective states influence willingness more so than intention, in part because affect plays a larger role in heuristic (vs. rational) processing (Gerrard, Gibbons, Houlihan, Stock, et al., 2008), and also because one’s mood and arousal level is a component of the risk-conducive situation in which willingness is proposed to operate. As already discussed, negative moods in particular are related to risky behavior. Thus, in this study, it was expected that a stress manipulation (which induces negative affect) would be related to greater subsequent willingness to engage in risky behavior. More specifically, it was hypothesized that negative affect will mediate the relation between the

stress induction and willingness to engage in casual sex and heavy drinking. Because people often associate alcohol use with positive expectancies (e.g., a good mood) and coping strategies, the relation was predicted to be stronger for heavy drinking than for casual sex.

What remains unclear in the literature is whether distressed people are simply less able to resist a risky situation or if their risk-taking is a strategic attempt to improve their mood. In other words, it is unknown if the relation between distress and willingness is mediated by increased risk-taking or by affect regulation motives. The present study attempted to clarify this by including measures meant to tap into the thoughts that participants considered when making their decisions regarding willingness to engage in risk behavior. For example, they were asked if they considered thoughts such as “feeling like taking chances,” “giving into temptation,” and “relieving my stress” when responding to the willingness scenarios.

#### Measurement of Willingness

The measurement of behavioral willingness involves asking participants to imagine themselves in a hypothetical situation in which they have the opportunity to engage in risky behavior. Important to the current study, the scenario described is meant to be tempting to the participant in that it describes a situation that will likely lead to short-term pleasure (although potentially at the cost of long-term negative consequences). For example, a measure of willingness to engage in unprotected sex describes a situation in which both members of a couple want to have sex but are without a condom. After imagining themselves in the scenario, participants are asked to report their willingness to engage in several behaviors of increasing risk (e.g., making out, have oral sex, have sex without a condom). In the short term, the situation promises the pleasure of sex, while in the long term it may result in unwanted pregnancy or sexually transmitted infection. In this way, willingness scenarios require self-regulation to override the impulse toward immediate

gratification in favor of the less risky behavior that will protect their health in the long-term. Thus, it was expected that in this study, people who were experiencing temporarily depleted self-control (versus control condition participants) would be likely to report greater willingness in response to these hypothetical scenarios. In other words, the self-control depletion task would lead participants to be less able to exert the self-control necessary to choose the less risky behavioral options.

## STUDY OVERVIEW

There were two main purposes of this study. The first was to experimentally link both stress and self-control depletion to risk cognitions (specifically, willingness to drink heavily and willingness to have casual sex). The second purpose was to distinguish the processes that mediate the relations between stress and willingness, and self-control depletion and willingness. Although both stress and self-control depletion were expected to be related to risk cognitions, this study attempted to clarify the different mechanisms (e.g., changes in affect due to stress, changes in cognitive processing due to self-control depletion) leading to willingness. It also tested for order effects among the dependent variables (intentions and willingness to have casual sex and to drink heavily). Participants underwent a stress induction, a self-control-depleting task, or a control task. They then were asked to report their willingness and intention to engage in both types of risk behavior. The order of drinking-related and sex-related measures was counterbalanced. Thus, the design of the experiment was a 3 (stress vs. self-control depletion vs. control) by 2 (drinking measures first vs. sex measures first) factorial design. In addition to the primary dependent variables, several other measures were included as potential mediating variables: perceived risk, conditional perceived vulnerability, consideration of consequences, affect, and physiological arousal.

### Hypotheses

*Willingness vs. Intentions.* Compared to the control condition, participants in the stress and self-control depletion conditions will report greater willingness to have casual sex and to drink heavily during the experimental session (controlling for their baseline willingness). Compared to willingness, intentions to engage in risk behavior are expected to change less due to either experimental manipulation.

*Stress Mediation.* Emotional (i.e., negative affect) and physiological arousal variables (i.e., heart rate, galvanic skin response) are expected to mediate the relations between stress

and willingness and stress and intention. The stress induction is expected to produce a negative mood and to increase physiological arousal, both of which are predicted to be associated with greater willingness (for both casual sex and heavy drinking).

*Self-control Depletion Mediation.* Cognitive variables (i.e., consideration of consequences, perceived risk, conditional perceived vulnerability) are expected to mediate the relation between self-control depletion and willingness. It is predicted that depleted self-control will be associated with less consideration of consequences and less perceived risk and vulnerability; these cognitions, in turn, are expected to lead to greater willingness to have casual sex and to drink heavily.

## METHOD

### Participants

College students were recruited from psychology classes to participate in the experiment. Prior to recruitment, participants completed a questionnaire including baseline measures of many of the study variables (Appendix A). Because significant gender differences in alcohol use and risky sexual behavior exist, and because gender differences are beyond the scope of this study, only male students were recruited for participation. Students were eligible to participate in the experimental session if they indicated at least minimal pre-test willingness to drink and to have casual sex (i.e., at least 2 on a 7-point scale for each behavior) and at least minimal previous alcohol consumption and sexual behavior (i.e., non-virgins who have had consumed alcohol at least once in the last month).

146 students participated in the study.<sup>1</sup> Data from 12 participants were excluded from the analyses because these participants had previously participated in a study that used the same stress manipulation or because of participants' suspicion concerning the true purpose of the study. An additional participant's data were not used because he could not accurately complete the Stroop task due to color blindness. This resulted in a final sample size of 133. On average, participants were 20.08 years old.

### Procedure

Participants were run individually. To conceal the true purpose of the experiment and thereby reduce experimental demand, participants were told that the lab session consisted of two unrelated studies. The experimenter explained that the first study was investigating performance on cognitive tasks and assessing attitudes and behaviors among college students. The experimenter also explained that he/she would be collecting physiological data from each participant to be used later for the second study. This explanation was meant to reduce suspicion about the purpose of the study (particularly in the stress condition) and to reduce the salience of the physiological measures to participants.

Participants were led to believe that they would be told more about the supposed second study after completing the first. After giving informed consent (Appendix B), participants were seated in another room where they completed the experiment. The physiological measures (heart rate and galvanic skin response) were recorded using Biopac equipment, which involved attaching small electrodes on three fingers on the participant's non-dominant hand. The participants were not able to see their physiological readings during the experiment. To allow the participants to get used to the feel of the electrodes and to establish baseline heart rate and galvanic skin response levels, they completed a filler questionnaire, ostensibly to be used in the second study. The experimenter randomly assigned participants to one of three manipulations: self-control depletion, stress induction, or a control task (see Table 1 for the number of participants per cell).

#### Self-control Depletion Condition

The self-control manipulation chosen for the proposed study (the Stroop task) was selected because previous research has shown that it depletes subsequent self-control but does not induce negative affect (e.g., Gailliot & Baumeister, 2007). The Stroop task involved presenting participants with words that were the names of colors in a font color that was incongruent with the meaning of the word (e.g., the word "red" appeared in green font). The participant's task was to respond with the name of the color ink that each word appeared in and to refrain from reading the word. Participants completed 85 trials on a computer using MediaLab software. The assumption behind the Stroop task is that self-control is required to override the impulse to respond with the word meaning so as to be able to state the color of the ink. Although the Stroop task was a manipulation in this study (and not a dependent variable), the total time to complete all the trials and the number of correct responses were recorded as measures of participants' performance.

### Stress Condition

For the stress induction, participants were told that they would give an impromptu speech on a randomly chosen topic. They were told that they would have only a few minutes to prepare the speech and that they will give the speech to three graduate students who would critique their performance. Previous research has indicated that this manipulation increases self-reported stress and anxiety levels compared to a control task (i.e., anticipating writing a brief anonymous essay on a randomly chosen topic; Houlihan, Gibbons, & Gerrard, 2008). To ensure that the participants believed what the experimenter said, the experimenter made a (bogus) phone call to the graduate students to confirm the time of the speech.

### Control Condition

The control task involved working on moderately difficult (but solvable) math problems (i.e., three-digit multiplication). Math problems require effort and are perceived as similar in difficulty to self-control tasks, but they involve little self-regulation because participants do not have to override their impulses in order to solve the problems. Furthermore, previous studies have shown that participants who complete math problems report similar moods and arousal levels as do those who complete self-control-depleting tasks (Muraven et al., 1998). Participants in the control condition were asked to work on the 10 problems until they believed they had completed as many as they could.

**Table 1: Cell Counts by Experimental Condition**

	Stress	Self-control depletion	Control
Drinking items first	24	24	19
Sex items first	22	24	20

Note.  $N = 133$ .

## Questionnaire

After participants completed one of the three manipulations, they were asked to complete a questionnaire using MediaLab software (see Appendix C). This questionnaire contained the primary dependent variables (willingness and intentions to have casual sex and to drink heavily) followed by the mediators (e.g., consideration of consequences, affect). The order of the measures (drinking measures first or sex measures first) was randomly determined. For both drinking and sex measures, the willingness measures always preceded the intention measures. Upon completion of the questionnaire, the experimenter questioned each participant about potential suspicion regarding the purpose of the study. He or she then fully debriefed the participants and thanked them for their participation.

## **Measures**

### Mass testing (T1)

The following items were assessed during a mass testing session three to 12 weeks prior to the experimental session.

*Willingness to have casual sex.* Participants read about a hypothetical situation (e.g., they meet an attractive woman at a party and go home with her) and then indicated how willing they would be to engage in certain behaviors if they were in that situation (“stay at her apartment and have oral sex,” “stay at her apartment and have sex,” “stay at her apartment but don’t have sex”). Each item was rated on a scale from 1 (*not at all willing*) to 7 (*very willing*). Together the three items did not exhibit good reliability ( $\alpha = .66$ ), so the third item was dropped, and the other two (have oral sex / have sex) were combined to form a willingness index ( $\alpha = .90$ )

*Willingness to drink heavily.* Participants were asked to read a hypothetical situation (e.g., suppose you are at a party with friends on a Saturday night and have had a few drinks) and then indicate how willing they would be to consume more alcohol (e.g., “stay and have one more drink,” “stay and continue to drink (more than one drink),” “stay but not drink

anymore”), each on a scale ranging from 1 (*not at all willing*) to 7 (*very willing*). They also were asked to report a more precise number of drinks they would be willing to consume from 1 (*zero*) to 10 (*9 drinks*). The four items did not exhibit good reliability (standardized  $\alpha = .54$ ), so the non-risk item (“stay but not drink anymore”) and the fourth item (precise number of drinks) were dropped. The remaining two items were used as a T1 willingness index ( $\alpha = .74$ ).

*Intention to have casual sex.* Using a scale from 1 (*definitely not*) to 7 (*definitely*), participants were asked to report the extent to which they intended to have casual sex (defined as sex with someone you do not know very well) in the next six months. Intentions also were assessed with an item phrased as a behavioral expectancy (“In the next six months, how likely is it that you will have casual sex?”) on a scale from 1 (*not at all likely*) to 7 (*very likely*). These two items were combined to form a casual sex intention index ( $\alpha = .97$ ).

*Intention to drink heavily.* Participants were asked to report the extent to which they intend to “have five or more drinks in a single drinking episode” in the next month on a scale from 1 (*definitely not*) to 7 (*definitely*). This was accompanied by a comparable behavioral expectation item assessing the likelihood that participants will drink heavily (5 or more drinks in a single drinking episode) on a scale from 1 (*not at all likely*) to 7 (*very likely*). These two items were combined to form a heavy drinking intention index ( $\alpha = .93$ ).

*Previous sexual behavior.* Participants were asked to indicate the number of people that they have had sex with in their lifetime on a scale from 1 (*none / I am a virgin*) to 10 (*12 or more*). Participants also were asked to report the number of times they have had casual sex in their lifetime on a scale from 1 (*none*) to 10 (*more than 25*).

*Previous drinking behavior.* Participants reported the number of times they have had a whole drink of alcohol in the past month as well as the number of times they had had five

or more drinks in a single drinking episode in the past three months. Both items used a scale from 1 (*never*) to 7 (*12 or more*).

*Consideration of consequences.* Two items assessed the extent to which participants considered the negative consequences of each risk behavior when they have engaged in that behavior in the past (“When you’ve had casual sex [drank heavily] in the past, how much did you think about the negative consequences of that behavior?”). If they have never engaged in the risk behavior, participants were scored as “0.” Otherwise, each item was reported on a scale from 1 (*not at all*) to 7 (*very much*).

*Perceived risk / vulnerability.* Participants were asked to indicate how risky they perceive casual sex and heavy drinking to be (“How risky (or dangerous) do you think heavy drinking [casual sex] is?”). They also were asked to rate their conditional perceived vulnerability to the negative consequences of each risk behavior with the item: “If you were to have casual sex [drink heavily], how vulnerable do you think you would be to the negative consequences of casual sex [drinking heavily] (e.g., sexually transmitted diseases [alcohol poisoning]).” These four items used a scale from 1 (*not at all*) to 7 (*very much*).

*Affect regulation.* Two items for each behavior assessed the extent to which participants believe engagement in the risk behavior will regulate affect: “In general, to what extent do you think having sex [drinking] relieves your stress [improves your mood]?” Each of the four items was reported on a scale from 1 (*not at all*) to 7 (*very much*). The two items for each behavior were combined to form a drinking affect regulation index ( $\alpha = .77$ ) and a sex affect regulation index ( $\alpha = .76$ ).

