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## THE MULTIFACETED NATURE OF IMPULSIVE SENSATION-SEEKING: DIFFERENTIAL RELATIONSHIPS WITH PERSONALITY, DEVIANCE, AND LABORATORY TASKS

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## ABSTRACT OF THESIS

### THE MULTIFACETED NATURE OF IMPULSIVE SENSATION-SEEKING: DIFFERENTIAL RELATIONSHIPS WITH PERSONALITY, DEVIANCE, AND LABORATORY TASKS

The current study examined divergences among impulsivity and sensation seeking items from the Zuckerman-Kuhlman Personality Questionnaire Impulsive Sensation Seeking scale in terms of their relations to other personality models, deviance, and laboratory task outcomes. A sample of 654 undergraduates was gathered across two studies and given a Five Factor Model of personality measure (e.g. NEO Five Factor Inventory, NEO Five Factor Report Form), deviance measures (e.g. Antisocial Behavior Inventory, Explicit Attitudes Towards Marijuana Questionnaire), and three laboratory tasks (e.g. Balloon Analogue Risk Task, Newman's Card-Playing Task). Results demonstrated the hypothesized divergences among impulsivity and sensation seeking items on measures of personality and deviance as well as laboratory tasks. We conclude that Impulsive Sensation Seeking is multidimensional and would be more useful if employed as two independent constructs: (Lack of) Premeditation and Sensation Seeking.

**KEYWORDS:** Impulsivity, Sensation-Seeking, Deviance, Personality, Five Factor Model

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October 3, 2006

THE MULTIFACETED NATURE OF IMPULSIVE SENSATION-SEEKING:  
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LABORATORY TASKS

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THESIS

The Graduate School  
University of Kentucky  
2006

THE MULTIFACETED NATURE OF IMPULSIVE SENSATION-SEEKING:  
DIFFERENTIAL RELATIONSHIPS WITH PERSONALITY, DEVIANCE, AND  
LABORATORY TASKS

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THESIS

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A thesis submitted in partial fulfillment of the  
requirements for the degree of Master of Science in the  
College of Arts and Sciences  
at the University of Kentucky

By

Drew J. Miller

Lexington, Kentucky

Director: Dr. Donald R. Lynam, Professor of Psychology

Lexington, Kentucky

2006

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For Claire Elizabeth

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## Chapter 1: Introduction

### *Background*

Sensation seeking (SS), defined as the need for new and intense experiences and the willingness to take risks for the sake of such experiences, is an important personality trait. Some variant or variants of the construct can be found in two-factor (Eysenck & Eysenck, 1978), three-factor (Cloninger, Przybeck, & Svrakic, 1991; Eysenck & Eysenck, 1985), and five-factor (Costa & McCrae, 1992a; Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993) models of personality. The global construct of SS has been shown to relate to a variety of negative outcomes and a number of underlying biological processes. Despite its ubiquity in personality models and its predictive utility, there remains confusion regarding its placement within comprehensive models of personality. For example, some models place sensation seeking or its elements on the personality domain of extraversion (Costa & McCrae, 1992a), some place it on psychoticism (Eysenck & Eysenck, 1985), and others place it on conscientiousness or constraint (Whiteside & Lynam, 2001). As a result, it is often difficult to interpret what SS refers to or should refer to in the literature. We argue in the present work that the confusion surrounding SS is due in part to the fact that it is a multidimensional rather than a unidimensional trait and should be delineated as such. In fact, the multidimensionality is present in the very definition of the construct. SS has two distinguishable components: (1) need for new and intense experiences *and* (2) the willingness to take risks for the sake of such experiences. These elements appear across multiple models, under a variety of names (see Table 1). In fact, the willingness to take risks might also be determined in several ways. Unfortunately, at times, the same terms refer to different constructs at different levels of specificity, whereas at other times, different terms seem to refer to the same construct.

Zuckerman's Impulsive Sensation Seeking (ImpSS) scale on the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ) attempts to extend his previous Sensation Seeking Scale (SSS) by adding more items embodying what he called "impulsivity." Although the additional items may have improved the scale's content validity, they also added to the construct's complexity. The terminological complexity of ImpSS deserves attention. Conceptually, "sensation seeking" items appear to be made up of several experience seeking (ES) and disinhibition (DIS) items from Zuckerman's SSS capturing one's desire for experiencing new, exciting, and sometimes dangerous activities (see Table 2). The dearth of thrill and adventure

seeking (TAS) and boredom susceptibility (BS) item content within these items suggest that they only capture a narrow aspect of SS. Additionally, “impulsivity” items capture one’s failure to plan ahead, but fail to capture other aspects of impulsivity such as an inability to follow through on activities (lack of perseverance) and acting impulsively while experiencing negative affect (urgency) (see Table 2). To bring clarity, we refer to SS and impulsivity items from the ImpSS scale according to their labels in the UPPS model—SS and (lack of) premeditation. It is our thesis that the multidimensionality of ImpSS will manifest itself in its relations with other operationalizations of the construct as well as with broader dimensions of personality. Furthermore, we believe that viewing each dimension of ImpSS separately will provide increased predictive accuracy.

Table 1

*Conceptualizations of Impulsivity and Sensation Seeking*

---

Impulsivity Term	Sample Item
UPPS (lack of) Premeditation	“I have a reserved and cautious attitude toward life” (R)
I-7 Impulsiveness	“Do you get so “carried away” by new and exciting ideas, that you never think of possible snags?”
NEO-PI-R Impulsivity	“I have trouble resisting my cravings”
Sensation Seeking Term	Sample Item
UPPS Sensation Seeking	“I would enjoy water skiing”
NEO-PI-R Excitement Seeking	“I like to be where the action is”
I-7 Venturesomeness	“Do you quite enjoy taking risks?”
TPQ Novelty Seeking	“I often try new things just for fun or thrills, even if most people think it is a waste of time”
SSS TAS	“I often wish I could be a mountain climber”
SSS ES	“I like to explore a strange city or section of town by myself, even if it means getting lost”
SSS DIS	“I like ‘wild’ uninhibited parties”
SSS BS	“I get bored seeing the same old faces”

---

*Merging of Sensation-Seeking and Impulsivity.* Following much of his work on the construct of SS, Zuckerman explored the basic dimensions of personality. Using factor analytic techniques on numerous scales measuring basic personality or temperament, Zuckerman and

colleagues developed the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ; Zuckerman et al., 1993). Impulsive Unsocialized Sensation Seeking, later renamed Impulsive Sensation Seeking, was one of five factors extracted and was composed of SS, impulsivity, and autonomy scales at the positive pole and socialization, need for cognitive structure (planning), inhibition of aggression, and responsibility scales at the negative pole (Joireman & Kuhlman, 2004). Zuckerman (1994) also termed the behavioral manifestations of the trait (e.g. criminality, sexual variety seeking, substance use/abuse) as “disinhibition.”

Table 2

*Zuckerman-Kuhlman Personality Questionnaire III Impulsive Sensation Seeking Items*

---

Sensation Seeking

- 24. I like to have new and exciting experiences and sensations even if they are a little frightening.
- 34. I would like to take off on a trip with no preplanned or definite routes or timetables.
- 45. I like doing things just for the thrill of it.
- 50. I tend to change interests frequently.
- 55. I sometimes like to do things that are a little frightening.
- 60. I'll try anything once.
- 65. I would like the kind of life where one is on the move and traveling a lot, with lots of change and excitement.
- 70. I sometimes do “crazy” things just for fun.
- 75. I like to explore a strange city or section of town by myself, even if it means getting lost.
- 79. I prefer friends who are excitingly unpredictable.
- 95. I like “wild” uninhibited parties.

Impulsivity or (lack of) Premeditation

- 1. I tend to begin a new job without much advance planning on how I will do it.
- 6. I usually think about what I am going to do before doing it. (reverse scored)
- 14. I often do things on impulse.
- 19. I very seldom spend much time on the details of planning ahead.
- 29. Before I begin a complicated job, I make careful plans. (reverse scored)
- 39. I enjoy getting into new situations where you can't predict how things will turn out.
- 84. I often get so carried away by new and exciting things and ideas that I never think of possible complications.
- 89. I am an impulsive person.