*Trait self-control.* Participants completed the brief (13-item) version of the self-control scale developed and validated by Tangney, Baumeister, and Boone (2004). Example items include: “I often act without thinking through all the alternatives,” “Pleasure and fun sometimes keep me from getting work done,” and “I am good at resisting temptation.” All

items were rated on a scale from 1 (*not at all*) to 5 (*very much*). Reliability among the 13 items was adequate ( $\alpha = .76$ ), and these items were combined to form a self-control index.

*Perceived stress.* Participants answered six items from the Perceived Stress Scale regarding their level of perceived stress over the past 30 days (Cohen, Karmarck, & Mermelstein, 1983). Example items are: “How often have you felt difficulties were piling up so high that you could not overcome them?” “How often have you found that you could not cope with all the things you had to do?” and “How often have you felt confident about your ability to handle your personal problems?” These items were scored on a scale from 1 (*never*) to 5 (*very often*). The six items were combined to create a T1 perceived stress index ( $\alpha = .82$ ).

#### Experimental session (T2)

All T2 measures were completed on a computer using MediaLab software. Intentions, willingness, perceived risk / vulnerability were assessed in the same manner during the experimental session (following the manipulation of stress / self-control or the control task) as they were in mass testing.<sup>2</sup> The T2 individual willingness and intention items were combined to form indices as they were at T1 (T2  $\alpha$ s: willingness to have casual sex = .86, intention to have casual sex = .90, willingness to drink heavily = .90, intention to drink heavily = .98).<sup>3</sup>

T2 also included the following measures:

*Self-control manipulation check.* To determine if participants perceived that the self-control depletion manipulation required more self-control than the control task did, participants in these two conditions were asked to report how much self-control they needed to exercise in completing their assigned task (“How much self-control did it require for you to work on the math problems [name the colors]?”) on a scale from 1 (*none*) to 7 (*a lot*).<sup>4</sup> They also rated the perceived difficulty of the task on a scale from 1 (*very easy*) to 7 (*very difficult*)

with the item: “How difficult was it for you to complete the math problems [complete the color-naming task]?”

*Consideration of consequences.* Following the willingness measures, participants were asked to report what influenced their decisions to have casual sex (drink heavily) or to abstain. First, participants were presented with a list of twelve possible considerations (e.g., “improving my mood,” “having fun,” giving in to temptation,” “feeling like taking chances”), and they were asked to indicate whether each one influenced their decision by selecting *yes* or *no*. Next, participants answered more specific items similar to the mass testing measures of consideration of consequences. They were asked two items for each behavior regarding how much they thought about the possible outcomes and negative consequences of the behavior (e.g., “When thinking about what you would be willing to do, how much did you think about what might happen as a result of drinking heavily?”). These four items were rated on scales from 1 (*not at all*) to 7 (*very much*). The two drinking-related items were combined into an index ( $\alpha = .83$ ), as were the two sex-related items ( $\alpha = .79$ ).

*Affect.* Participants rated their current emotional state from 1 (*not at all*) to 7 (*very*) using a list of 11 adjectives which served as a manipulation check for the stress condition. The following adjectives were intended to serve as an index of stress-related affect: anxious, nervous, calm (reversed), panicky, confident (reversed), and stressed. The remaining adjectives (happy, sad, excited, pleased, angry) were included primarily as filler to reduce suspicion that the purpose of the study involved stress or negative affect. All items were entered into a principal components factor analysis with varimax rotation, and three factors were extracted (all eigenvalues greater than 1.28). The first factor included: anxious, calm, confident, nervous, and panicky. The second factor contained the positive affect variables: excited, happy, and pleased. The remaining two negative affect variables (angry and sad) comprised the third factor. Factor loadings for “stressed” were similar for both the first and third factors (.41 and .49, respectively). The decision was made to include this item with the

first factor because it fit with the other stress-related adjectives conceptually, and because results of reliability analyses did not differ whether or not “stressed” was included. Thus, the following adjectives comprised the stress-related affect index: anxious, nervous, calm (reversed), panicky, confident (reversed), and stressed ( $\alpha = .78$ ).

*Physiological arousal.* Biopac equipment was used to measure participants' heart rate (i.e., time elapsed, in seconds, between heart beats) and galvanic skin response (in hertz) throughout the study. Readings for both heart rate and galvanic skin response were recorded every thirty seconds. The mean of the readings for the first two minutes (before the experimental manipulations occurred) was used as a baseline measure of physiological arousal. The mean of the readings for the next four minutes served as the post-manipulation arousal score.

## RESULTS

### General Analytic Strategy

Due to the categorical nature of the design, the main method of analysis for the first two hypotheses (regarding willingness and intention) was analysis of covariance (ANCOVA). Separate 3 (task condition: stress, self-control depletion, control) x 2 (order: drinking measures first or sex measures first) ANCOVAs were conducted on both T2 willingness to drink heavily and T2 willingness to have casual sex. In each case the corresponding T1 measure (willingness or intention) was used as the covariate. The 3 x 2 ANCOVAs were used to establish an overall pattern of means and to determine if further analyses should continue to include order as a factor. To more closely examine the differences among task conditions, the 3 x 2 ANCOVAs were followed by one-way ANCOVAs in which the two task conditions of interest were compared (separately) to the control condition (i.e., one-way ANCOVAs comparing the stress and control conditions, as well as one-way ANCOVAs comparing the self-control depletion and control conditions).

To further explore possible order effects, subsequent analyses were conducted only on the measure that participants completed first (given that the second measure tends to be influenced by the response to the first). For example, ANCOVAs were conducted on drinking willingness only among the participants who answered drinking measures first. Additionally, to examine potential order effects between groups, subsequent analyses were conducted on whatever measure (drinking or casual sex) was answered first. When there was no effect of drinking/sex order detected, the order factor was collapsed and only the one-way ANCOVA was considered.

Finally, the bootstrapping method of testing for indirect effects (Preacher and Hayes, 2004; 2008) was employed to test the hypotheses regarding the mediation of the stress induction and of self-control depletion on T2 willingness.

### Randomization Checks

To verify that the distribution of drinking and sexual behavior variables among participants in the six experimental conditions did not differ significantly, 3 (stress induction vs. self-control depletion vs. control) by 2 (drinking measures first vs. sex measures first) ANOVAs were conducted on the T1 drinking and sexual behavior items. No differences were detected for the T1 casual sex willingness or intention indices ( $p$ s > .60). For T1 sexual behavior, however, there was a significant difference between the two order conditions, such that the participants assigned to answer sex measures first reported more lifetime sexual partners ( $F(1, 127) = 5.01, p < .03$ ) and more casual sex behavior ( $F(1, 127) = 6.72, p < .02$ ) at T1 than did participants assigned to answer alcohol measures first.

For the alcohol-related measures, a 3 x 2 ANOVA revealed a significant difference among the three task conditions on the T1 heavy drinking willingness index ( $F(2, 127) = 3.36, p < .04$ ). Follow-up pairwise comparisons revealed that participants in the control condition reported greater T1 willingness than did those in the stress condition ( $t = -2.55, p < .02$ ) and those in the self-control depletion condition ( $t = -2.34, p < .03$ ). There were no differences detected for T1 heavy drinking intention nor the T1 drinking behavior items ( $p$ s > .14). Although random assignment was achieved for the most part, subsequent analyses on T2 variables were conducted to control for the corresponding T1 variable.

### Manipulation Checks

A one-way ANOVA comparing the three task conditions (stress, self-control depletion, and control) was conducted on the T2 stress index to determine if the stress induction successfully manipulated participants' stress-related affect. Results revealed a significant effect of task condition on stress-related affect during the experimental session ( $F(2, 130) = 12.44, p < .001$ ). Follow-up t-tests confirmed that the stress condition participants scored higher on the stress index (i.e., anxious, stressed, calm (reversed), confident (reversed), nervous, and panicky) than both the self-control depletion participants

( $t = 3.85, p < .001$ ) and the control participants ( $t = 4.18, p < .001$ ), who did not differ from each other ( $t = .42, p > .67$ ). The three task conditions did not differ on the other affect variables (pleased, excited, happy, sad, angry;  $ps > .16$ ), raising confidence that it was stress-related affect only that was affected by the manipulation.

In addition, a one-way ANCOVA was conducted on the post-manipulation physiological arousal scores (covarying the baseline arousal scores). Although no difference between conditions was detected for heart rate ( $p = .72$ ), there was a task condition effect on galvanic skin response ( $F(2, 128) = 3.49, p = .03$ ; see Table 2 for adjusted means). Follow-up ANCOVAs comparing two conditions at a time revealed that the stress condition participants had significantly higher galvanic skin response levels than did the control condition participants ( $F(1, 81) = 6.80, p = .01$ ) and marginally higher galvanic skin response levels than did the self-control depletion condition participants ( $F(1, 90) = 3.64, p = .06$ ). The self-control depletion and control conditions did not differ ( $p = .34$ ). Thus, there is evidence that the stress induction had its intended effects on both physiological arousal and perceived affect.

**Table 2. Adjusted Means by Task Condition for Post-manipulation Heart Rate and Galvanic Skin Response, Controlling for the Corresponding Baseline Measure**

	Stress	Self-control depletion	Control
Heart rate (in seconds, range = .24 to 1.15)	.71	.72	.70
Galvanic skin response (in Hz, range = .02 to 34.48)	9.30	8.65	8.41

To confirm that the Stroop task successfully manipulated self-control, pairwise comparisons (comparing the self-control depletion condition and the control condition) were conducted on the perceived self-control and perceived difficulty measures. T-tests confirmed

that participants rated the Stroop task as requiring more self-control than did the math problems ( $t = 4.26, p < .001$ ). Participants also rated the Stroop task as significantly more difficult than the math problems ( $t = 2.42, p < .02$ ). Although limited by the use of self-reports, these results indicate that self-control was manipulated in accordance with previous research (Gailliot & Baumeister, 2007; Muraven et al., 1998).

### **Descriptive Statistics**

The means and standard deviations for all T1 and T2 variables are presented in Appendix D. Overall at T1, participants reported relatively high willingness to drink heavily ( $M = 5.03$ ) and to have casual sex ( $M = 5.49$ ) and intentions to engage in those behaviors ( $M = 5.94$  for heavy drinking;  $M = 3.69$  for casual sex). Given the large discrepancy between casual sex willingness and intention, it appears that casual sex is more willingness-based than is heavy drinking. In general, participants reported a moderate level of previous risk behavior. They had, on average, three lifetime sexual partners. Approximately 70% of participants reported having had casual sex at least once, and 28% of participants reported having had casual sex more than six times in their lifetime. On average, participants reported consuming at least one alcoholic drink an average of six to eight times in the past month. 41% of participants had consumed 12 or more drinks in the past month. Nearly all participants (94%) reported drinking heavily (defined as consuming five or more drinks in one episode) at least once in the past three months, and 34% reported drinking heavily 12 or more times in the past three months. Table 3 presents the correlations among the T2 dependent variables.

The T2 dependent variables were also significantly correlated with T1 individual difference variables. As shown in Table 4, trait self-control was correlated with T2 willingness and intention to have casual sex ( $|rs| > .16, ps < .05$ ). Significant associations were also found between T2 willingness and intention and affect regulation for both risk behaviors. Endorsement of drinking for affect regulation purposes was positively correlated

with willingness and intention to drink heavily ( $r = .28$  and  $r = .30$ ,  $ps = .001$ , respectively). When controlling for previous drinking behavior, however, the associations between affect regulation and drinking willingness and intention were no longer significant ( $rs < .12$ ,  $ps > .22$ ). Endorsement of sexual behavior for affect regulation purposes was positively correlated with willingness and intention to have casual sex ( $r = .28$ ,  $p = .001$ ;  $r = .22$ ,  $p = .01$ , respectively). The associations between affect regulation and casual sex willingness and intention remained significant when controlling for previous sexual behavior ( $r = .27$ ,  $p < .01$  for willingness;  $r = .21$ ,  $p < .02$  for intention). Finally, participants' level of perceived stress at T1 was not correlated with their T2 willingness or intentions ( $rs < .13$ ,  $ps > .13$ ).

**Table 3. Correlations among T2 Dependent Variables**

<u>Variable</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>
1. Drinking Willingness	-	.31***	.52***	.40***	-.13	-.35***	-.35***	-.12	.05	-.36***	-.03
2. Sex Willingness		-	.29***	.38***	-.10	-.29***	-.18*	-.30***	-.21*	-.22**	-.43***
3. Drinking Intention			-	.26**	-.10	-.35***	-.35***	-.04	-.05	-.27***	-.08
4. Sex Intention				-	-.20*	-.21*	-.14	-.25**	-.16	-.20*	-.27***
5. Stress-related affect					-	-.02	.03	-.06	.10	-.06	-.12
6. Drinking Perceived Risk						-	.52***	.44***	.29***	.47***	.23**
7. Drinking Conditional PV							-	.28***	.23**	.28***	.19*
8. Sex Perceived Risk								-	.37***	.18*	.32***
9. Sex Conditional PV									-	.11	.11
10. Drinking Considerations										-	.11
11. Sex Considerations											-

Note.  $N = 133$ . \*\*\*  $p \leq .001$ , \*\*  $p \leq .01$ , \*  $p \leq .05$ . PV = perceived vulnerability.