---

The most recent version of the ZKPQ ImpSS scale is made up of 8 (lack of) premeditation items and 11 SS items. The ImpSS scale demonstrated strong convergent validity

with the SSS's total score and subscale scores, although the correlations between the SSS subscales and the specific lack of premeditation and narrow sensation seeking items on ImpSS were not reported (Angleitner, Riemann, & Spinath, 2004; Zuckerman, et al., 2003). Although Zuckerman argues that his new ImpSS scale consists of his original SSS plus new impulsivity items, we believe that (lack of) premeditation was already present in the original scale.

Zuckerman has argued that SS and impulsivity are very similar constructs conceptually, biologically, and empirically and supports the marriage of the traits (Zuckerman, 1993). However, Zuckerman (1993) also acknowledged several conceptual and empirical differences between SS and impulsivity. Zuckerman (1993) asserted that the distinction between SS and impulsivity can be described in the context of the SSS's TAS subscale. TAS involves taking part in physical risk taking activities, but the motivation behind pursuing these activities varies among sensation seekers and impulsive individuals. For example, sensation seekers take risks because of the rewards associated with the risks whereas impulsive sensation seekers take risks simply for the sake of taking risks (Zuckerman, 1993). Thus, an important distinction between SS and (lack of) premeditation appears to be their associated cognitive appraisal of risk taking activities (Zuckerman, 1993). Additionally, Zuckerman (1993) illustrated that TAS loads equally on Psychopathy-Impulsive Sensation Seeking (essentially SS + impulsivity) and Sociability (Extraversion) dimensions, which again demonstrated the distinction between SS and (lack of) premeditation, which loaded primarily on the Psychopathy-Impulsive Sensation Seeking dimension. Lastly, thrill seeking (SS) predicted fast reaction times and latencies on the Matching Familiar Figures Test (MFFT) whereas impulsivity (lack of premeditation) did not (Gerbing, Ahadi, & Patton, 1987; Zuckerman, 1993). Clearly, there are conceptual as well as empirical differences in SS and (lack of) premeditation.

Despite their differences, SS and (lack of) premeditation did show similarities with other factors, which led Zuckerman (1993) to conclude that the traits were similar enough to be included on the same factor of the ZKPQ-III. Although their similarities may outnumber their differences in some cases, one must be cautious not to engage in "nose-counting." That is, rather than merging constructs that correlate highly with each other ( $r = .52-.59$ ) (Zuckerman, 1993), more work should be done to determine whether their differences are reliable and meaningful.

*Biological Correlates of Impulsive Sensation-Seeking.* Not surprisingly, the biological correlates of ImpSS are strikingly similar to those of the SSS. Although little research has

utilized psychophysiological measures (e.g. EEGs) to study ImpSS, Zuckerman (1996) summarized ImpSS's relationships with several psychobiological measures. For example, ImpSS is associated with low levels of MAO and gonadal hormones (e.g. testosterone) (Zuckerman, 1996). Additionally, Zuckerman (1996) asserted that ImpSS could be linked to interactions between neurotransmitter systems. Specifically, ImpSS appears to be based on the combination of a highly reactive dopaminergic system and weakly reactive serotonergic and noradrenergic systems (Zuckerman, 1996). The underarousal caused by low peripheral epinephrine and noradrenaline was posited to be partially responsible for the weak inhibition experienced by impulsive sensation seekers (Zuckerman, 1996). Although the SSS and ImpSS appear to be similar at a psychobiological level, the unique relationships of SS and (lack of) premeditation with these correlates were not reported or included in Zuckerman's model. Furthermore, these relations are as consistent with two main effects as they are with an interaction. That is, it is plausible that SS is associated with highly reactive dopaminergic systems and (lack of) premeditation is associated with weakly reactive serotonergic and noradrenergic systems.

*Impulsive Sensation-Seeking on Lab Tasks.* To date, only three studies have been conducted examining the relationships between ImpSS and lab tasks (Breen & Zuckerman, 1999; Brocke, Beauducel, and Tasche, 1999; Thornquist and Zuckerman, 1995). Breen and Zuckerman (1999) examined the relationship between the SS and (lack of) premeditation subscales of ImpSS and "chasing," a common trait associated with pathological gamblers, using a computer-generated card-playing task. "Chasers" are essentially individuals who continue gambling, often with increased wagers, after a sequence of losing bets (Breen & Zuckerman, 1999). Within the study, chasers were those individuals who played until they lost all available money, non-chasers were those who gambled, but quit with cash left over, and non-players were those who declined to gamble (Breen & Zuckerman, 1999). Results showed that players and non-players did not significantly differ in SS or (lack of) premeditation, but that chasers scored significantly higher on (lack of) premeditation than non-chasers (Breen & Zuckerman, 1999). However, chasers and non-chasers did not differ significantly in SS (Breen & Zuckerman, 1999). Breen and Zuckerman (1999) concluded that impulsive individuals' hypersensitivity to reward and hyposensitivity to punishment led to their chasing behavior in gambling and that SS



individuals did not chase because the gambling paradigm was not “active” or stimulating enough.

Brocke et al. (1999) examined ImpSS as it was manifested on three experimental paradigms: the continuous performance task (CPT), delayed reaction time task (DRTT), and the augmenting-reducing paradigm (ARP). ImpSS obtained high correlations with intensity-dependent slopes for EEG-recorded N1 and P2 amplitudes (Brocke et al., 1999). In other words, individuals high in ImpSS experienced increases in cortical arousal as stimulus intensities increased. ImpSS was not significantly related to performance on the CPT or DRTT. Lastly, Thornquist and Zuckerman (1995) examined the relationship between ZKPQ factors and performance on a learning task designed by Newman and Kosson (1986). Results indicated that ImpSS was significantly associated only with errors of commission (Thornquist & Zuckerman, 1995). In sum, ImpSS appears to be significantly related to augmenting in ARPs, which is consistent with previous findings (Buchsbbaum, 1971; Zuckerman, Murtaugh, & Siegel, 1974), but unrelated to measures of inhibition of behavior such as the CPT and DRTT. Specifically, the SS and (lack of) premeditation subscales of ImpSS appear to be differentially related to various aspects of gambling behavior.

*Impulsive Sensation-Seeking and Other Personality Models.* Several studies have examined the relationship between the ZKPQ and the Eysenck Personality Questionnaire (EPQ), and/or Five Factor Model (FFM) personality measures (NEO Personality Inventory Revised; Costa & McCrae, 1992a; Goldberg’s 50-bipolar adjectives; Goldberg, 1992) (Aluja, Garcia, & Garcia, 2002; Thornquist & Zuckerman, 1995; Zuckerman & Cloninger, 1996; Zuckerman et al., 1993). With regard to the EPQ, results consistently demonstrated ImpSS to have the highest factor loadings on the Psychoticism factor (Aluja et al., 2002; Thornquist & Zuckerman, 1995; Zuckerman et al., 1993). However, ImpSS also demonstrated marked factor loadings on the Extraversion factor (Aluja et al., 2002; Thornquist & Zuckerman, 1995; Zuckerman et al., 1993).

Similarly, ImpSS obtained its highest factor loadings on the NEO-PI-R/Goldberg Conscientiousness factor, but also had evident factor loadings on the factor containing NEO-PI-R Extraversion and Goldberg Surgency (Aluja et al., 2002; Zuckerman et al., 1993) and the factor containing NEO-PI-R and Goldberg Agreeableness (Aluja et al., 2002). ImpSS has also been compared to Cloninger’s Temperament and Character Inventory (TCI; Cloninger, Przybeck, Svrakic, & Wetzel, 1994). ImpSS obtained significant positive correlations with TCI

Novelty Seeking and Self-Transcendence and significant negative correlations with TCI Harm Avoidance and Reward Dependence (Zuckerman & Cloninger, 1996). However, ImpSS's relationship with TCI Novelty Seeking was the only correlation above .60, which indicates that ImpSS may be strongly related to ancillaries of extraversion. Although most of these relationships are consistent with Zuckerman's conceptual definition of ImpSS (Zuckerman et al., 1993), the moderate to high correlations between ImpSS and Extraversion scales and marked factor loadings on Extraversion factors raise questions concerning what parts of each construct share common variance.

*External Correlates of Impulsive Sensation-Seeking.* Several studies have also examined ImpSS as a predictor of risk taking behaviors (De Wit & Richards, 2004; McDaniel & Zuckerman, 2003; O'Sullivan, Zuckerman, & Kraft, 1996; Robbins & Bryan, 2004; Zuckerman & Kuhlman, 2000). All results converged on the fact that ImpSS was a significant predictor of risk taking behaviors such as sex, alcohol use, cigarette smoking, drug use, physically dangerous activities, and gambling as well as dangerous driving (De Wit & Richards, 2004; McDaniel & Zuckerman, 2003; O'Sullivan et al., 1996; Robbins & Bryan, 2004; Zuckerman & Kuhlman, 2000). Thus, (lack of) premeditation and SS taken together appear to be useful in predicting risky and even deviant behaviors. The similar external correlates of SS, (lack of) premeditation, and ImpSS again raise questions regarding the dimensionality of ImpSS and the predictive validity and utility of SS and (lack of) premeditation by themselves and combined. Despite their apparent predictive similarities, broader models and conceptualizations of impulsivity have presented evidence that (lack of) premeditation and sensation seeking are separable constructs.

#### *Divergences Within the Sensation-Seeking Construct*

The study of trait SS began in the late 1960s and grew primarily from work concerning stimulation, arousal, and sensory deprivation and their relationship to personality traits (e.g. the introversion-extraversion trait; Eysenck, 1967; Zubek, 1969; Zuckerman, 1969; Zuckerman, Buchsbaum, & Murphy, 1980). During this time, using factor analytic techniques, Zuckerman, Kolin, & Price (1964) developed a Sensation Seeking Scale (SSS). Table 3 lists the four factors (Thrill and Adventure Seeking (TAS), Experience Seeking (ES), Disinhibition (DIS), and Boredom Susceptibility (BS)) and their items, which tap manifestations of high or low optimal levels of arousal in human activities (Zuckerman et al., 1980). Although each SSS factor is

related, studies have evidenced important divergences in what they measure, their biological correlates, and their relations to other personality constructs and demographic variables.

Table 3

*Sensation Seeking Scale (SSS) Form V Subscales and Items*

---

Thrill and Adventure Seeking

- 3. A. I often wish I could be a mountain climber.  
B. I can't understand people who risk their necks climbing mountains.
- 11. A. A sensible person avoids activities that are dangerous.  
B. I sometimes like to do things that are a little frightening.
- 16. A. I would like to take up the sport of water skiing.  
B. I would not like to take up water skiing.
- 17. A. I would like to try surfboard riding.  
B. I would not like to try surfboard riding.
- 20. A. I would not like to learn to fly an airplane.  
B. I would like to learn to fly an airplane.
- 21. A. I prefer the surface of the water to the depths.  
B. I would like to go scuba diving.
- 23. A. I would like to try parachute jumping.  
B. I would never want to try jumping out of a plane, with or without a parachute.
- 28. A. I like to dive off the high board.  
B. I don't like the feeling I get standing on the high board (or I don't go near it at all).
- 38. A. Sailing long distances in small sailing crafts is foolhardy.  
B. I would like to sail a long distance in a small but seaworthy sailing craft.
- 40. A. Skiing down a high mountain slope is a good way to end up on crutches.  
B. I think I would enjoy the sensations of skiing very fast down a high mountain slope.

Experience Seeking

- 4. A. I dislike all body odours.  
B. I like some of the earthy body smells.
- 6. A. I like to explore a strange city or section of town by myself, even if it means getting lost.  
B. I prefer a guide when I am in a place I don't know well.
- 9. A. I have tried cannabis or would like to.  
B. I would never smoke cannabis.
- 10. A. I would not like to try any drug which might produce strange and dangerous effects on me.  
B. I would like to try some of the drugs that produce hallucinations.
- 14. A. I like to try new foods that I have never tasted before.  
B. I order the dishes with which I am familiar so as to avoid disappointment and unpleasantness.
- 18. A. I would like to take off on a trip with no preplanned or definite routes or timetable.

Table 3 continued

*Sensation Seeking Scale (SSS) Form V Subscales and Items*

---

19. B. When I go on a trip I like to plan my route and timetable fairly carefully.  
A. I prefer the “down to earth” kinds of people as friends.  
B. I would like to make friends in some of the “far-out” groups like artists or anarchists.
22. A. I would like to meet some people who are homosexual (men or women).  
B. I stay away from anyone I suspect of being gay or lesbian.
26. A. The essence of good art is in its clarity, symmetry of form, and harmony of colours.  
B. I often find the beauty in the clashing colours and irregular forms of modern paintings.
37. A. People should dress according to some standard of taste, neatness and style.  
B. People should dress in individual ways even if the effects are sometimes strange.

Disinhibition

1. A. I like “wild” uninhibited parties.  
B. I prefer quiet parties with good conversation.
12. A. I dislike “swingers” (people who are uninhibited and free about sex).  
B. I enjoy the company of real “swingers.”
13. A. I find that stimulants make me uncomfortable.  
B. I often like to get high (drinking alcohol or smoking marijuana).
25. A. I am not interested in experience for its own sake.  
B. I like to have new and exciting experiences and sensations even if they are a little frightening.
29. A. I like to date people who are physically exciting.  
B. I like to date people who share my values.
30. A. Heavy drinking usually ruins a party because some people get loud and boisterous.  
B. Keeping the drinks full is the key to a good party.
32. A. A person should have considerable sexual experience before marriage.  
B. It’s better if two married people begin their sexual experience with each other.
33. A. Even if I had the money, I would not care to associate with flighty rich people in the jet set.  
B. I could conceive of myself seeking pleasures around the world with the jet set.
35. A. There is altogether too much portrayal of sex in the movies.  
B. I enjoy watching many of the sexy scenes in movies.
36. A. I feel best after taking a couple of drinks.  
B. Something is wrong with people who need alcohol to feel good.

Boredom Susceptibility

2. A. There are some movies I enjoy seeing a second or even a third time.  
B. I can’t stand watching a movie that I have seen before.
5. A. I get bored seeing the same old faces.  
B. I like the comfortable familiarity of everyday friends.

Table 3 continued

*Sensation Seeking Scale (SSS) Form V Subscales and Items*

---

- 7. A. I don't like people who do or say things just to shock or upset others.  
B. I get a laugh out of people who do or say things just to shock or upset others.
  - 8. A. I usually don't enjoy a movie or play where I can predict what will happen in advance.  
B. I don't mind watching a movie or play where I can predict what will happen in advance.
  - 15. A. I enjoy looking at home movies, videos, or travel slides.  
B. Looking at someone else's home movies, videos, or travel slides bores me tremendously.
  - 24. A. I prefer friends who are excitingly unpredictable.  
B. I prefer friends who are reliable and dependable.
  - 27. A. I enjoy spending time in the familiar surroundings of home.  
B. I get very restless if I have to stay around home for any length of time.
  - 31. A. The worst social sin is to be rude.  
B. The worst social sin is to be a bore.
  - 34. A. I like people who are sharp and witty even if they do sometimes insult others.  
B. I dislike people who have their fun at the expense of hurting the feelings of others.
  - 39. A. I have no patience with dull or boring persons.  
B. I find something interesting in almost every person I talk to.
- 

*Changes in the Measurement of the Construct.* More recently, Zuckerman (1984) has acknowledged important differences between factors of the SSS based on whether they measure one's actual experiences or desired experiences. Specifically, the DIS scale appears to index past or present behaviors and the TAS appears to index future preferred behaviors (Zuckerman, 1984). Moreover, the DIS and TAS scales typically demonstrate the lowest correlation among the subscales of the SSS (Zuckerman, 1984). However, in the SSS form VI, the DIS and TAS scales were further split into Experience and Intention versions (e.g. E-DIS, I-DIS, E-TAS, I-TAS) (Zuckerman, 1984). Results showed the Experience and Intention subscales to be related across DIS and TAS, but still less related than the Experience and Intention scales were within the DIS and TAS (Zuckerman, 1984). Thus, DIS and TAS scales appear to differ on more than their measurement of actual vs. desired experiences. In addition to differing in their content and temporal relevance, the subscales of the SSS have also demonstrated differences with biological traits in humans.