**Table 4. Correlations between T2 Willingness and Intention and T1 Individual Differences**

<u>Variable</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
1. T2 Drinking Willingness	-	.31***	.52***	.40***	-.09	.28***	-.01	-.13
2. T2 Sex Willingness		-	.29***	.38***	-.19*	.09	.28***	.02
3. T2 Drinking Intention			-	.26***	-.08	.30***	.11	.04
4. T2 Sex Intention				-	-.17*	.24***	.22**	.06
5. T1 Trait Self-control					-	-.07	-.14	-.32***
6. T1 Affect Reg. - Drinking						-	.15	-.01
7. T1 Affect Reg. - Sex							-	-.03
8. T1 Perceived Stress								-

*Note.*  $N = 133$ . \*\*\*  $p \leq .001$ , \*\*  $p \leq .01$ , \*  $p \leq .05$ . Affect Reg. = Affect Regulation.

T1 and T2 willingness were significantly correlated, as were T1 and T2 intention (for both drinking and casual sex;  $r_s > .50$ ,  $p_s < .001$ ). Overall, stability from T1 to T2 was greater for intentions than for willingness. An examination of these correlations by task condition revealed that stability was greater among the stress condition compared to the other two conditions, as presented in Table 5. To further explore this difference, the control and self-control depletion conditions were combined into a single non-stress condition, and analyses were conducted to test for differences in the T1 to T2 correlations for the stress and non-stress conditions (see Table 6). The T1 to T2 correlation for drinking willingness was significantly stronger for the stress condition than for the non-stress condition ( $z = 1.94$ ,  $p = .05$ ).

**Table 5. Correlations by Task Condition Demonstrating the Stability of Willingness and Intention from T1 to T2**

	Control (n = 39)	Self-control Depletion (n = 48)	Stress (n = 46)
Drinking Willingness	.45	.50	.71
Sex Willingness	.54	.64	.67
Combined Willingness	.55	.62	.74
Drinking Intention	.60	.76	.82
Sex Intention	.62	.63	.77
Combined Intention	.58	.74	.81

*Note.* All correlations  $p \leq .001$ . Combined Willingness (Intention) = indices of all individual drinking and casual sex willingness (intention) items.

**Table 6. Stress vs. Non-stress Condition Correlations between T1 and T2 Willingness / Intention**

	Non-stress (n = 87)	Stress (n = 46)	Difference between correlations
Drinking Willingness	.48	.71	$z = -1.94,$ $p = .05$
Sex Willingness	.58	.67	$z = -.08,$ $p = .43$
Combined Willingness	.56	.74	$z = -1.69,$ $p = .09$
Drinking Intention	.71	.82	$z = -1.44,$ $p = .15$
Sex Intention	.63	.77	$z = -1.49,$ $p = .14$
Combined Intention	.68	.81	$z = -1.59,$ $p = .11$

*Note.* All correlations  $p \leq .001$ . Combined Willingness (Intention) = indices of all individual drinking and casual sex willingness (intention) items.

## **Willingness**

Participants in the stress and self-control depletion conditions were expected to report greater willingness to engage in risky behavior at T2, controlling for T1 willingness. To test this hypothesis, 3 (task condition: stress, self-control depletion, or control) x 2 (order: sex measures first or drinking measures first) ANCOVAs were conducted on the T2 willingness indices with the T1 willingness index used as the covariate. No main effects of order or task condition x order interactions were found. Additionally, the ANOVA on the willingness index that came first (disregarding the type of behavior) did not reveal an effect of task condition ( $p > .75$ ). Therefore, order was dropped as a factor, and only the one-way ANCOVAs are reported (for tables containing the adjusted means for all the 3 x 2 ANCOVAs on willingness and intentions see Appendix E).

Analyses were also conducted on each willingness index examining only the participants who answered questions regarding that behavior first (i.e., a one-way ANCOVA on drinking willingness only for people who answered drinking items first). This allowed for an examination of “pure” willingness responses for each behavior that were not influenced by the preceding willingness responses for the other behavior. To further explore differences in willingness between the experimental conditions, one-way ANCOVAs (covarying the corresponding T1 variable) were conducted in which the control condition was compared to each of the conditions of interest (stress and self-control depletion) separately.

### Heavy Drinking Willingness

A one-way ANCOVA revealed no main effect of task condition on T2 willingness to drink heavily ( $p = .16$ ), although an examination of the adjusted means revealed that the pattern of means was in the predicted direction: the stress and self-control depletion conditions reported higher willingness to drink heavily compared to the control condition (see Appendix E). The ANCOVA comparing only the stress and control conditions revealed a significant main effect of condition such that participants in the stress condition reported

greater drinking willingness than did those in the control condition ( $F(1, 82) = 4.59, p < .04; d = .22$ ; stress condition adjusted mean = 4.34, control condition adjusted mean = 3.72). In contrast, there was no difference in willingness when comparing the self-control depletion condition to the control condition ( $p = .77; d = .20$ ; self-control condition adjusted mean = 3.90, control condition adjusted mean = 3.82).

When examining only the participants who answered drinking items first, the overall task condition effect was closer to statistical significance ( $F(2, 63) = 2.58, p = .08$ ). Follow-up ANCOVAs (comparing two groups at a time) revealed that among participants who answered drinking items first, the stress condition reported greater drinking willingness than did the self-control depletion condition ( $F(1, 45) = 5.43, p < .03; d = .29$ ) but did not differ significantly from the control condition ( $p = .17; d = .32$ ). The self-control depletion and control conditions did not differ from each other ( $p = .37; d = .32$ ). Thus, although no significant differences were found in the analysis comparing all three conditions, the stress participants did report significantly greater willingness than did the control participants, as predicted.

### Casual Sex Willingness

The one-way ANCOVA on T2 casual sex willingness did not produce a significant effect of task condition ( $p = .17$ ). However, the adjusted means were in the predicted direction: the stress and self-control depletion conditions reported greater willingness to have casual sex compared to the control condition (see Appendix E). There was also no significant task condition effect when the ANCOVA was conducted only on participants who answered the sex measures first ( $p > .50$ ).

The follow-up ANCOVAs comparing the two manipulation conditions to the control condition separately showed that the stress condition had a marginal effect on casual sex willingness ( $p = .08; d = .22$ ; stress condition adjusted mean = 5.46, control condition adjusted mean = 4.99). There was not a significant difference in casual sex willingness

between the self-control depletion and control conditions ( $p = .15$ ;  $d = .21$ ; self-control condition adjusted mean = 5.39, control condition adjusted mean = 4.99).

### Combined Willingness

Next, to examine potential task condition effects on willingness overall (i.e., disregarding type of behavior), a combined willingness index was created by averaging the individual drinking and casual sex willingness items (T1  $\alpha = .76$ , T2  $\alpha = .80$ ).<sup>5</sup> The one-way ANCOVA on T2 combined willingness (covarying T1 combined willingness) revealed a significant main effect of task condition ( $F(2, 129) = 3.27$ ,  $p = .04$ ; see Appendix E for adjusted means). Follow-up ANCOVAs revealed that this main effect was due to the effect of the stress manipulation. Compared to the control condition, the stress condition reported significantly greater combined willingness ( $F(1, 82) = 7.08$ ,  $p < .01$ ;  $d = .22$ ; stress condition adjusted mean = 5.03, control condition adjusted mean = 4.46). In contrast, the self-control depletion condition did not differ significantly from the control condition ( $p = .15$ ;  $d = .22$ ; self-control condition adjusted mean = 4.82, control condition adjusted mean = 4.49) or the stress condition ( $p = .27$ ;  $d = .20$ ).

In sum, the willingness hypothesis was partially supported. Although there was an overall trend for both the stress and self-control conditions to report greater willingness than did the control condition, the differences between the self-control condition and the control condition did not reach statistical significance. However, as predicted, the stress manipulation led to greater combined willingness and to greater willingness to drink heavily.

### **Intentions**

T2 intentions were not predicted to differ between the study conditions as much as T2 willingness was. As with the willingness analyses, 3 (task condition: stress, self-control depletion, or control) x 2 (order: sex measures first or drinking measures first) ANCOVAs were used to test for differences in intentions among the study conditions. In each analysis the corresponding T1 intention measure was used as the covariate. Again, no significant

order main effects or task condition x order interactions were found for any of the intention items. Furthermore, the ANOVA on the intention index that came first (disregarding the type of behavior) did not reveal a task condition effect ( $p > .35$ ). Thus, order was dropped and only one-way ANCOVAs are reported (refer to Appendix E for adjusted means from the 3 x 2 ANCOVAs).

One-way ANCOVAs were also used to examine intentions only among the participants who answered that behavior first (i.e., a one-way ANCOVA on casual sex intention only for people who answered the sex items first). To further explore differences in intention between the experimental conditions, one-way ANCOVAs (again covarying the corresponding T1 variable) were conducted in which the control condition was compared to each of the conditions of interest (stress and self-control depletion) separately.

#### Heavy Drinking Intention

The ANCOVA on T2 drinking intention did not reveal a significant effect of task condition ( $p > .30$ ), although the effect was closer to significance when only the participants who answered drinking measures first were considered ( $F(2, 63) = 2.54, p < .09$ ). Both of the follow-up ANCOVAs (stress vs. control and self-control depletion vs. control) were also nonsignificant ( $ps > .16; ds = .22$ ).

#### Casual Sex Intention

The comparable ANCOVA on T2 casual sex intention also did not produce a significant main effect of task condition ( $p > .30$ ). Similarly, ANCOVAs comparing the control condition to the stress condition and to the self-control depletion condition separately did not reveal effects of either manipulation on casual sex intentions ( $ps > .23; ds < .22$ ); however, casual sex intentions were not expected to differ due to either the stress or self-control manipulations.

When the one-way ANCOVA was conducted only for the participants who answered sex measures first, the effect of task condition was significant ( $F(2, 62) = 3.40, p = .04$ ).

Unexpectedly, follow-up ANCOVAs (comparing two conditions at a time) showed that the stress condition participants reported significantly greater intention to have casual sex than did participants in the self-control depletion and control conditions ( $F(1, 62) = 3.40, p = .04; d = .30$ ; and  $F(1, 39) = 5.71, p = .02; d = .31$ , respectively). The self-control depletion and control conditions did not differ from each other ( $p = .85; d = .28$ ).

### Combined Intention

As with the willingness items, a combined intention index was created by averaging the drinking and casual sex intention items to test for differences among the three conditions in overall intention (i.e., disregarding the type of behavior;  $T1 \alpha = .76, T2 \alpha = .77$ ).<sup>6</sup> A one-way ANCOVA on T2 combined intention (covarying T1 combined intention) did not produce a main effect of task condition ( $p = .17$ ; see Appendix E for adjusted means). Likewise, the stress vs. control ANCOVA and the self-control depletion vs. control ANCOVA were also nonsignificant ( $ps > .12, ds < .22$ ). Thus, as expected, the experimental manipulations had relatively little influence overall on participants' intentions to engage in risky behavior.

### **Additional Control Variables and Moderators**

#### Controlling for Affect Regulation and Trait Self-control

Individual differences measured at T1 were expected to correlate with T2 willingness and intention. Endorsement of the affect regulation beliefs for sex and drinking was expected to positively correlate with willingness and intention to engage in those behaviors. Additionally, trait self-control was expected to correlate negatively with willingness and intention to engage in both risk behaviors. With the exception of nonsignificant relations between trait self-control and drinking willingness and intention, the predicted correlations among T1 individual differences and T2 willingness and intentions were significant (see Table 4).

Additional one-way ANCOVAs were conducted to control for these individual differences (in addition to controlling for T1 willingness / intention) when they correlated with

the T2 dependent variable. Drinking-related affect regulation (i.e., belief that drinking reduces stress / improves mood) was used as an additional covariate in the drinking willingness and intention analyses. Both sex-related affect regulation (i.e., belief that having sex reduces stress / improves mood) and trait self-control were included as covariates in the casual sex willingness and intention analyses. Generally, including the additional control variables did not change the pattern of results, so they were not used as covariates in any subsequent analyses.

#### Affect Regulation as Moderator of Stress Effect

People may have reacted (in terms of their reported willingness or intention) to the stress induction in different ways depending on their previous level of affect regulation. For example, people who strongly believe that these risk behaviors improve negative moods may have been more likely to report greater willingness or intention in response to the stressful experimental situation. To explore the possibility of moderation (i.e., an interaction between affect regulation and the stress manipulation), 2 (task condition: stress vs. control) x 2 (affect regulation: high vs. low using a median split) ANCOVAs were conducted on willingness and intentions to drink heavily and to have casual sex. No Affect Regulation x Stress Condition interactions were found for any of the dependent variables ( $ps > .15$ ). There were also no main effects of affect regulation ( $ps > .13$ ). Thus, there was no evidence that participants' beliefs about risky behavior as affect regulation moderated the effect of the stress manipulation on willingness or intentions.

#### Trait Self-control as Moderator of Self-control Depletion Effect

Previous research suggests that self-control manipulations should have similar depleting effects regardless of participants' levels of trait self-control (Gailliot & Baumeister, 2007). However, because the current study found no overall effect of the self-control depletion manipulation for willingness or intention, it remained a possibility that the manipulation had different effects (that were not detected in the original one-way ANCOVA)

depending on participants' levels of trait self-control. To test this possibility, 2 (task condition: self-control depletion vs. control) x 2 (trait self-control: high vs. low using a median split) ANCOVAs were conducted on willingness and intentions. Results of the ANCOVAs revealed no interactions between the self-control depletion condition and trait self-control ( $p$ s > .08) or main effects of trait self-control on any of the dependent variables ( $p$ s > .11). Thus, it was not the case that trait self-control moderated the effect of the self-control manipulation.