*Biological Correlates of Sensation Seeking.* The SSS and its subscales have been found to correspond to a number of physiological, neurochemical, and adrenal phenomena, but even

here, divergence among subscales is evident. Neary and Zuckerman (1976) examined the SS total score as it relates to people's orienting reflexes (ORs), which involve changes in the muscles and autonomic system and increased sensory sensitivity and cortical arousal (Zuckerman et al., 1980). ORs differ markedly from startle reactions. ORs direct one's body toward the source of stimulation and are accompanied by positive affect whereas startle reactions direct one's body away from the source of stimulation and are accompanied by negative affect (Zuckerman et al., 1980). Employing skin conductance measures, Neary and Zuckerman (1976) found that high sensation seekers exhibited stronger skin conductance change responses on the first exposure visual stimuli and auditory stimuli compared to low sensation seekers. Thus, high sensation seekers tend to become more aroused than low sensation seekers when presented with novel stimuli (Neary & Zuckerman, 1976).

Another similar study examined skin conductance responses and their relationships to the subscales of the SSS (Feij, Orlebeke, Gazendam, & van Zuilen, Note 1). Results showed TAS to be the only subscale significantly correlated with skin conductance response magnitude and that high DIS was related to heart rate deceleration during the first three stimulus presentations and fast habituation of the skin conductance responses (Feij et al., Note 1). That is, TAS predicts the strength of one's reaction to novel stimuli and DIS predicts one's reactivity to protective inhibition of arousal. These findings further support the divergent validity of the TAS and DIS scales.

Other studies have employed EEG technology to measure the relationship between sensation seeking and the augmenting-reducing of evoked potentials (EPs) (Buchsbaum, 1971; Zuckerman, Murtaugh, & Siegel, 1974). Augmenting refers to a positively sloped regression line between stimulus intensities and the EP at each of the intensities (Zuckerman et al., 1980). Augmenting-reducing is generally elicited by presenting subjects with randomized blocks of light flashes or tones of varied intensities (Buchsbaum, Landau, Murphy, & Goodwin, 1973). Nearly all results converged on the finding that augmenting was positively related to all subscales of the SSS, but most strongly related to the DIS subscale (Zuckerman et al., 1974). These findings provide evidence that individuals high in DIS seem to lack the protective reducing mechanism in high stimulus intensity conditions that low sensation seekers have (Zuckerman et al., 1974).

Interestingly, there appear to be similar findings pertaining to SS at neurochemical and adrenal levels. Specifically, studies have examined sensation seeking's relationship to platelet monoamine oxidase (MAO) and gonadal hormones, which have been associated with passivity/inactivity and social/sexual dominance, respectively (Murphy, Donnelly, Miller, & Wyatt, 1976; Schooler, Zahn, Murphy, & Buchsbaum, 1978; Zuckerman et al., 1980). Findings consistently supported negative correlations between platelet MAO and total scores on the SSS and positive correlations between androgens, estrogen, testosterone, 17 $\beta$ -estradiol, and estrone and DIS and total scores on the SSS, but not TAS, ES, or BS (Daitzman & Zuckerman, 1980; Daitzman, Zuckerman, Sammelwitz, & Ganjam, 1978; Murphy et al., 1976; Schooler et al., 1978). These findings suggest that sensation seekers are more likely to be very sociable and even hyperactive and high DIS individuals are more likely to be socially and sexually dominant (Daitzman & Zuckerman, 1980; Daitzman et al., 1978; Murphy et al., 1976; Schooler et al., 1978). Although much of the early research done with the SSS was concerned with its relationship to biological phenomena, much has also been done to establish its construct validity through comparisons with other dimensions of personality.

*Sensation-Seeking and Other Dimensions of Personality.* With specific responses being subsumed under habitual patterns of responses, which are subsumed under traits, which are often subsumed under higher order traits or superfactors, SS's place within the hierarchy is disputable. While not considered a higher order trait, it fails to fit neatly as a lower-order trait, showing relations with a variety of traits subsumed under a number of higher order traits. Zuckerman, Bone, Neary, Mangelsdorff, and Brustman (1972) examined relationships between the SSS and its subscales and other personality measures such as the MMPI, 16 PF, and Eysenck Personality Inventory (EPI). With regard to the MMPI, results showed the ES scale to be most strongly and consistently correlated with the MMPI scales, particularly the F, Pd, and Ma scales, which assess deviant ways of responding to test items, psychopathic personality, and hyperactivity, respectively (Graham, 2006; Zuckerman et al., 1972). The DIS scale also obtained moderate correlations with the MMPI Pd and Ma scales, but correlations were only significant for females (Zuckerman et al., 1972).

Overall, the Ma scale of the MMPI was the best general correlate of all subscales of the SSS (Zuckerman et al., 1972). The magnitudes and significance of these relationships were somewhat variable across samples and subscales. For example, in one sample DIS was

moderately and significantly correlated with Pd for both men and women (.40, and .23, respectively), but in another sample DIS was nonsignificantly correlated with Pd for men and moderately correlated with Pd for women (.21 and .26 respectively). Additionally, ES obtained moderate to high correlations with F, Pd, and Ma in men and women whereas TAS and BS correlations with F, Pd, and Ma were nonexistent in men and low to moderate in women. The inconsistencies across samples could be attributable to a number of factors including these studies' small sample sizes, unequal numbers of men and women, the relatively small number of items used to measure each subscale of the SSS, and the potential problem of measurement variance across genders. On a more general level, the inconsistencies among subscales demonstrate the divergent content captured by the subscales of the SSS and the heterogeneity of the construct of SS.

On the 16 PF, the SSS correlated positively with Dominance, Surgency, Adventurous, Bohemian, and Radicalism scales and correlated negatively with the Super-Ego scale, which suggested the SSS captures the impulsive, non-conforming type of extraversion as opposed to the sociable, cooperative type of extraversion (Zuckerman et al., 1972). The TAS subscale demonstrated the highest relationship with the EPI Extraversion scale and no subscale was significantly correlated with EPI Neuroticism (Zuckerman et al., 1972). Although the subscales of the SSS demonstrated similar correlations on Dominance, Surgency, and Adventurous scales, there was significant divergence on relations with Bohemian, and Radicalism scales. For example, TAS and DIS correlations with Bohemian and Radicalism scales were nonsignificant (with the exception of male TAS and Radicalism) and much lower than ES and BS correlations.

A later study employed a larger sample size and looked at the SSS as it related to the Eysenck Personality Questionnaire (EPQ), which included assessments of Extraversion, Neuroticism, and Psychoticism (Eysenck & Zuckerman, 1978). Findings were consistent with previous research that found the SSS to be moderately and significantly related to Extraversion (Eysenck & Zuckerman, 1978; Zuckerman et al., 1972). However, in contrast to the earlier study, Extraversion was most highly correlated with DIS rather than TAS (Eysenck & Zuckerman, 1978; Zuckerman et al., 1972). The inclusion of the Psychoticism factor also provided new insight into the construct of SS by demonstrating moderate, significant correlates with SSS total, ES, DIS, and BS (Eysenck & Zuckerman, 1978). Eysenck and Zuckerman (1978) concluded that SS falls between the Extraversion and Psychoticism dimensions of the



EPQ. These results, however, are also consistent with the original SS construct representing a blend of items from E and P.

*The Epidemiology of Sensation Seeking.* Several research studies have examined the differences in SS among different genders, cultures, and ages (Eysenck & Zuckerman, 1978; Zuckerman et al., 1972; Zuckerman, Eysenck, & Eysenck, 1978). Interestingly, divergence among subscales is also apparent in this research. For example, English and American men did not differ on their total scores, but Americans scored higher on ES and the English scored higher on BS (Zuckerman et al., 1978). Furthermore, American women scored significantly higher than English women on their ES and TAS scores (Zuckerman, et al., 1978). The DIS scale was the least influenced by cultural differences (Zuckerman et al., 1978). With regard to age, results showed a significant decline in SS as age increased, which was consistent with previous theory (Zuckerman, 1969; Zuckerman et al., 1978). However, at the subscale level TAS and DIS appear to decline much more quickly with age compared to ES and BS (Zuckerman et al., 1978). These findings illustrate the divergence of the SSS subscales and the heterogeneity of sensation seeking.

Although Zuckerman has demonstrated several general common characteristics associated with his SSS, there are clearly many important divergences among its subscales. The divergences are particularly evident in the subscales' relations with biological correlates, broader dimensions of personality, and demographic variables. Thus, even the original SS construct appears to be multidimensional.