### **Stress Mediation**

It was hypothesized that participants' physiological arousal and self-reported perceived stress would mediate the effect of the stress induction on subsequent willingness to drink heavily and willingness to have casual sex. Because no effect of the stress manipulation was found for willingness to have casual sex, mediation analyses were not conducted for that variable. Instead, the mediation analyses focused on the drinking willingness and the combined (drinking and casual sex) willingness variables. Each potential mediator (stress-related affect, post-manipulation heart rate, and post-manipulation galvanic skin response) was tested in separate bootstrapping analyses.

Stress-related affect did not mediate the effect of the stress induction on T2 drinking willingness or T2 combined willingness. The bias-corrected, accelerated 95% confidence intervals included zero (drinking willingness lower limit = -.45, upper limit = .07; combined willingness lower limit = -.29, upper limit = .10).

Results also did not support the prediction that physiological arousal would mediate the effect of the stress induction. For both drinking and combined willingness, the bias-corrected, accelerated 95% confidence intervals included zero when both heart rate and galvanic skin response were tested as mediators (heart rate: drinking willingness lower limit = -.25, upper limit = .03; combined willingness lower limit = -.02, upper limit = .21; galvanic skin response: drinking willingness lower limit = -.20, upper limit = .02; combined willingness

lower limit = -.19, upper limit = .03). In sum, the stress mediation hypothesis was not supported.

### **Consideration of Negative Consequences and Perceived Risk / Vulnerability**

The effect of the self-control manipulation was hypothesized to be mediated by consideration of consequences, perceived risk, and perceived conditional vulnerability. Because the predicted effect of self-control depletion on willingness was not found, the mediators were instead analyzed as dependent variables. 3 (task condition) x 2 (order) ANCOVAs (in which the corresponding T1 variable was the covariate) revealed no main effects of order or interactions between task condition and order for any of the consideration of consequences, perceived risk, or conditional perceived vulnerability variables ( $ps > .07$ ). Thus, only the one-way ANCOVAs are reported.

#### Consideration of Consequences

It was expected that the self-control depletion condition (compared to the other two conditions) would report thinking less about the negative consequences of each risk behavior. To test this hypothesis, analyses were first conducted on the items that measured the extent to which participants reported thinking about the potential outcomes and negative consequences of the risk behavior when deciding their responses to the willingness items. The one-way ANCOVAs (covarying the corresponding T1 variable) did not produce a significant effect of task condition on either the drinking consideration or casual sex consideration variables ( $ps > .65$ ). ANCOVAs comparing only the control condition to the stress condition and to the self-control depletion condition separately also did not reveal significant condition differences for the either drinking consideration or casual sex consideration variables ( $ps > .47$ ;  $ds < .22$ ).

In addition to answering the above scaled items, participants were also presented with a list of possible considerations (e.g., “improving my mood,” “having fun”) and were asked to indicate whether they had thought about each one when deciding their responses

to the willingness items. Responses to each item were dummy coded (0 = no, 1 = yes). The two (one for drinking and one for casual sex) groups of twelve considerations were factor analyzed separately. The items were entered into a principal components factor analysis with varimax rotation, and four factors were extracted. Tables 7 and 8 present the items and largest factor loadings for the drinking and casual sex considerations, respectively. All eigenvalues for the four drinking consideration factors were greater than 1.13, explaining 55% of the variance. All eigenvalues for the four casual sex consideration factors were greater than 1.32, explaining 59% of the variance.

**Table 7. Factor Loadings for Drinking Considerations**

Factor 1	Factor 2	Factor 3	Factor 4
Having fun .76	Health problems .62	Giving in to temptation .68	Improving my mood .86
Feeling like taking chances .68	Possibly getting into trouble .63	Not wanting to say "no" .78	Relieving my stress .63
Wanting some excitement .76	Getting a bad reputation .48		
Curiosity .48	My morals .62		

Note.  $N = 133$ .

**Table 8. Factor Loadings for Casual Sex Considerations**

Factor 1	Factor 2	Factor 3	Factor 4
Having fun .96	Health problems -.51	Possibly getting into trouble .68	Improving my mood .66
Wanting some excitement .52	Feeling like taking chances .74	Getting a bad reputation .66	Relieving my stress .68
	Giving in to temptation .77	My morals .72	Not wanting to say "no" .61
	Curiosity .56		

Note.  $N = 133$ .

For each factor, an index was created by calculating the sum of the individual items comprising the factor. To test for differences between the three experimental conditions, one-way ANOVAs were conducted on each of the drinking and casual sex consideration factor indices. No task condition differences were found for the drinking consideration factors ( $ps > .44$ ) or for the casual sex consideration factors ( $ps > .27$ ). ANCOVAs comparing only the control condition to the stress condition and to the self-control depletion condition separately also did not reveal significant condition differences for any of the drinking consideration or casual sex consideration factors ( $ps > .17$ ;  $ds < .24$ ). In sum, no differences were found between task conditions in the *extent* to which participants considered the negative consequences of the risk behaviors or in the *types* of considerations that they thought about when responding to the willingness measures.

Although there were no differences in the T2 consideration of consequences variables between the three experimental conditions, it remained a possibility that the relations between these variables and T2 willingness would differ by condition. To examine this possibility, correlations among the T2 consideration of consequences and willingness variables were conducted separately by task condition (see Table 9). In general, the patterns for the self-control depletion and control conditions were more similar to each other than they were to the stress condition; therefore, to simplify the comparison, the self-control depletion and control conditions were combined into a non-stress condition. As shown in Table 10, there were significant correlations between casual sex willingness and three of the four consideration factors among participants in the non-stress condition. In other words, a variety of positive and negative considerations (“wanting some excitement,” “health problems,” “getting a bad reputation”) related to participants’ casual sex willingness in this condition (although the corresponding correlations for drinking willingness were not significant). In contrast, the only consideration factors significantly correlated with willingness in the stress condition were Factors 1 and 4, which included “having fun,” “wanting some

excitement,” “improving my mood,” and “relieving my stress.” Thus, although the stress participants reported thinking about the various considerations as often as participants in the other two conditions did, only the considerations regarding feeling better and having fun related to their willingness to engage in risky behavior. Very few correlations were found between the consideration factors and intention to engage in either risk behavior (see Appendix F).

**Table 9. Correlations by Task Condition between T2 Drinking and Casual Sex Considerations and T2 Willingness, Controlling for T1 Willingness**

	Control (n = 39)		Self-control Depletion (n = 48)		Stress (n = 46)	
	Drinking Willingness	Sex Willingness	Drinking Willingness	Sex Willingness	Drinking Willingness	Sex Willingness
Drinking Factor 1: Fun	.24		.14		.31*	
Drinking Factor 2: Negative Consequences	-.05		.00		.13	
Drinking Factor 3: Temptation	-.08		.07		.08	
Drinking Factor 4: Relief	.06		.14		.29*	
Sex Factor 1: Fun		.45***		.26		.27
Sex Factor 2: Temptation		.36*		.18		.24
Sex Factor 3: Negative Consequences		-.24		-.33*		-.14
Sex Factor 4: Relief		.19		.14		.13

Note. \*\*\*  $p \leq .001$ , \*\*  $p \leq .01$ , \*  $p \leq .05$ .

**Table 10. Stress vs. Non-stress Condition Correlations between T2 Drinking and Casual Sex Considerations and T2 Willingness, Controlling for T1 Willingness**

	Non-Stress (n = 87)		Stress (n = 46)	
	Drinking Willingness	Sex Willingness	Drinking Willingness	Sex Willingness
Drinking Factor 1: Fun	.19		.31*	
Drinking Factor 2: Negative Consequences	-.01		.13	
Drinking Factor 3: Temptation	.01		.08	
Drinking Factor 4: Relief	.11		.29*	
Sex Factor 1: Fun		.35***		.27
Sex Factor 2: Temptation		.30**		.24
Sex Factor 3: Negative Consequences		-.27**		-.14
Sex Factor 4: Relief		.18		.13

Note. \*\*\*  $p \leq .001$ , \*\*  $p \leq .01$ , \*  $p \leq .05$ .

### Perceived Risk

Participants in the self-control depletion condition were expected to report lower perceived risk and conditional perceived vulnerability compared to participants in the other two conditions. For T2 drinking perceived risk, the one-way ANCOVA (covarying T1 drinking perceived risk) did not reveal a task condition effect ( $p = .62$ ). Likewise, there were no task condition effects for follow-up ANCOVAs comparing the stress and control conditions and comparing the self-control depletion and control conditions ( $ps > .32$ ;  $ds < .28$ ). The one-way

ANCOVA on T2 casual sex perceived risk (covarying T1 casual sex perceived risk) also did not produce a significant effect of task condition ( $p = .42$ ). There were no differences due to condition for either the stress vs. control condition ANCOVA or the self-control depletion vs. control condition ( $ps > .22$ ;  $ds < .23$ ). Though none of the differences was significant, an examination of the adjusted means revealed a consistent pattern in that the stress and self-control depletion conditions reported less perceived risk for each behavior than did the control condition (see Appendix G for adjusted means for perceived risk measures).

#### Conditional Perceived Vulnerability

For T2 drinking conditional perceived vulnerability, the one-way ANCOVA (covarying T1 drinking conditional perceived vulnerability) revealed a significant effect of task condition ( $F(2, 129) = 3.01, p = .05$ ). Follow-up ANCOVAs comparing two conditions at a time showed that participants in the stress condition reported significantly less T2 conditional perceived vulnerability than did participants in the control condition ( $F(1, 82) = 8.16, p < .01; d = .22$ ; stress condition adjusted mean = 2.37, control condition adjusted mean = 3.05). The self-control depletion condition did not differ from the control condition ( $p = .33; d = .22$ ) nor the stress condition ( $p = .17; d = .20$ ).

The one-way ANCOVA on T2 casual sex conditional perceived vulnerability (covarying T1 casual sex conditional perceived vulnerability) did not produce a significant effect of task condition ( $p = .55$ ). There were no differences due to condition for either the stress vs. control condition ANCOVA or the self-control depletion vs. control condition ( $ps > .49; ds < .24$ ; see Appendix G for adjusted means for conditional perceived vulnerability measures).

In sum, the experimental manipulations had little overall influence on participants' perceived risk and conditional perceived vulnerability; however, there was evidence that the stress induction led to reduced drinking conditional perceived vulnerability. This finding was

unexpected, because it was predicted that the self-control manipulation (not the stress induction) would lead to less perceived risk and conditional perceived vulnerability.

To explore potential differences in the relations between perceived risk / vulnerability and willingness, the correlations among these T2 variables (controlling for T1 willingness) were examined separately by each condition (see Table 11). Because perceived risk and conditional perceived vulnerability were significantly correlated ( $r = .52$  for drinking,  $r = .37$  for sex,  $ps < .001$ ), and because correlations with willingness were very similar for perceived risk and conditional perceived vulnerability, these items were combined into a perceived vulnerability index for each behavior (drinking  $\alpha = .69$ , casual sex  $\alpha = .54$ ). As with the consideration variables, patterns among the self-control depletion and control conditions were more similar to each other than they were to the stress condition, so these two conditions were combined into a non-stress condition.

**Table 11. Correlations by Task Condition between T2 Willingness and Perceived Vulnerability, Controlling for T1 Willingness**

	Control (n = 39)			Self-control Depletion (n = 48)			Stress (n = 46)		
	T2 Drinking PV	T2 Sex PV	T2 Combined PV	T2 Drinking PV	T2 Sex PV	T2 Combined PV	T2 Drinking PV	T2 Sex PV	T2 Combined PV
T2 Drinking Willingness	-.31			-.45***			.03		
T2 Sex Willingness		-.10			-.45***			.01	
T2 Combined Willingness			-.22			-.29***			.15

Note. \*\*\*  $p \leq .001$ . PV = index of perceived risk and conditional perceived vulnerability.