#### *Conceptualizations of Impulsivity*

*General Conceptualizations.* Multidimensionality in the original SS construct should not be surprising. Research on the even broader construct of impulsivity has consistently revealed a multidimensional rather than a unidimensional construct. Despite the importance of impulsivity in predicting antisocial behavior, alcohol and drug abuse, sexual promiscuity, etc., there is little consensus in the literature regarding the construct's definition and underlying trait structure. Milich and Kramer (1984) presented several conceptualizations of impulsivity present in the literature, which described impulsivity as an "inability to stop, look and listen," "poor planning ability," "weak restraints," "sensation seeking behavior," "rapid responding in ambiguous situations," etc. Moreover, models of general impulsivity are almost as numerous as its definitions. Models of general impulsivity are made up of anywhere from one to four factors,

most of which contain separate representations of sensation seeking and lack of premeditation (Carver, 2005; Whiteside & Lynam, 2001). Several multidimensional models of general impulsivity are subsequently presented in an effort to provide evidence for the separability of (lack of) premeditation and SS.

*Two-Factor Models of Impulsivity.* Gray's (1972, 1981, 1982) model of motivation captures two dimensions of personality (anxiety and impulsivity) and consists of two underlying systems: behavioral inhibition (BIS) and behavioral activation (BAS). BIS and BAS regulate aversive motivation and appetitive motivation, respectively. This model has since been operationalized by Carver and White (1994), who constructed a self-report measure of the BIS and BAS. Research of the BIS/BAS scales indicated that BIS is strongly related to TPQ Harm Avoidance and Reward Dependence, the Manifest Anxiety Scale (MAS), PANAS-NA, and Susceptibility to Punishment (Carver & White, 1994). Furthermore, BAS showed strong positive relationships with Extraversion, PANAS-PA, Sensitivity to Reward, and Motor Impulsiveness and moderate relationships with three of the four scales of the SSS (TAS, DIS, and BS) (Carver & White, 1994; Quilty & Oakman, 2004). Perhaps most striking was the finding that the model with BAS and impulsivity as separate constructs had the best fit (Quilty & Oakman, 2004). Quilty and Oakman's (2004) impulsivity construct correlated very similarly with Zuckerman's SSS and BAS, but was most highly related to scores on the Barratt Impulsiveness Questionnaire, which measures 3 facets of impulsivity (attentional impulsiveness, motor impulsiveness, and non-planning impulsiveness). Interestingly, at the subscale level, BAS was moderately related to attentional impulsiveness and highly related to motor impulsiveness, but was not related to non-planning impulsiveness (lack of premeditation). Thus, BAS appears to be a good measure of extraversion and sensitivity to reward and is part of SS, attentional impulsiveness, and motor impulsiveness, but is quantitatively different from (lack of) premeditation.

A recent study further established the differences between the BAS and "trait impulsivity" or (lack of) premeditation (i.e. acting on the spur of the moment) by demonstrating superior fit of a model made up of a BAS superfactor (Drive and Reward Responsiveness) and a fun-seeking factor, which was believed to represent trait impulsivity (Smillie, Jackson, & Dalgleish, 2006). Although the Fun-Seeking factor correlated with impulsiveness higher than both Drive and Reward Responsiveness, it has achieved very similar correlations with Eysenck

Personality Profiler (EPP) sensation-seeking and Eysenck I-7 Venturesomeness in several studies (Miller, Joseph, & Tudway, 2004; Smillie et al., 2006). In fact, Fun-Seeking loaded higher on the “Functional Venturesomeness” factor, which is similar to SS, than the “Non-Planning and Dysfunctional Impulsive Behavior” factor (Miller et al., 2004). This is not surprising considering that three out of the four items appear to be more conceptually similar to SS; that is, “I often act on the spur of the moment” represents the only item that conceptually fits with (lack of) premeditation (Eysenck & Eysenck, 1978). Therefore, we would argue that the Fun-Seeking scale is not a valid measure of impulsivity and that its significant correlation with impulsiveness is merely the shared variance between the two constructs of impulsivity and sensation-seeking. In any case, there are certainly still questions concerning whether impulsivity is high BAS, low BIS, a combination of both, or none of them.

Eysenck and Eysenck (1978) explicitly examined broad conceptualizations of SS and impulsivity in an attempt to clarify their positions in their dimensional model of personality. Impulsivity items were gathered from subscales of risk-taking, non-planning, liveliness, and (narrow) impulsivity and SS items were taken from the four scales of Zuckerman et al.’s (1993) SSS. Factor analyses of all the items yielded three factors: Impulsiveness, Venturesomeness/SS, and Empathy (Eysenck & Eysenck, 1978). Impulsiveness correlated more strongly with Psychoticism and Venturesomeness correlated more strongly with Extraversion. Although Impulsiveness and Venturesomeness correlated positively, but differentially with Psychoticism and Extraversion, the two scales were perhaps more strikingly divergent in their relations with Neuroticism (Impulsiveness was the only trait to correlate positively with Neuroticism). Thus, impulsivity and SS certainly share variance on a number of items (particularly risk-taking and thrill and adventure seeking), but also diverge in a number of important ways such as pre-planning (e.g. “saying and doing things without stopping to think”) and susceptibility to experiencing negative affect.

Carver (2005) recently proposed a unidimensional model of impulsivity made up of “Impulse” and “Constraint.” Although these concepts have been used in other models of personality and impulsivity, Carver (2005) conducted a cross-disciplinary review of psychodynamic models, trait models, biological process models, cognitive models, and developmental temperament models that addressed impulsivity in an attempt to integrate them. Interestingly, Carver concluded that all of the aforementioned theories could be integrated into a

unidimensional trait with Impulse at one pole and Constraint at the other (Carver, 2005).

Impulse refers to the tendency to act spontaneously without deliberation and Constraint refers to the tendency to reflect and deliberate before acting (Carver, 2005). Specifically, Carver (2005) mapped Id, emotional dysregulation, Psychoticism, BAS, sensation seeking, and ImpSS onto Impulse and Conscientiousness, Agreeableness, Tellegen's (1985) Constraint, and BIS onto Constraint.

Although Impulse and Constraint are placed on one dimension, in the context of SS and impulsivity it may be useful to consider them as separate dimensions. For example, Carver's (2005) model suggests that variability in the construct of impulsivity is contingent on the extent that Impulse dominates Constraint in influencing behavior. Similarly, Zuckerman (1993) argues that impulsivity is the result of the strength of the inhibition trait and that sensation seeking can be regarded as the strength of excitation. In this framework an impulsive individual (someone low in inhibition) may not be high in SS (strength of excitation). That is, despite the biological link between SS and impulsivity, there may be marked differences in behavior among individuals high in SS (strength of excitation) and individuals high in (lack of) premeditation (low inhibition). Thus, a multidimensional model appears to provide a better explanation of differences in SS and impulsivity and their interactive effects on behavior. Although it is still unclear whether Carver's model is valid, it provides a useful framework for understanding ImpSS taken together with Zuckerman's (1993) conceptual understanding of SS and impulsivity.

*UPPS Four-Factor Model of Impulsivity.* Using a similar integrative strategy, Whiteside and Lynam (2001) used factor analytic methods to identify separable aspects of impulsivity. Specifically, Whiteside and Lynam (2001) factor analyzed the NEO-PI-R and different impulsivity measures and identified four "pathways" to impulsivity: urgency, (lack of) premeditation, (lack of) perseverance, and SS. The factors measure one's tendency to act on strong impulses when experiencing negative affect, fail to think about consequences before acting, fail to stay focused on tasks, and pursue exciting experiences, respectively (Whiteside & Lynam, 2001). A factor analysis of the NEO-PI-R facets and UPPS scales showed (lack of) premeditation and perseverance and all facets of conscientiousness to load on one factor, SS and all facets of extraversion to load on another factor, and urgency and all facets of neuroticism to load on the last factor (Whiteside & Lynam, 2001). These factors have also been shown to be useful in predicting substance use disorders and antisocial and aggressive behaviors (Lynam &

Miller, 2004; Whiteside & Lynam, 2003). In the broader context of conceptualizations of impulsivity, the UPPS to capture many diverse definitions of impulsivity and may provide a useful medium to communicate about the construct.