**Table 12. Non-stress vs. Stress Condition Correlations between T2 Willingness and Perceived Vulnerability, Controlling for T1 Willingness**

	Non-stress (n = 87)			Stress (n = 46)			Difference between correlations
	T2 Drinking PV	T2 Sex PV	T2 Combined PV	T2 Drinking PV	T2 Sex PV	T2 Combined PV	
T2 Drinking Willingness	-.39***			.03			$z = 2.29,$ $p = .02$
T2 Sex Willingness		-.29**			.01		$z = 1.60,$ $p = .11$
T2 Combined Willingness			-.39***			.15	$z = 2.91,$ $p = .01$

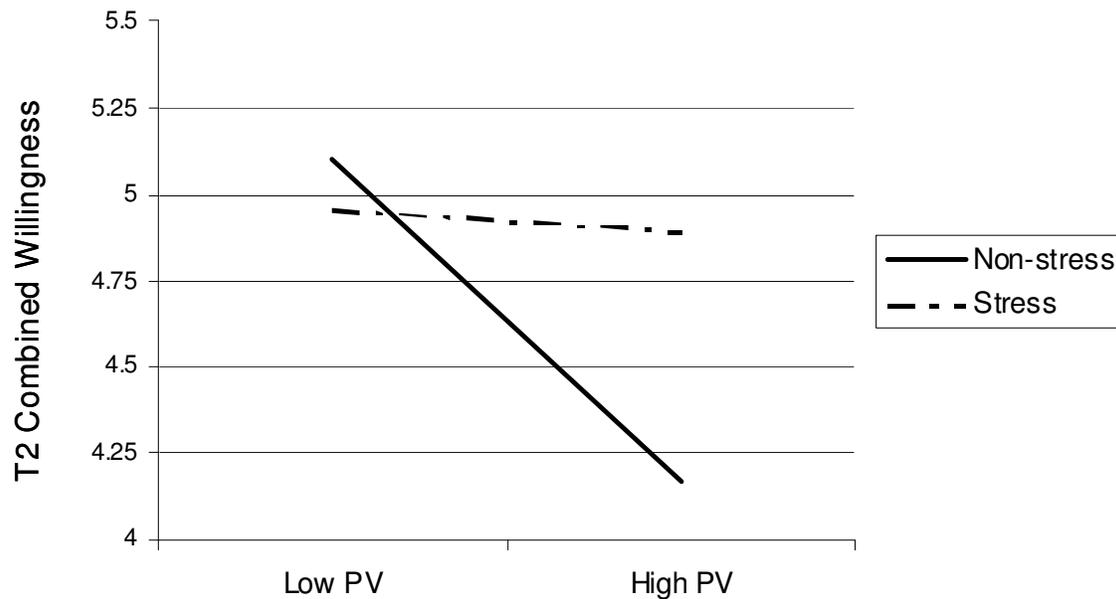
Note. \*\*\*  $p \leq .001$ . PV = index of perceived risk and conditional perceived vulnerability.

As presented in Table 12, among participants in the non-stress condition, the perceived vulnerability index was negatively correlated with drinking, casual sex, and combined willingness (all  $ps < .01$ ). In contrast, the perceived vulnerability index was not related to willingness in the stress condition ( $ps > .34$ ). Thus, although the stress condition significantly differed from the other two conditions on only one perceived risk / vulnerability variable (drinking conditional perceived vulnerability), the level of the perceived vulnerability index was unrelated to willingness among these participants. Overall, the perceived vulnerability indices were not correlated with intentions for either the stress or non-stress conditions (the one exception being drinking intention among non-stress participants; see Appendix H for correlations between perceived vulnerability indices and intentions).

To illustrate the different patterns of correlations between the stress and non-stress conditions, a 2 (stress vs. non-stress) x 2 (high vs. low perceived vulnerability using a median split of an index of all four perceived risk / vulnerability items) ANCOVA was conducted on T2 combined willingness, controlling for T1 combined willingness. The analysis revealed a significant Stress Condition x Perceived Vulnerability interaction ( $F(1, 128) = 6.76, p = .01$ ). As shown in Figure 1, an examination of the adjusted means revealed

that in the non-stress condition, participants with low perceived vulnerability reported greater willingness. In contrast, for participants in the stress condition, willingness was relatively high regardless of the level of perceived vulnerability. Thus, under non-stressful conditions, there was a strong negative relation between participants' willingness and their perceived vulnerability, as predicted by the prototype/willingness model; however, in the stress condition, there was no relation between participants' willingness and their perceived vulnerability.

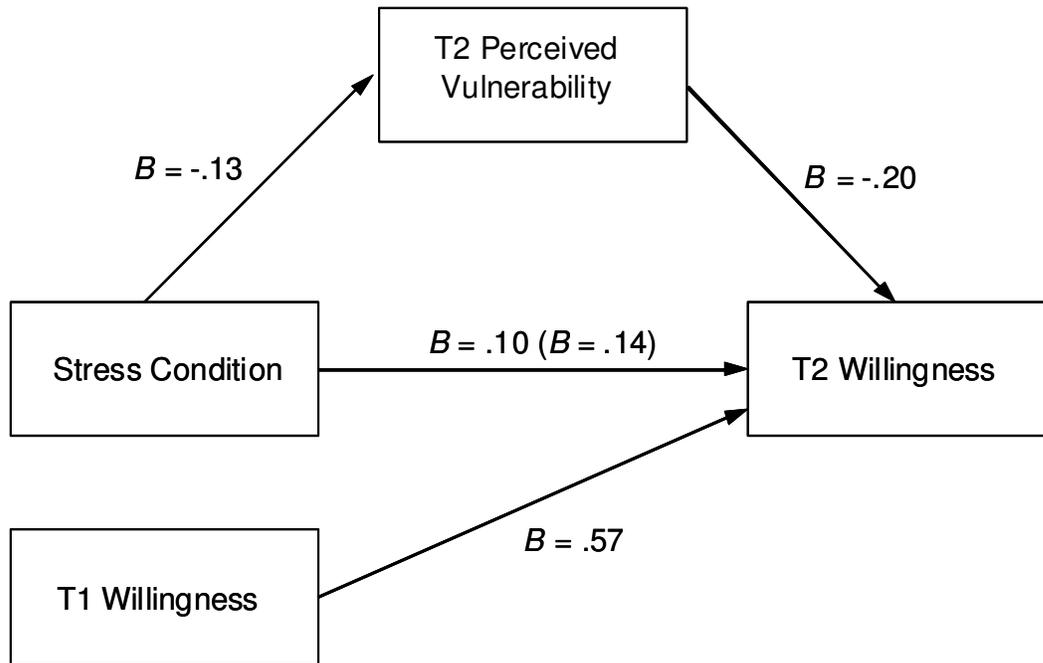
**Figure 1. Adjusted Means for T2 Combined Willingness by Stress Condition and Perceived Vulnerability (PV), Controlling for T1 Combined Willingness**



These results raised the possibility that decreases in perceived vulnerability mediated the effect of the stress induction on T2 willingness. To investigate this possibility, the bootstrapping method for testing indirect effects was utilized. This analysis revealed a small but significant indirect effect of the stress condition on T2 combined willingness through T2 perceived vulnerability (controlling for T1 combined willingness). The bias-corrected, accelerated 95% confidence interval excluded zero (lower limit = .01, upper limit

= .23). Thus, as presented in Figure 2, there was evidence that the stress induction led to decreased perceived vulnerability, which predicted participants' subsequent willingness to engage in risk behavior.

**Figure 2. Regression Coefficients Demonstrating Mediation of the Stress Condition on T2 Willingness by T2 Perceived Vulnerability, Controlling for T1 Willingness**



## DISCUSSION

The goals of this study were to examine experimentally whether stress and self-control depletion lead to increases in willingness to engage in risk behavior, and to clarify the mechanisms by which these effects occur. Previous correlational research consistently has found associations between various measures of stress and risk behavior. For example, perceived stress is related to smoking rates (e.g., Cohen et al., 1983), and traumatic life events are linked to sexual risk-taking (e.g., Kaufman et al., 2004). Similarly, low self-control is related to health-risk behaviors such as substance use and unsafe sex (e.g., Gerrard, Gibbons, Houlihan, Yeh, et al., 2008; Vazsyoni et al., 2006). As with the stress-related research, most of the work examining self-control and risky behavior has been correlational, and little is known about the mediators of the effects of stress and low self-control on risk behavior. The current study attempted to fill this gap in the extant literature by inducing stress and (independently) self-control depletion and by examining the corresponding pathways to risk behavior.

Participants were assigned to undergo a stress induction, self-control manipulation, or a control task. They then completed measures of their willingness and intention to engage in two different risk behaviors (heavy drinking and casual sex). It was predicted that both stress and self-control depletion would lead to increased willingness, but not to increased intention. Furthermore, it was expected that different variables would mediate the effects of stress and self-control depletion. Specifically, negative affect and physiological arousal were expected to mediate the relation between stress and willingness, and reduced perceived vulnerability and consideration of consequences were expected to mediate the relation between self-control depletion and willingness. Overall, results supported the prediction that stress would lead to increased willingness, but did not support the prediction that self-control depletion would lead to increased willingness. Although the stress induction did produce greater stress-related affect and physiological arousal, these variables did not mediate the

effect of stress on willingness. Somewhat unexpectedly, there was evidence that decreased perceived vulnerability mediated the effect of stress on willingness (it was expected that perceived vulnerability would mediate the effect of self-control depletion on willingness, but this was not the case). Compared to the other participants, stressed participants' willingness seemed to be a reflection of their desire to feel better and to have fun as opposed to their consideration of negative consequences. On the other hand, there was very little evidence that self-control depletion influenced either perceived vulnerability or consideration of negative consequences, as was hypothesized.

### **Stress and Risk Cognitions**

#### Willingness vs. Intention

As predicted, the stress induction led to greater willingness to engage in risk behavior. Compared to the control condition, participants in the stress condition reported significantly greater drinking willingness, marginally greater casual sex willingness, and significantly greater combined willingness. Importantly, this effect was found controlling for participants' T1 perceived stress, endorsement of risk behavior as affect regulation, and previous drinking. Also as expected, stress had little effect overall on intentions to engage in risk behavior. In prototype/willingness model terms, it seems that the experience of stress operates on risk behavior via the social reaction path (as opposed to the reasoned action path). High levels of stress may lead to risk behavior not through any pre-planned intentions but instead as a reaction to the stressful situation. From T1 to T2, participants' intentions remained more stable (i.e., displayed higher T1-T2 correlations) than did their willingness. Thus, the current study supports the tenet of the prototype/willingness model that intentions are relatively stable, and willingness is more likely to change in response to the immediate context.

### Previous Experiments on Stress and Risk Behavior

Few studies have attempted to induce stress and measure actual subsequent risk behavior; those that have attempted it have produced mixed results. In one study, participants who underwent a stress induction similar to the one used in the current study drank more alcohol than did participants in a control condition (Kidorf & Lang, 1999). Another study, again using a similar stress induction, showed no difference in drinking between stress and control conditions (Corcoran & Parker, 1991). The current study replicates and expands upon a previous experiment specifically designed to examine differences in willingness and intention to drink in response to stress (Houlihan et al., 2008). In this earlier study, stress was related to willingness to drink; however, there were significant limitations to the results of this study. The effect of willingness was moderated by another task included in the earlier study: writing about one's thoughts and feelings. Participants reported greater willingness in response to the stress induction only if they first wrote about the current thoughts and feelings. The current study extends this finding by demonstrating that participants do not necessarily have to focus specifically on their current emotional state in order for their stress to influence willingness. Furthermore, in the earlier study, the effect of stress on willingness only emerged when conducting an internal analysis (i.e., using self-reported perceived stress, rather than stress condition, as the independent variable); using the same stress induction, another more recent experiment showed a similar pattern of results (O'Hara, 2008).

Thus, the current experiment contributes to the literature on stress and risk behavior by strengthening the argument that stress increases the likelihood that one will engage in risk behavior, particularly heavy drinking. It also demonstrates that acute stress does not just influence decisions about alcohol consumption, but may also influence other risk behaviors as well (e.g., risky sexual behavior). Given that the effect of stress was significant when the drinking and sex willingness items were combined (and given that there was a trend in

which the stress condition participants were more willing to have casual sex than were the control condition participants), it may be that stress increases willingness to engage in risky behaviors *in general* and that the effect of stress is more global than the current literature (which focuses exclusively on substance use) would lead one to believe.

### **Mediation of the Effect of Stress**

Based on a large body of literature linking negative affect to risky behavior, it was hypothesized that stress-related affect and physiological arousal would mediate the effect of the stress induction on subsequent willingness. A previous experiment involving the prototype/willingness model found that (non-stress-related) negative affect leads to increased willingness to have risky sex (Pomery, 2004). Other research has found support for the mediating role of multiple types of negative affect (e.g., anxiety, depression, anger, hostility) in the relation between stressful life events (in general, and some events in particular – e.g., racial discrimination) and risk behaviors such as alcohol use (Gibbons et al., 2008; Hussong & Chassin, 1994; Richman et al., 2002). Furthermore, there are clear relations between negative affect, maladaptive coping, and risk behavior. For example, Colder (2001) found positive associations between high levels of stress, high levels physiological reactivity (i.e., change in skin conductance) in response to a negative mood induction, and frequent alcohol use for coping reasons among young adults. In addition, people who tended to use substances to cope with stress (compared to those who did not) were more likely to report willingness to use drugs after visualizing a stressful discrimination-related scenario (Gibbons et al., 2008).

Although participants in the stress condition experienced higher levels of perceived stress during the experimental session as expected, the affect variables did not mediate the effect of the stress induction. Similarly, the stress condition participants displayed greater evidence of physiological arousal (i.e., change in galvanic skin response), but this arousal was unrelated to their willingness. One possible reason that the current study failed to

demonstrate mediation by negative affect may be the type of stressor used. The previous research that demonstrated this mediation of negative affect focused largely on stressors that were traumatic life events (e.g., victimization, death of a family member). In comparison, the speech task used in the current study is much less stressful. For ethical reasons, experimentally-induced stress must be mild and transient. It may be that different mechanisms are responsible for the associations between mild vs. intense stressors and subsequent risk cognitions and behaviors. Thus, though the stress induction successfully produced a stress reaction (both in terms of perceived stress and physiological response), it remains unclear what the precise mechanism is by which this (relatively mild) stressor influenced willingness to engage in risk behavior.

### **Stress, Consideration of Consequences, and Perceived Vulnerability**

Although the current study did not find evidence of mediation using the hypothesized mediators, interesting patterns emerged that shed some light on what may have influenced participants' decision-making when considering the willingness scenarios. Participants did not significantly differ in the extent to which they considered negative consequences of the risk behaviors, and they did not significantly differ in the types of thoughts they had when thinking about their willingness. Additionally, participants in the three conditions had similar levels of perceived risk and conditional perceived vulnerability (with the one exception of drinking conditional perceived vulnerability, in which case the stress condition was significantly lower than the other two).