#### *Current Study*

“*Sensation Seeking*” and “*(lack of) Premeditation.*” Zuckerman and colleagues have provided some evidence that SS and impulsivity are biologically, behaviorally, psychophysiological, and neurochemically similar (Zuckerman, 1993; Zuckerman, 1994; Zuckerman, 1996). For example, similar factors measuring SS and (lack of) premeditation such as Tellegen’s (1985) MPQ-Constraint and Zuckerman’s (1991) ImpUSS were both shown to be among the most heritable traits in twin studies (Zuckerman, 1991). Additionally, individuals high in SS and (lack of) premeditation both show augmentation of cortical reaction to novel stimuli whereas individuals low in SS and (lack of) premeditation react with cortical inhibition (Zuckerman, 1994). Moreover, SS and (lack of) premeditation have both been shown to be useful predictors of risk taking behaviors such as sex, alcohol use, cigarette smoking, drug use, physically dangerous activities, and gambling (Carrol & Zuckerman, 1977; Fisher, 1973; Hoyle, Fejfar, & Miller, 2000; Langewisch & Frisch, 1998; Lejuez, Bornovalova, Daughters, & Curtin, 2005; Lynam & Miller, 2004; Miller, Flory, Lynam, & Leukefeld, 2003; Whiteside & Lynam, 2003; Zuckerman, 1974; Zuckerman et al., 1972; Zuckerman et al., 1980; Zuckerman, Tushup, & Finner, 1976).

However, several models and other research suggest that they may be separable constructs (Breen & Zuckerman, 1999; Eysenck & Eysenck, 1978; Whiteside & Lynam, 2001). Although Zuckerman’s first attempts envisioned impulsive unsocialized sensation seeking as a unidimensional construct, the recent version of the ZKPQ contains impulsivity ((lack of) premeditation) and SS subscales (Zuckerman et al., 1991, 1993). Furthermore, Zuckerman (1993) acknowledged that SS and impulsivity ((lack of) premeditation) differ in their impact on an individual’s cognitive appraisal of risk taking activities as well as his or her performance on the MFFT.

Still, Zuckerman’s primary goal behind constructing the ZKPQ was to create an index of the basic dimensions of personality (Joireman & Kuhlman, 2004). In attempting to achieve this goal, Zuckerman has been successful in mapping ImpSS onto higher order traits such as EPQ Psychoticism and NEO-PI-R Conscientiousness (Zuckerman et al., 1993). However, in five

factor solutions, ImpSS would have been the next scale included on the factor made up of EPQ and NEO-PI-R Extraversion (Zuckerman et al., 1993). That is, ImpSS obtained similar loadings on Psychoticism/Conscientiousness and Extraversion factors. Thus, the divergence of SS and (lack of) premeditation item content may be distributing the variance of ImpSS across two higher order traits. Furthermore, Eysenck and Eysenck (1978) factor analyzed impulsivity and SS items and found two factors: Impulsivity and Venturesomeness, which map onto psychoticism and extraversion, respectively. These patterns demonstrate impulsivity's relationship to psychoticism and SS's relationship to extraversion, which suggests that (lack of) premeditation and SS may diverge in a similar way.

However, Zuckerman (1993) asserted that the strong associations between Venturesomeness and Extraversion are due to the surplus of TAS items in the scale. If TAS items were solely responsible for Venturesomeness' loading on Extraversion, one could argue that (lack of) premeditation and SS would not diverge as Impulsivity and Venturesomeness did. However, this seems unlikely; the ES and DIS scales, which are most represented on SS, have shown relationships with extraversion similar to or above those of TAS (Eysenck & Zuckerman, 1978; Zuckerman et al., 1972). Moreover, ES and DIS have shown relationships with psychoticism only marginally higher than those of TAS in most cases (Eysenck & Zuckerman, 1978). Thus, ES and DIS content in SS may only increase its association with extraversion and would not likely significantly increase its association with psychoticism. That is, it is plausible that the divergence reported by Eysenck and Eysenck (1978) will be similar for ImpSS and that the stable associations between ImpSS and Eysenck's Psychoticism may be largely attributable to the (lack of) premeditation items of the scale, not the SS items.

Breen and Zuckerman (1999) examined the SS and (lack of) premeditation subscales of ImpSS and found that only increases in (lack of) premeditation accounted for chasing behavior in gambling. Thus, despite the similarities between SS and (lack of) premeditation, their subtle differences may manifest themselves in meaningful ways on self-report measures and behavioral paradigms. By the same logic, it may be useful to separate these two constructs in order to understand the nuances of ImpSS as they relate to higher order personality traits, deviance, and behavioral paradigms. ImpSS most likely lives on two factors: Extraversion and Psychoticism/Conscientiousness.

Conceptually, their differences can be thought of in terms of the aforementioned models of impulsivity such as BAS/BIS (Gray, 1972, 1981, 1982; Carver & White, 1994), Impulsiveness/Venturesomeness (Eysenck & Eysenck, 1978), (lack of) premeditation/sensation seeking (Whiteside & Lynam, 2001), and Impulse/Constraint (Carver, 2005). For example, when impulsivity and sensation seeking scales were factor analyzed, two factors emerged (Eysenck & Eysenck, 1978; Whiteside & Lynam, 2001). Moreover, BAS scales, particularly Fun-Seeking, have been shown to be quantitatively and qualitatively different from traditional conceptualizations of impulsivity and contain items more akin to SS (Miller et al., 2004; Quilty & Oakman, 2004; Smillie et al., 2006). Their differences are also evident in their relationships with other measures of personality traits (e.g. EPQ, NEO-PI-R). For example, BAS scales, which have been considered approximations of impulsivity, but probably more closely represent SS, are highly correlated with EPQ and NEO-PI-R Extraversion, but fail to correlate with General Temperament Survey (GTS) Disinhibition-Constraint, a scale associated with (lack of) premeditation (Watson & Clark, 1993). Additionally, UPPS SS strongly related to NEO-PI-R Extraversion whereas UPPS (lack of) premeditation is strongly related to NEO-PI-R Conscientiousness (Whiteside & Lynam, 2001). Conceptually, these two factors appear to most closely resemble “SS” (the strong push or willingness to pursue exciting, new, and potentially dangerous experiences) and “(lack of) premeditation,” (the failure to think about consequences before acting).

The fact that previous studies have found different relationships between the SSS subscales and personality measures across gender and country (Eysenck & Zuckerman, 1978; Zuckerman et al., 1972; Zuckerman et al., 1978) suggests that it may be useful to examine gender differences on SS and (lack of) premeditation. That is, in addition to well-established main effect differences in SS and (lack of) premeditation among men and women, the two constructs may operate differently in men and women evidencing a synergistic effect with measures of personality and deviance and laboratory tasks. Lastly, although Eysenck and Eysenck’s (1978) finding that impulsiveness and venturesomeness diverged most greatly in their relations to neuroticism is the only one of its kind, it would be useful to examine relations between SS and (lack of) premeditation and neuroticism to determine if the constructs lie predominantly on extraversion and conscientiousness or if neuroticism plays a role as well.

Lastly, although Zuckerman acknowledges the multidimensional nature of ImpSS by including (lack of) premeditation and sensation seeking subscales, the psychometric characteristics of these subscales remain to be examined and to my knowledge only one study has examined the subscales separately (Breen & Zuckerman, 1999). Furthermore, the (lack of) premeditation and SS subscales contain relatively few items and reliabilities for them have never been reported, which raises concerns about their abilities to reliably measure (lack of premeditation) and SS. Therefore, due to the importance of reliability in finding predicted relationships, it may be useful to add more items to each subscale, particularly in studies limited by small sample sizes.

*Hypotheses.* Based on the aforementioned theoretical and conceptual models, we expected the SS and (lack of) premeditation subscales of ImpSS to be differentially related to other self-report personality and deviance measures as well as lab tasks measuring risk taking. Based on current conceptualizations of SS and (lack of) premeditation, we expected the sensation seeking subscale of ImpSS to be more highly correlated with Extraversion (as indexed by the NEO-FFI and FFMRF) and UPPS sensation seeking than (lack of) premeditation. Additionally, we expected (lack of) premeditation to be more highly correlated with Conscientiousness (as indexed by the NEO-FFI and FFMRF), and UPPS (lack of) premeditation.

With regard to self-report deviance measures, we expected that (lack of) premeditation's association with general deviance (as indexed by the ABI) will be significantly greater than SS's association with general deviance. However, we expected that SS's and (lack of) premeditation's associations with favorable explicit and implicit attitudes toward drug use (e.g. smoking marijuana) would not significantly differ.

With regard to behavioral paradigms, previous research has demonstrated SS to be strongly related to risk taking to achieve "optimal levels of arousal" (Carrol & Zuckerman, 1977; Fisher, 1973; Zuckerman, 1974; Zuckerman et al., 1972). Thus, we expected the SS subscale to be more strongly related to Balloon Analogue Risk Task outcomes than the impulsivity subscale. In contrast, because a major component of (lack of) premeditation appears to be weak inhibition, we expected (lack of) premeditation to be more strongly related to Newman's Card-Playing Task than SS.

Lastly, because a strong willingness to pursue exciting and potentially dangerous experiences paired with a failure to consider the consequences of such pursuits would likely



increase the probably, duration, and severity of such actions, we expected there to be a significant interaction between SS and (lack of) premeditation in predicting all forms of deviance and outcomes on the Balloon Analogue Risk Task and Newman's Card-Playing Task.

## Chapter 2: Method

### *Participants*

Participants were recruited across two studies and were 654 undergraduates enrolled in an introductory psychology course. Participants were given credit to fulfill a course requirement. The entire sample consisted of 42% males (N = 275), 56% females (N = 363), and 2% (N = 16) who did not indicate their gender. Participants ranged in age from 18 to 52, with a mean age of 19.26.

### *Measures*

*Zuckerman-Kuhlman Personality Questionnaire III (ZKPQ-III)*. The ZKPQ-III has 99 items and has five scales measuring Impulsive Sensation-Seeking (ImpSS), Neuroticism-Anxiety (N-Anx), Aggression-Hostility (Agg-Hos), Activity (Act), Sociability (Sy), and Infrequency (*Inf*). In the present study only the ImpSS scale was used. It has 19 items: 8 impulsivity and 11 sensation seeking items. Impulsivity items describe an inability to plan and a failure to deliberate about actions before they are carried out (e.g. “I very seldom spend much time on the details of planning ahead”; Breen & Zuckerman, 1999). SS items describe a preference for exciting, novel, and unpredictable situations and friends (e.g. “I like doing things just for the thrill of it”; Breen & Zuckerman, 1999). Although these items are traditionally scored on a two-point (0-1) scale, for the purposes of the present study responses were scored on a five-point scale (1-5) ranging from “disagree strongly” to “agree strongly.” Possible scores ranged from 19 to 95, with higher scores indicating higher impulsivity. Zuckerman et al. (1993) reported internal consistencies for this scale to be .82. In the present study, the ImpSS scale’s coefficient  $\alpha = .88$ . Means and standard deviations are reported in Table 4.

*NEO Five Factor Inventory (NEO-FFI)*. The NEO-FFI contains 60 items and measures the same domains as the Costa and McCrae’s (1992a) NEO-PI-R: Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness. Responses are scored on a five-point scale (1-5) ranging from “disagree strongly” to “agree strongly.” However, unlike the NEO-PI-R, the NEO-FFI lacks facet scales for each domain. Nevertheless, the NEO-FFI’s domain scales have consistently demonstrated internal consistencies above .70 (Costa and McCrae, 1989, 1992b, 2004). Coefficient  $\alpha$ s for the domain scales in the current study were .85, .78, .68, .72, and .82, respectively. Means and standard deviations are reported in Table 4.

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Table 4

*Descriptive Statistics for Measures of Sensation Seeking, (lack of) Premeditation, Neuroticism, Extraversion, Conscientiousness, General Deviance, Explicit Attitudes Toward Marijuana, Implicit Attitudes Toward Marijuana, Balloon Analogue Risk Task Outcomes, Newman's Card-Playing Task Outcomes, and Hypothetical Money Choice Outcomes*

Measure	M	SD
Sensation Seeking	38.15	7.40
Premeditation	19.12	4.77
NEO-FFI Neuroticism	2.75	0.74
FFMRF Neuroticism	2.53	0.65
NEO-FFI Extraversion	3.83	0.53
FFMRF Extraversion	3.54	0.69
NEO-FFI Conscientiousness	3.71	0.57
FFMRF Conscientiousness	3.61	0.67
Delinquency	0.64	0.91
Substance Use	1.34	1.06
Explicit Attitudes Toward Marijuana	53.0	5.29
Implicit Attitudes Toward Marijuana	-.32	0.51
BART Pumps/Trial	8.38	3.21
BART Explosions	6.94	2.74
Newman's Card-Playing Task Money Won	3.72	1.37
HMCT	810.81	209.46

*Note.* NEO-FFI = NEO Five Factor Inventory. FFMRF = Five Factor Model Report Form. General Deviance = Antisocial Behavior Inventory Total Score. BART = Balloon Analogue Risk Task. HMCT = Hypothetical Money Choice Task.

*Five Factor Model Report Form (FFMRF)*. The FFMRF is the short form of the NEO-PI-R that contains 30 items and yields scores for the 5 domain scales and each of their 6 facet scales. Self-descriptions on the FFMRF also relate to maladaptive personality traits in a manner consonant with theoretic interpretations (Mullins-Sweatt, Jamerson, Samuel, Olson, and Widiger, in press). Internal consistencies for the domain scales range from acceptable to good ( $\alpha = .51$  for Openness,  $\alpha = .87$  for Conscientiousness) (Mullins-Sweatt et al., in press). Internal consistencies for the facet scale items varied widely, but indicated good convergent and discriminant validity (Mullins-Sweatt et al., in press). Coefficient  $\alpha$ s in the current study ranged from .70 (Openness) to .86 (Conscientiousness) for the domain scales. Means and standard deviations are reported in Table 4.

*UPPS Impulsive Behavior Scale (UPPS)*. The UPPS is a 45-item inventory used to measure four discrete personality pathways to impulsivity. Responses are scored on a four-point scale (1-4) ranging from “agree strongly” to “disagree strongly.” It was conceived through a factor analytic method, which was applied to numerous impulsivity scales. The four factors of the UPPS are urgency (e.g. “When I feel bad, I will often do things I later regret in order to make myself feel better now”), (lack of) premeditation (e.g. “I don't like to start a project until I know exactly how to proceed”), (lack of) perseverance (e.g. “Unfinished tasks really bother me”), and sensation seeking (e.g. “I would enjoy fast driving”). These scales have also consistently demonstrated internal consistencies above .80 (Whiteside & Lynam, 2001, 2003). Additionally, Whiteside and Lynam (2001) reported intercorrelations ranging from -.14 to .45 for the factors of the UPPS, further indicating their divergent validity. Internal consistencies in the current study were also good; coefficient  $\alpha$ s were .84, .88, .88, and .84, respectively. Means and standard deviations are reported in Table 4.

*Positive and Negative Affective Schedule (PANAS)*. The PANAS is a 20 item scale that contains 10 positive (e.g. proud) and 10 negative (e.g. lonely) affect descriptors. The items were borne from a principal components analysis of Zevon and Tellegen's (1982) mood checklist, which is thought to tap the affective lexicon (Crawford & Henry, 2004). Responses were scored on a five-point scale (1-5) ranging from “very slightly or not at all” to “very much or extremely.” Possible scores for each affect scale range from 10 to 50, with higher scores indicating higher affect. Although the two factors of the PANAS do not appear to be completely independent, both scales have demonstrated internal consistencies well above .80 and seem to be reliable and

valid measures of positive and negative affect (Crawford & Henry, 2004; Watson, Clark, & Tellegen, 1988). In the present study, the PA and NA scales obtained coefficient  $\alpha$ s of .85 and .95, respectively. Means and standard deviations are reported in Table 4.

*Antisocial Behavior Inventory (ABI)*. The ABI is a 22 item, self-report inventory that asks the respondent about criminal behavior (i.e., stealing, bouncing checks, fighting) and substance use (i.e. alcohol, marijuana, other drug use). The ABI consists of 22 items assessing 11 behaviors. Eleven of the items ask whether the participant has ever done the behavior, while the other 11 ask the participant about the number of times they have done the behavior in the past year. Self-report measures of deviant behaviors have shown high test-retest reliabilities from .75 to .98 for periods between 2 weeks to 6 months, and criterion correlations with parent or police data near .50 (Lynam, Whiteside, & Jones, 1999). Means and standard deviations are reported in Table 4.

*Explicit Attitudes Towards Marijuana Questionnaire (EATM)*. EATM is a 14 item self-report instrument that measures negative attitudes toward marijuana (items 1-4), positive attitudes toward marijuana (items 5-8), self-reported use (items 9-10), and behavioral intention to use (items 11-12). Response options include yes-no responses and four, five, and seven-point Likert scale items. Means and standard deviations are reported in Table 4.