Despite these similarities, there were discrepancies in the correlations between the consideration and perceived vulnerability variables and the willingness variables, suggesting that whether consideration of consequences or perceived vulnerability related to willingness varied as a function of condition. For the non-stress participants, multiple types of considerations (e.g., "feeling like taking chances," "possibly getting into trouble," "having fun," "my morals") were related to their willingness to drink heavily and to have casual sex.

Furthermore, for these participants, the perceived vulnerability index was significantly negatively correlated with willingness. In contrast, for the stress participants, only the considerations involving having fun or excitement and feeling better were related to their willingness. Willingness was also not reflective of perceived vulnerability for participants in the stress condition; there was no correlation among these variables in this condition. Follow-up analyses using the bootstrapping method revealed that the perceived vulnerability index mediated the effect of stress on T2 willingness, controlling for T1 willingness.

Thus, it seems that stressed participants displayed a lack of connection between the negative outcomes they were considering (i.e., the risks) and their willingness. For non-stressed participants, perceived vulnerability and thoughts of negative consequences logically translated into relatively low willingness. Stressed participants did acknowledge these risks when asked about them directly, but they seemed not to take them into account when making their decisions about what they would be willing to do. Participants under stress appear to have responded to the willingness scenarios heuristically, perhaps focusing only on what would make them feel better in the short term. It was predicted that self-control depletion would lead to deficits in cognitive processing. Support for that hypothesis was not found (see below); however, there is evidence that stress may have depleting effects and cause more reactive decision-making (perhaps even more so than tasks that temporarily deplete self-control).

### **Self-control Depletion and Willingness**

Trait self-control has been linked to both willingness to engage in risky behavior as well as to actual risk behavior (Gerrard, Gibbons, Houlihan, Yeh, et al., 2008; Tangney et al., 2004; Wills et al., 2002). For instance, self-control has been linked prospectively to substance use among adolescents, and this relation was mediated by willingness to use substances (Gerrard, Gibbons, Houlihan, Yeh, et al., 2008). Therefore, it was predicted that participants who were temporarily depleted of their self-control would likewise be more

willing to engage in risky behavior. Unexpectedly, the current study did not produce an effect of self-control depletion on willingness to drink heavily or to have casual sex. It was hypothesized that after exerting self-control (by completing the Stroop task), participants would experience a temporary depletion of their self-control. According to the strength model of self-control, any act of self-control temporarily depletes people of their subsequent ability to exert self-control. Although the conclusions are far from definitive, the best-supported explanation for how the breakdown of self-control occurs is that the depletion of self-control is mediated by cognitive impairment. Specifically, exerting self-control uses up the brain's fuel (glucose), thereby impairing subsequent cognitive functioning (Gailliot et al., 2007). Consistent with that explanation, people who exert self-control perform more poorly on subsequent cognitive tasks and make more passive decisions on subsequent decision-making tasks (Baumeister, 2002; Schmeichel et al., 2003).

In the present study, self-control depletion was predicted to manifest as reduced perceived vulnerability and less consideration of negative consequences of risky behavior, both of which were expected to lead to greater willingness. Although the differences were not statistically significant, there was a trend for participants in the self-control depletion condition to report less perceived risk and conditional perceived vulnerability and to report greater willingness (for both heavy drinking and casual sex) than did participants in the control condition. It appears then that there was some small effect of the self-control manipulation, but perhaps the present study lacked sufficient power to detect it. It remains a possibility that the self-control manipulation may not have been strong enough to produce the intended effect on willingness. The manipulation checks indicated that self-control was depleted as intended, but perhaps more depletion is necessary to influence people's decision-making about risky behaviors. Much of the research on self-control depletion utilized, as dependent variables, tasks that are presumably irrelevant (or at least inconsequential) to participants' lives or well-being (e.g., solving anagrams, squeezing a

handgrip). It is possible that to change more meaningful decisions about people's health behaviors, a more powerful depletion manipulation than the Stroop task is needed. Although depleted, participants in this study may have "mustered up" the self-control necessary to make the healthier decisions when asked about their willingness to engage in risky behavior (although perhaps not completely as these participants were still, nonsignificantly, more willing than control condition participants). This interpretation is consistent with research that shows that when people are sufficiently motivated to do so, they can overcome self-control depletion (Muraven & Slessareva, 2003).

## **Limitations**

### External Validity

There are limitations to the current study that need to be addressed. The first limitation concerns the issue of external validity. Although the speech task induced feelings of stress that were intended to be similar to those that participants experience during their real-life stressful times, the experimental situation was nevertheless somewhat artificial. During debriefing, some participants acknowledged that they believed there would be no real negative consequences if they performed poorly on the speech. Although they were still admittedly uneasy about the task, this belief made them feel a little better. The stress induction has been shown both in this study and in previous research to create stress-related affect and influence willingness (Houlihan et al., 2008); however, creating a stress-inducing task with greater perceived consequences would likely bolster the effects of stress on subsequent risk cognitions.

External validity is perhaps a greater issue for the self-control manipulation. Completing the Stroop task is very different from the ways that participants typically exert self-control in their daily lives. According to the strength model, all types of self-control draw upon the same resource, so the Stroop or any other task requiring self-control should reduce self-control on subsequent tasks. However, because the anticipated effects of self-

control depletion were not found, it remains a possibility that self-control depletion may not have any effect on risk cognitions or behaviors unless there is a real risky opportunity at hand. Perhaps when depleted of self-control, people are able to say they would resist the temptation of the (hypothetical) risk behavior; but it is likely that they would have difficulty actually doing so if they were really in that situation

#### Power and Sample Size

It is possible that the current study simply lacked the power to detect the effect of self-control depletion on the dependent measures. The sample size analysis conducted before the data were collected assumed .80 power to detect a medium-sized effect of self-control depletion. The assumption of a medium-sized effect was based on the study from the self-control literature that most closely resembled the current study, although it did not include the same dependent variables (i.e., a study that investigated the effect of self-control depletion on the (dis)inhibition of sex-related words). In actuality, the true effect size of self-control depletion on willingness may be smaller than anticipated. Given that there were several trends in which participants in the self-control depletion condition reported greater willingness and less perceived risk and conditional perceived vulnerability than did participants in the control condition, it is possible that replicating this study with a larger sample size would yield the hypothesized self-control depletion results.

#### Generalizability of the Findings

Furthermore, it is not clear from this study how the findings would generalize to other populations. Participants were male college students, so potential gender differences could not be examined. Previous (non-experimental) research has demonstrated gender differences in the relations between stress and substance use, but the direction of the moderation is not consistent across studies. For example, in one study, stressful life events were related to heavy drinking behavior for women but not for men (Rospenda, Fujishiro, Shannon, & Richman, 2008). In another study, the association between stressful events and

alcohol consumption (including drinking to cope) was stronger for men than for women (Cooper, Russell, Skinner, Frone, & Mudar, 1992). Notably, experiments that have induced stress or manipulated self-control have not produced evidence of interactions between the experimental manipulations and gender (e.g., Gailliot & Baumeister, 2007; Kidorf & Lang). Finally, although not necessarily a high-risk sample, participants had at least minimal experience with drinking and sexual behavior. It remains unknown whether people who abstain from these behaviors would react differently when under stress or when depleted of self-control.

## **Future Directions**

### Self-control Manipulations and Measures

Given the findings and shortcomings of this study, there are several possible avenues for future research. First, future studies should other use other known methods of depleting self-control to determine if the lack of an effect of self-control depletion in this study was a result of the specific manipulation used. Other successful self-control manipulations include instructing participants to inhibit their emotional reactions, to suppress specific thoughts, to break established habits, to drink bad tasting beverages, and to resist tempting snacks (Baumeister et al., 1998; Gailliot & Baumeister, 2007; Muraven & Slessareva, 2003; Muraven et al., 1998). Because the nature of the willingness scenarios involves making decisions about presumably tempting behaviors (i.e., drinking alcohol or having sex), perhaps a manipulation that involves resistance to temptation would be more effective in increasing subsequent willingness as the manipulation and the dependent measures would be more similar.

Future studies should also incorporate measures of self-control depletion beyond what was used in the current study, which was limited by the reliance on self-reports of perceived self-control exerted and perceived difficulty of the task. People may not be able to judge accurately how much self-control they exerted on a given task, so indirect measures

of depletion (i.e., manipulation checks that do not rely on self-reports) would be useful in determining to what extent participants are really depleted of self-control. In this study, a measure of performance on the Stroop task was recorded, and overall, participants performed well. The mean number of correct responses out of 85 trials was 82.3. However, the Stroop performance is not necessarily a proxy for self-control depletion. One could argue that poor performance indicates depleted self-control (i.e., participants become depleted during the task and struggle to respond correctly), but the opposite could also be true: good performance could be indicative of the amount of self-control exerted (i.e., participants expended a great deal of self-control in order to answer many trials correctly and should, therefore, be more depleted subsequently). In most studies involving the strength model of self-control, self-control depletion is measured with an unrelated subsequent task that also requires self-control to complete. No such second task was included in the present study; participants completed the Stroop task and proceeded directly to the questionnaire. A follow-up study should utilize a second task (completed before the dependent measures) that would serve as a better measure of participants' depletion. If participants perform more poorly on the second task (compared to a control group), it would raise confidence that self-control was successfully manipulated. This would also allow for analyses to be conducted that examine the effect of actual depletion (in addition to depletion condition) on subsequent willingness and intention.

#### Stress Mediation and Cognitive Processing

Future research should also re-examine the issue of stress mediation. The current study did not support the hypothesized mediation of stress by negative affect and physiological arousal that has been found in previous research (Hussong & Chassin, 1994; Richman et al., 2002). However, much of this previous work measured more chronic forms of stress. It is possible that the mediators of the stress to risk behavior relation are different depending on the duration (and perhaps intensity) of the stressor. This study suggests that

people experiencing relatively mild, temporary stress may respond to risk decision-making less rationally (evidenced by the lack of influence of their perceived vulnerability on their willingness); future research should investigate this possibility by including measures of cognitive processing. For example, participants could be instructed to read information regarding risk behavior and later have their recall tested. If stressed participants are, in fact, depleted cognitively, and more likely to be processing information superficially, then they should have poorer recall of the information compared to non-stressed participants.

The finding that decreased perceived vulnerability mediates the relation between stress and willingness also warrants further investigation. In this study, perceived vulnerability was measured after willingness and intention (because they were the primary dependent variables, willingness and intention were placed early in the questionnaire to minimize the influence of responses to measures that came before). A stronger argument for mediation could be made if perceived vulnerability measures preceded willingness and intention. In addition, possible distinctions between absolute perceived risk and conditional perceived vulnerability should be explored. Compared to absolute perceived risk, conditional perceived vulnerability is more strongly related to willingness and more reflective of heuristic processing (Gibbons et al. 2004; Stock, Gibbons, & Gerrard, 2008). If people who are experiencing stress are more likely to process risk information heuristically, there may be a greater difference in their conditional perceived vulnerability compared to that of people who are not under stress (a difference that may not be detected by an absolute perceived risk measure). In the current study, these two types of perceived vulnerability measures did not differ much and were combined to simplify analyses; however, because this study was not designed to examine distinctions between these types of items, these variables appeared consecutively in the questionnaire. A better way to test for distinctions among the measures would be to space them throughout the questionnaire to minimize the influence of the response to one item on the next. Alternatively, the type of risk perception measure could be

treated as a between-subjects factor (i.e., half of the participants answer an absolute perceived risk measure, and half answer a conditional perceived vulnerability measure).

Related to perceived vulnerability, future research should continue to explore differences in the types of considerations that relate to willingness (and intention) among stressed and non-stressed people. This study suggests that when thinking about their willingness, stressed participants thought more about hedonistic considerations, whereas non-stressed participants considered both hedonistic outcomes *and* negative consequences. The list of considerations used in this study was not exhaustive; one other factor that people likely consider is the extent to which precautions have been taken in the hypothetical willingness scenario (e.g., whether there is a condom available, whether there is a designated driver at the party). Based on the results of this study, it seems probable that people who are stressed would be less likely to consider these precautions than would people who are not under stress. A study using open-ended measures in which participants write about what they are thinking about as they respond to the willingness measures (rather than a list of considerations presented after the willingness measures) would also shed more light on the ways in which stressed people think about risky situations differently from non-stressed people. Similarly, another ongoing study based on the prototype/willingness model is examining potential differences in these types of considerations (i.e., positive and negative outcomes associated with risky sex) and their relations to willingness and intentions among people in experimentally-induced positive and negative moods (Pomery, 2008).

### Stress and Intention Formation

The current study found that stress influenced willingness to engage in risky behavior more so than intention. Consistent with other research on the prototype/willingness model, intentions remained more stable than willingness from T1 to T2, especially for the stress condition (Gibbons et al., 2003). Future research should continue to examine distinctions

between willingness and intention under stressful and non-stressful situations. One question to explore is whether intentions are formed differently under stressful conditions than they are under non-stressful conditions. For example, a study could involve a stress induction (and a control task) followed by the presentation of information about a novel risk behavior or health problem. Participants would then be asked about their intentions to protect themselves from the health risk. If people under stress are less likely to process the risk information thoroughly, this should be evidenced by their lower intention to adopt the health precaution (or to avoid the risk behavior) compared to non-stressed participants. Such a finding would support the hypothesis that stress induces truncated cognitive processing of risk information, resulting in less careful decision-making.

#### Combined Effects of Self-control Depletion and Stress

Finally, the interaction between stress and self-control depletion should be investigated. The current study attempted to untangle the effects of stress and self-control depletion and to identify different mediating mechanisms between these two conditions and risk cognitions. Also interesting would be research that examines the *combined* effects of stress and depleted self-control. There is reason to predict that depleted self-control would moderate the effect of stress, as at least one study has demonstrated that the negative effect of adolescent life events on substance use is greater for those with poor self-control (Wills et al., 2002). The reverse is also possible: levels of stress may moderate the effects of self-control depletion (e.g., people under a high level of stress may become depleted of self-control more easily than those under low stress). One study has demonstrated that the effect of temporary self-control depletion was greater among people currently experiencing stress than those not under stress (Oaten & Cheng, 2005). To date, no experiments have examined these potential interactions by manipulating both stress and self-control (Wills et al. used cross-sectional survey data and examined trait self-control, as opposed to

temporarily depleted self-control. Oaten and Cheng manipulated self-control depletion, but did not manipulate stress).

### **Conclusion**

Everyone experiences periods of high stress or diminished self-control, and for some these are chronic conditions. Both high stress and low self-control are related to risky behavior, and the current study attempted to investigate these relations experimentally and to identify how these experiences lead to risk behavior. Although this study did not demonstrate the predicted effects of self-control depletion, it did provide clear evidence that stress leads to increased willingness to engage in risk behavior, especially heavy drinking. Intentions were less affected by stress, suggesting that stressful situations are one type of context conducive to reactive (rather than reasoned) risk behavior. Furthermore, results of this study suggest that when people are under stress, their perceived vulnerability to the negative consequences associated with risky behaviors does not relate to their willingness to engage in those behaviors. In fact, there was evidence that decreased perceived vulnerability mediated the relation between stress and willingness. Perhaps people become short-sighted when under stress, making decisions based on affect regulation rather than consideration of the negative consequences of the behavior.

## ENDNOTES

1. Because this study combined two literatures, separate power analyses were conducted using results from one study from each literature to determine an estimate of the necessary sample size for the proposed study. The first analysis was conducted using the data from Houlihan, Gibbons, and Gerrard (2008). In this study, the effect size of stress level on willingness to drink alcohol was determined to be medium ( $d = .36$ ; Cohen, 1992). Assuming .80 power to detect a medium effect and an alpha of .01, a conservative estimate is a sample size of 190. Gailliot and Baumeister (2007) was selected as a representative article from the self-control depletion literature. In this study, the effect of self-control depletion (i.e., the Stroop task) on solving word problems with sexual words was, conservatively, considered medium (odds ratio = 15). Assuming .80 power to detect a medium effect and an alpha of .01, the estimated necessary sample size is 113. Given these two estimates, it was concluded that a reasonable sample size for the study was 165. Although the sample size ( $N = 146$ ) was smaller than this, it was deemed adequately large to test the hypotheses of this study.

2. At T2 the wording of the perceived vulnerability items was simplified to read: “If you were to have casual sex [drink heavily], how likely is it that you would get an STD [alcohol poisoning])?”

3. Because measures of willingness to do *non*-risky behaviors may not make sense conceptually to participants, at T2 the non-risk willingness items (“stay at her apartment but not have sex” and “stay but not drink anymore”) were replaced with: “stay at her apartment and make out” and “stay and keep drinking until the party winds down,” respectively. Because the reliability did not differ whether the “stay at her apartment and make out” item was included or not, all three willingness items were used to form the T2 casual sex willingness index ( $\alpha = .86$ ). The T2 heavy drinking willingness index included only the two

riskiest items: “stay and continue to drink (more than one drink)” and “stay and keep drinking until the party winds down” as these two items were the most reliable ( $\alpha = .90$ ).

4. For the perceived self-control items, participants were provided the following definition of self-control: “Self-control means having to override your natural tendencies/impulses in order to complete the task.”

5. The items were the same individual items that comprised the separate drinking and casual sex willingness indices. Therefore, there were four items (two for drinking and two for casual sex) included in the T1 combined willingness index, and five items (two for drinking and three for casual sex) included in the T2 combined willingness index.

6. The combined intention index included the two items for casual sex intention and the two items for drinking intention at both T1 and T2.

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**APPENDIX A**  
Mass Testing (T1) Measures

*Willingness to have casual sex*

Please think carefully about the following situations. We are not implying that you would ever be in these situations, but try to think about how you would respond if you were.

Suppose you were at a party and met a man/woman for the first time. You think that he/she is very attractive, and the two of you get along very well. At the end of the evening, you go to his/her apartment with him/her. You're feeling as if you might like to have sex with him/her, and he/she obviously feels the same way. How willing would you be to do each of the following?

1	2	3	4	5	6	7
Not at all willing			Maybe			Very willing

1. Stay at his/her apartment and have oral sex.
2. Stay at his/her apartment and have sex.
3. Stay at his/her apartment, but don't have sex.

*Willingness to drink heavily*

Suppose that you are at a party with friends on a Saturday night. After a few drinks you are beginning to feel that you may have had enough, and you are getting ready to leave. Then a friend you haven't seen for a while starts talking to you and offers to get you another drink. How willing would you be to do each of the following?

1	2	3	4	5	6	7
Not at all willing			Maybe			Very willing

4. Stay and have one more drink.
  5. Stay and continue to drink (more than one drink).
  6. Stay, but not drink anymore
  7. In this situation, how many drinks do you think you would be willing to have?
- |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|

*Intentions to have casual sex*

8. In the next 6 months, do you intend to have casual sex? (for all questions, casual sex is defined as sex with someone you just met)

1	2	3	4	5	6	7
Definitely not			Maybe			Definitely

9. In the next 6 months, how likely is it that you will have casual sex?

1	2	3	4	5	6	7
Not at all likely			Maybe			Very likely

*Intentions to drink heavily*

10. In the next month, do you intend to have 5 or more drinks in a single night when you're out with friends?

1	2	3	4	5	6	7
Definitely Not			Maybe			Definitely

11. In the next month, how likely is it that you will have 5 or more drinks in a single night when you're out with friends?

1	2	3	4	5	6	7
Not at all likely			Maybe			Very likely

*Previous sexual behavior*

12. How many people have you had sexual intercourse with total in your lifetime?

1	2	3	4	5	6	7	8	9	10
None	1	2	3	4	5	6-7	8-9	10-11	12 or more

13. How many times have you had casual sex in your lifetime?

1	2	3	4	5	6	7	8	9	10
None	1 or 2	3 to 6	7 to 9	10 to 12	13 to 15	16 to 19	20 to 22	23 to 25	More than 25

*Previous drinking behavior*

14. Using the scale below, please indicate how many times you have had a whole drink of alcohol (for example, a bottle of beer or a whole mixed drink) during the last month:

1	2	3	4	5	6	7
Never	Once	Twice	3-5	6-8	9-11	12 or more

15. Using the scale below, please indicate how many times you have had 5 or more drinks in a single drinking episode during the last 3 months:

1	2	3	4	5	6	7
Never	Once	Twice	3-5	6-8	9-11	12 or more

*Consideration of consequences – casual sex*

16. When you've had casual sex in the past, how much did you think about what might happen as a result of that behavior?

0	1	2	3	4	5	6	7
Never had casual sex	Not at all						Very much

17. When you've had casual sex in the past, how much did you think about the negative consequences of that behavior?

0	1	2	3	4	5	6	7
Never had casual sex	Not at all						Very much

*Consideration of consequences - drinking*

18. When you've drunk heavily in the past (5 or more drinks in one drinking episode), how much did you think about what might happen as a result of that behavior?

0	1	2	3	4	5	6	7
Never drank heavily	Not at all						Very much

19. When you've drunk heavily in the past (5 or more drinks in one drinking episode), how much did you think about the negative consequences of that behavior?

0	1	2	3	4	5	6	7
Never drank heavily	Not at all						Very much

*Perceived risk / vulnerability*

20. If you were to have casual sex, how vulnerable do you think you would be to the negative consequences of casual sex (e.g., STD)?

1	2	3	4	5	6	7
Not at all			Somewhat			Very much

21. How risky (or dangerous) do you think casual sex is?

1	2	3	4	5	6	7
Not at all			Somewhat			Very much

22. If you were to drink heavily, how vulnerable do you think you would be to the negative consequences of drinking heavily (e.g., alcohol poisoning)?

1	2	3	4	5	6	7
Not at all			Somewhat			Very much

23. How risky (or dangerous) do you think heavy drinking is?

1	2	3	4	5	6	7
Not at all			Somewhat			Very much

*Affect Regulation*

24. In general, to what extent do you think having sex improves your mood?

A	B	C	D	E	F	G
Not at all						Very much

25. In general, to what extent do you think having sex relieves your stress?

A B C D E F G  
Not at all Very much

26. In general, to what extent do you think drinking improves your mood?

A B C D E F G  
Not at all Very much

27. In general, to what extent do you think drinking relieves your stress?

A B C D E F G  
Not at all Very much

### *Trait Self-control*

Using the scale provided, indicate how much each of the following statements reflects how you typically are.

1 2 3 4 5  
Not at all Very much

28. I am good at resisting temptation.
29. I have a hard time breaking bad habits.
30. I am lazy.
31. I say inappropriate things.
32. I do certain things that are bad for me, if they are fun.
33. I refuse things that are bad for me.
34. I wish I had more self-discipline.
35. People would say that I have iron self-discipline.
36. Please and fun sometimes keep me from getting work done.
37. I have trouble concentrating.
38. I am able to work effectively toward long-term goals.
39. Sometimes I can't stop myself from doing something, even if I know it is wrong.
40. I often act without thinking through all the alternatives.

### *Perceived Stress*

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate *how often* you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate. For each question choose from the following alternatives:

1 2 3 4 5  
Never Almost never Sometimes Fairly often Very often

In the last month...

41. how often have you felt that you were unable to control the important things in your life?
42. how often have you felt confident about your ability to handle your personal problems?
43. how often have you felt that things were going your way?
44. how often have you found that you could not cope with all the things you had to do?

45. how often have you felt that you were on top of things?

46. how often have you felt difficulties were piling up so high that you could not overcome them?

## **APPENDIX B**

### Informed Consent Document

**Title of Study:** Cognitive tasks and attitudes among college students  
**Investigators:** Amy Houlihan, M.S., Meg Gerrard, Ph.D., and Rick Gibbons, Ph.D.

This is a research study. Please take your time in deciding if you would like to participate. Please feel free to ask questions at any time. As indicated on your course syllabus, participation in experiments is one of the options for earning experimental credit in your course.

### **INTRODUCTION**

The purpose of this study is to investigate how college students carry out a variety of cognitive tasks and to collect data on various attitudinal and behavioral measures. You are being invited to participate in this study because of your participation in mass testing earlier this semester. You must be 18 to participate.

### **DESCRIPTION OF PROCEDURES**

If you agree to participate in this study, your participation will consist of only this appointment and will last no more than 50 minutes. During the study you will be asked to complete two separate and unrelated tasks. First, you will be asked to complete one of a variety of cognitive tasks (e.g., math problems). Second, you will also be asked to answer questions about yourself, including some that may be considered personal in nature. You may skip any question that you do not wish to answer or that makes you feel uncomfortable. In addition, you can expect to have physiological measures (e.g., pulse) taken throughout the study by having small electrodes placed on your fingers.

### **RISKS**

While participating in this study you may experience the following risks: slight discomfort in answering personal questions about yourself.

### **BENEFITS**

If you decide to participate in this study there will be no direct benefit to you. It is hoped that the information gained in this study will benefit society by contributing to the existing body of research in this area.

### **COSTS AND COMPENSATION**

You will not have any costs from participating in this study. You will receive one hour of research participation credit for your psychology course. You will receive this credit regardless of your decision to participate.

### **PARTICIPANT RIGHTS**

Your participation in this study is completely voluntary and you may refuse to participate or leave the study at any time. If you decide to not participate in the study or leave the study early, it will not result in any penalty or loss of benefits to which you are otherwise entitled.

**CONFIDENTIALITY**

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy your records for quality assurance and data analysis. These records may contain private information.

To ensure confidentiality to the extent permitted by law, the following measures will be taken. Participants will be assigned numbers so names will not appear on the data. Participants will be assigned ID numbers so that their names will not appear with their responses, thus ensuring that the data remain anonymous. Data will be stored on password protected computers in locked offices to which only the investigators and research assistants have access. If the results are published, your identity will remain confidential.

**QUESTIONS OR PROBLEMS**

You are encouraged to ask questions at any time during this study. For further information about the study contact Amy Houlihan at 294-3260 or Dr. Rick Gibbons at 294-8924. If you have any questions about the rights of research subjects or research-related injury, please contact the Human Subjects Research Office, 1138 Pearson Hall, (515) 294-4566; jcs1959@iastate.edu or the Office of Research Compliance, 1138 Pearson Hall, (515) 294-3115; dament@iastate.edu.

\*\*\*\*\*

**SUBJECT SIGNATURE**

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document and that your questions have been satisfactorily answered. You will receive a copy of the written informed consent prior to your participation in the study.

Subject's Name (printed) \_\_\_\_\_

\_\_\_\_\_  
(Subject's Signature)

\_\_\_\_\_  
(Date)

**INVESTIGATOR STATEMENT**

I certify that the participant has been given adequate time to read and learn about the study and all of their questions have been answered. It is my opinion that the participant understands the purpose, risks, benefits and the procedures that will be followed in this study and has voluntarily agreed to participate.

\_\_\_\_\_  
(Signature of Person Obtaining  
Informed Consent)

\_\_\_\_\_  
(Date)

**APPENDIX C**  
Lab Session (T2) Measures

*Affect*

We would like to know how you feel right now. Please rate yourself on each adjective below.

1                      2                      3  
Not at all      A little bit      Very much

- 47. Anxious
- 48. Happy
- 49. Stressed
- 50. Excited
- 51. Calm
- 52. Nervous
- 53. Angry
- 54. Pleased
- 55. Sad
- 56. Panicky
- 57. Confident

*Willingness to have casual sex*

Please read the following description of a social situation and think about how you would respond if you were ever in that situation.

Assume that you are not in a committed relationship, and suppose you were at a party and met a woman for the first time. You think that she is very attractive, and the two of you get along very well. At the end of the evening, you go to her apartment with her. You're feeling as if you might like to have sex with her, and she obviously feels the same way. How willing would you be to do each of the following?

1                      2                      3                      4                      5                      6                      7  
Not at all                      Maybe                      Very willing  
willing

- 58. Stay at his/her apartment and have oral sex.
- 59. Stay at his/her apartment and have sex.
- 60. Stay at his/her apartment and make out.

*Consideration of consequences – casual sex*

61. When thinking about what you would be willing to do, how much did you think about what might happen as a result of having sex?

1                      2                      3                      4                      5                      6                      7  
Not at all                      Somewhat                      Very much



78. Stay and continue to drink (more than one drink).  
 79. Stay and keep drinking until the party winds down.  
 80. In this situation, how many drinks do you think you would be willing to have? (open-ended)

*Consideration of consequences - drinking*

81. When thinking about what you would be willing to do, how much did you think about what might happen as a result of drinking heavily?

1                      2                      3                      4                      5                      6                      7  
 Not at all                      Somewhat                      Very much

82. When thinking about what you would be willing to do, how much did you think about potential negative consequences of drinking heavily (e.g., alcohol poisoning)?

1                      2                      3                      4                      5                      6                      7  
 Not at all                      Somewhat                      Very much

The following is a list of things that people may consider in making their decisions about drinking in this situation. Please indicate (with a “yes” or “no”) whether or not you thought about each:

83. Improving my mood  
 84. Having fun  
 85. Health problems  
 86. Relieving my stress  
 87. Possibly getting into trouble  
 88. Feeling like taking chances  
 89. Wanting some excitement  
 90. Giving in to temptation  
 91. Curiosity  
 92. Getting a bad reputation  
 93. My morals  
 94. Not wanting to say “no”  
 95. Other

*Intentions to drink heavily*

96. In the next month, do you intend to have 5 or more drinks in a single night when you're out with friends?

1                      2                      3                      4                      5                      6                      7  
 Definitely                      Maybe                      Definitely  
 Not

97. In the next month, how likely is it that you will have 5 or more drinks in a single night when you're out with friends?

1                      2                      3                      4                      5                      6                      7  
 Not at all                      Maybe                      Very likely  
 likely



**APPENDIX D**

## Means and Standard Deviations for T1 / T2 Variables by Task Condition

Variable (Scale)	Stress		Self-control depletion		Control		Overall	
	T1	T2	T1	T2	T1	T2	T1	T2
Drinking Willingness (1 – 7)	4.78 (1.56)	4.05 (1.74)	4.85 (1.54)	3.72 (1.60)	5.53 (1.01)	4.00 (1.47)	5.03 (1.44)	3.92 (1.61)
Drinking Intention (1 – 7)	5.95 (1.93)	5.98 (1.79)	5.62 (1.81)	5.47 (1.92)	6.35 (1.30)	5.92 (1.60)	5.94 (1.74)	5.78 (1.79)
Sex Willingness (1 – 7)	5.40 (1.62)	5.38 (1.36)	5.43 (1.46)	5.31 (1.48)	5.67 (1.16)	5.07 (1.68)	5.49 (1.43)	5.26 (1.50)
Sex Intention (1 – 7)	3.51 (1.98)	3.38 (1.92)	3.92 (1.95)	3.26 (1.78)	3.63 (2.00)	3.12 (1.68)	3.69 (1.97)	3.26 (1.79)
Number of drinks (1 – 7)	5.43 (1.79)	-	5.06 (1.79)	-	5.41 (1.70)	-	5.29 (1.76)	-
Number of heavy drinking episodes (1 – 7)	5.15 (2.03)	-	4.65 (1.89)	-	5.41 (1.50)	-	5.05 (1.85)	-
Number of sexual partners (1 – 10)	4.41 (2.41)	-	4.02 (2.37)	-	4.56 (2.81)	-	4.32 (2.51)	-
Number of casual sex episodes (1 – 10)	3.002 (2.53)	-	3.04 (2.61)	-	3.03 (2.31)	-	3.03 (2.48)	-
Trait self-control (1 – 5)	2.80 (.53)	-	2.97 (.57)	-	2.99 (.55)	-	2.92 (.55)	-
Perceived stress (1 – 5)	2.27 (.63)	-	2.45 (.61)	-	2.42 (.71)	-	2.38 (.65)	-
Drinking affect regulation (1 – 7)	4.31 (1.46)	-	4.74 (1.44)	-	4.67 (1.09)	-	4.57 (1.36)	-
Sex affect regulation (1 – 7)	5.36 (1.43)	-	5.57 (1.32)	-	5.78 (1.01)	-	5.56 (1.28)	-
Drinking Conditional PV (1 – 7)	3.85 (1.40)	2.39 (1.13)	4.08 (1.71)	2.83 (1.60)	3.69 (1.45)	3.03 (1.16)	3.89 (1.53)	2.74 (1.34)
Drinking Perceived Risk (1 – 7)	4.43 (1.42)	4.52 (1.44)	5.17 (1.36)	4.90 (1.51)	4.77 (1.39)	4.92 (1.31)	4.80 (1.41)	4.77 (1.43)
Sex Conditional PV (1 – 7)	3.98 (1.39)	3.28 (1.46)	4.19 (1.55)	3.04 (1.25)	3.69 (1.38)	3.15 (1.14)	3.97 (1.45)	3.16 (1.29)

Sex Perceived Risk (1 - 7)	4.13 (1.42)	4.17 (1.34)	4.33 (1.40)	4.50 (1.32)	4.21 (1.34)	4.51 (1.37)	4.23 (1.39)	4.39 (1.34)
Drinking Consideration (1 - 7) <sup>+</sup>	3.52 (.92)	3.54 (1.46)	3.76 (1.43)	3.82 (1.43)	3.56 (1.19)	3.80 (1.38)	3.62 (1.20)	3.72 (1.42)
Sex Consideration (1 - 7) <sup>+</sup>	3.91 (1.44)	4.46 (1.56)	4.50 (1.86)	4.73 (1.44)	3.83 (1.46)	4.50 (1.39)	4.09 (1.62)	4.57 (1.46)
Stress-related Affect (1 - 3)	-	1.74 (.46)	-	1.42 (.33)	-	1.39 (.25)	-	1.52 (.39)

*Note.*  $N = 133$ . Variables are coded so that higher numbers represent more of the construct. PV = Perceived Vulnerability. + Excluded participants who did not report engaging in the behavior in the past (coded as 0).

**APPENDIX E**

## Adjusted Means for T2 Willingness and Intention

**T2 Drinking Willingness, Controlling for T1 Drinking Willingness**

	Stress	Self-control depletion	Control
Drinking items first	4.19	3.42	3.70
Sex items first	4.28	4.28	3.70
Collapsed across order	4.23	3.85	3.70

**T2 Casual Sex Willingness, Controlling for T1 Casual Sex Willingness**

	Stress	Self-control depletion	Control
Drinking items first	5.68	5.30	4.85
Sex items first	5.18	5.41	5.07
Collapsed across order	5.43	5.35	4.96

**T2 Combined Willingness, Controlling for T1 Combined Willingness**

	Stress	Self-control depletion	Control
Drinking items first	5.12	4.56	4.36
Sex items first	4.83	4.96	4.48
Collapsed across order	4.97	4.77	4.43

**T2 Drinking Intention, Controlling for T1 Drinking Intention**

	Stress	Self-control depletion	Control
Drinking items first	6.01	5.42	5.47
Sex items first	5.98	6.07	5.79
Collapsed across order	6.00	5.74	5.63

**T2 Casual Sex Intention, Controlling for T1 Casual Sex Intention**

	Stress	Self-control depletion	Control
Drinking items first	3.19	3.34	3.44
Sex items first	3.82	2.90	2.88
Collapsed across order	3.50	3.12	3.16

**T2 Combined Intention, Controlling for T1 Combined Intention**

	Stress	Self-control depletion	Control
Drinking items first	4.61	4.35	4.48
Sex items first	4.90	4.46	4.35
Collapsed across order	4.75	4.41	4.41

**APPENDIX F**

## Correlations between Considerations and Intention / Willingness

**Correlations by Task Condition between T2 Drinking and Casual Sex Considerations and T2 Willingness (Intention), Controlling for T1 Willingness (Intention)**

	Control (n = 39)		Self-control Depletion (n = 48)		Stress (n = 46)	
	Drinking Willingness (Intention)	Sex Willingness (Intention)	Drinking Willingness (Intention)	Sex Willingness (Intention)	Drinking Willingness (Intention)	Sex Willingness (Intention)
Drinking Factor 1: Fun	.24 (.20)		.14 (.06)		.31* (.23)	
Drinking Factor 2: Negative Consequences	-.05 (-.05)		.00 (.05)		.13 (-.02)	
Drinking Factor 3: Temptation	-.08 (-.08)		.07 (-.09)		.08 (.07)	
Drinking Factor 4: Relief	.06 (-.01)		.14 (.20)		.29* (.19)	
Sex Factor 1: Fun		.45*** (.28)		.26 (.16)		.27 (.08)
Sex Factor 2: Temptation		.36* (.20)		.18 (.00)		.24 (.11)
Sex Factor 3: Negative Consequences		-.24 (-.10)		-.33* (-.26)		-.14 (-.08)
Sex Factor 4: Relief		.19 (.10)		.14 (.38**)		.13 (.01)

Note. \*\*\*  $p \leq .001$ , \*\*  $p \leq .01$ , \*  $p \leq .05$ . Correlations for intentions are in parentheses.

**Stress vs. Non-stress Condition Correlations between T2 Drinking and Casual Sex Considerations and T2 Willingness (Intention), Controlling for T1 Willingness (Intention)**

	Non-Stress (n = 87)		Stress (n = 46)	
	Drinking Willingness (Intention)	Sex Willingness (Intention)	Drinking Willingness (Intention)	Sex Willingness (Intention)
Drinking Factor 1: Fun	.19 (.13)		.31* (.23)	
Drinking Factor 2: Negative Consequences	-.01 (.01)		.13 (-.02)	
Drinking Factor 3: Temptation	.01 (-.09)		.08 (.07)	
Drinking Factor 4: Relief	.11 (.10)		.29* (.19)	
Sex Factor 1: Fun		.35*** (.22*)		.27 (.08)
Sex Factor 2: Temptation		.30** (.09)		.24 (.11)
Sex Factor 3: Negative Consequences		-.27** (-.18)		-.14 (-.08)
Sex Factor 4: Relief		.18 (.26*)		.13 (.01)

*Note.* \*\*\*  $p \leq .001$ , \*\*  $p \leq .01$ , \*  $p \leq .05$ . Correlations for intentions are in parentheses.

**APPENDIX G**

## Adjusted Means for T2 Perceived Risk and Vulnerability

	Stress	Self-control depletion	Control
T2 Drinking Perceived Risk	4.64	4.77	4.93
T2 Drinking Conditional Perceived Vulnerability	2.39	2.78	3.07
T2 Casual Sex Perceived Risk	4.19	4.45	4.52
T2 Casual Sex Conditional Perceived Vulnerability	3.27	3.00	3.20

*Note.* Controlling for the corresponding T1 measure.

**APPENDIX H**

Correlations between Perceived Vulnerability and Willingness / Intention

**Correlations by Task Condition between T2 Willingness (Intention) and Perceived Vulnerability, Controlling for T1 Willingness (Intention)**

	Control (n = 39)			Self-control Depletion (n = 48)			Stress (n = 46)		
	T2 Drinking PV	T2 Sex PV	T2 Combined PV	T2 Drinking PV	T2 Sex PV	T2 Combined PV	T2 Drinking PV	T2 Sex PV	T2 Combined PV
T2 Drinking Willingness (Intention)	-.31 (-.44**)			-.45*** (-.25)			.03 (-.06)		
T2 Sex Willingness (Intention)		-.10 (.00)			-.45*** (-.09)			.01 (-.10)	
T2 Combined Willingness (Intention)			-.22 (-.23)			-.29*** (-.14)			.15 (-.04)

*Note.* \*\*\*  $p \leq .001$ . PV = index of perceived risk and conditional perceived vulnerability. Correlations for intentions are in parentheses.