*Marijuana Implicit Association Task (MIAT)*. The MIAT is a computer-administered task that measures an individual's implicit attitudes toward marijuana. Like other more traditional IATs, the MIAT is a dual categorization task; unlike other IATs, however, the discrimination is between a target category (marijuana) and a distinct neutral category (chairs), rather than between target (e.g. blacks) and non-target (e.g. whites) categories (see Czopp, Monteith, Zimmerman, & Lynam, 2004). On the first block of trials, participants indicated whether a word was a pleasant or unpleasant word. On the second block, participants categorized pictures as being either marijuana-related or a chair. In Blocks 3 and 4, these tasks were combined, requiring participants to use one response key (e.g. the Z key) to categorize pleasant words and marijuana on one side of the screen (e.g. the left side) and another response key (e.g. the number pad 2 key) to categorize unpleasant words and chairs on the other side of the screen (e.g. the right side). Block 3 was a practice block, and Block 4 was a critical block. In Block 5, the response keys previously assigned to chairs and marijuana in Block 2 were reversed (i.e. if marijuana-related stimuli were categorized on the left and chairs on the right side

in Block 2, marijuana-related stimuli were categorized on the right and chairs on the left in Block 5). Blocks 6 and 7 combined the tasks of Block 1 and Block 5 such that, for example, participants used one response key to categorize pleasant words and chairs and another response key to categorize unpleasant words and marijuana-related stimuli. Block 6 was a practice block, and Block 7 was a critical block. The two critical blocks (5 and 7) consisted of 40 trials each, and all other blocks consisted of 20 trials. Within each block, the order of stimuli presentation was randomly determined, but an equal number of exemplars from each category were presented. If an incorrect response was given, an error message of a red X briefly appeared on the screen before continuing to the next trial. Scores were calculated according to the improved “d” scoring algorithm provided by Greenwald, Nosek, and Banaji (2003); higher scores on this variable indicate more favorable attitudes towards marijuana. Means and standard deviations are reported in Table 4.

*Balloon Analogue Risk Task (BART).* The BART is a computer-simulated measure of risk-taking behavior (Hunt, Hopko, Bare, Lejuez, & Robinson, 2005; Lejuez, Read, Kahler, Richards, Ramsey, Stuart, Strong, & Brown, 2002). During the task, a small image of a balloon and balloon pump are presented on the computer screen along with a reset button labeled “Collect \$\$\$” and a display of total money earned. Participants use the computer’s mouse to click the balloon pump and inflate the balloon, but are not given any information about the probability of a balloon exploding (it could explode after the first pump or only after the balloon fills the entire screen). In the present study, balloons had a 1 out of 32 chance of exploding on the first pump, a 1 out of 31 chance of exploding on the second pump, and so on. Each click inflates the balloon about .125 inches in all directions and \$0.05 is added to a temporary reserve that is added to the “Total Earned” display if the participant clicks “Collect \$\$\$” before the balloon explodes. If the balloon explodes before the participant clicks “Collect \$\$\$,” the money accumulated in the temporary reserve is lost. Not including practice trials, participants complete a total of 30 trials. In the present study, total money earned and total balloon explosions were utilized as dependent measures. Means and standard deviations are reported in Table 4.

*Hypothetical Money Choice Task (HMCT).* The HMCT is a computer-simulated measure of temporal discounting. It was developed as an index of impulsivity and self-control. The task presents two choice options; one option involves a smaller, but immediate reward and the other option involves a larger, but delayed reward. Repeated preferences for smaller, immediate

rewards are indicative of more impulsivity and behavioral patterns such as heavy alcohol use (Vuchinich & Simpson, 1998). In the current study, the HMCT consisted of 2 trials (one with ascending values and one with descending values). Money values ranged from \$1.00 to \$1,000.00 with a stable time delay of 6 months. Two amounts of money were displayed on the computer screen with the immediate reward displayed on the right and the delayed reward displayed on the left with a caption indicating the time of delay. Means and standard deviations are reported in Table 4.

*Card-Playing Task (CPT).* The CPT is a computer-administered task, which presents participants with a series of cards on the screen one at a time and measures inhibitory responses to punishment (Newman, Widom, & Nathan, 1985). Participants are told that the cards are not from a standard deck and begin the task with 50 cents. After each card is presented face-down, participants decide if they want to bet whether or not the card is a face card or quit the task. If the participant chooses to bet and the card is a face card, he or she wins 5 cents. If the card is not a face card, the participant loses 5 cents. Participants can quit the task and leave with their winnings at any time. The task is set up in such a way that the ratio of face cards to number cards begins fairly high (9:1), but gradually decreases. Scoring consists of number of cards played and total earnings. Means and standard deviations are reported in Table 4.

### *Procedure*

In the first study, 402 participants (48% male, 52% female) were told that they were being asked to participate in a study designed to determine what aspects of television programming college students find entertaining. After informed consent was obtained, participants viewed a high sensation value television program, that included embedded within it either high or low sensation value anti-drug public service announcements. Following the viewing of these materials, participants completed measures of behavioral intention to use drugs, a measure of explicit attitudes towards drug use, and an implicit association task. Completion of the testing took approximately one hour and fifteen minutes.

In the second study, 252 participants (33% male, 61% female, 6% missing) were told that they are being asked to participate in a study designed to determine how entertaining college students find various activities. After informed consent was obtained, participants received a pretreatment consisting of video games and music, which differed in sensation value. Following pretreatment, participants completed measures of behavioral intentions to use drugs, a measure

of explicit attitudes, and a measure of implicit attitudes towards drugs as well as several behavioral tasks. Both rooms and measures were counterbalanced. Completion of the testing took approximately forty-five minutes.



## Chapter 3: Results

### *Confirmatory Factor Analyses*

Confirmatory factor analyses were used to test the underlying factor structure of ImpSS (see Table 5). A single factor model was tested against a two-factor model. In the first set of analyses, models were examined collapsing across gender. In the second set of analyses, model fit was compared across men and women. The first model represented ImpSS as a single factor with no error correlations. This model did not fit the data well,  $\chi^2(152, N = 636) = 1073.17$ , with a 90% confidence interval of the root mean square error of approximation (RMSEA) ranging from .092-.103 and a comparative fit index (CFI) of .759. The second model included two factors based on Zuckerman's two-factor structure with no error correlations. This model fit the data better than the single factor model,  $\chi^2(151, N = 636) = 911.76$ , with a 90% confidence interval of the root mean square error of approximation (RMSEA) ranging from .084-.095 and a comparative fit index (CFI) of .801; in fact, this two-factor model fit significantly better than the one-factor model,  $\Delta\chi^2(1) = 161.41, p < .001$ . Because the regression weight for item 50 ("I tend to change interests frequently") was quite small and below standard inclusion criterion, standardized regression weight equal to .273, it was dropped from subsequent analyses. The two-factor model continued to fit significantly better than the one-factor model in these analyses;  $\Delta\chi^2(1) = 183.24, p < .001$ . In an effort to identify the best fitting, two-factor model, modification indices were examined. These indices suggested that item 39 ("I enjoy getting into new situations where you can't predict how things will turn out") should be moved from the (lack of) premeditation factor to the SS factor. They also suggested inclusion of 7 error correlations. These changes resulted in a significant improvement in fit over the previous model,  $\Delta\chi^2(7) = 286.27, p < .001$ . This final model fit the data quite well,  $\chi^2(127, N = 636) = 436.91$ , with a 90% confidence interval of the root mean square error of approximation (RMSEA) ranging from .056-.068 and a comparative fit index (CFI) of .917.

In an effort to examine whether this final two-factor model was similar across men and women, a set of multigroup models was fitted. The first model imposed no constraints on the estimates across men and women, allowing measurement weights, structural covariances, and error variances to vary across gender. The second model was fully constrained, requiring measurement weights, structural covariances, and error variances to be the same across men and women. The fully unconstrained model did not fit significantly better than the fully constrained

model,  $\Delta\chi^2(46) = 44.46$ , ns. This final model fit the data quite well,  $\chi^2(298, N = 636) = 636.97$ , with a 90% confidence interval of the root mean square error of approximation (RMSEA) ranging from .038-.047 and a comparative fit index (CFI) of .908, and indicates that the factor structure is the same for men and women.

For the following analyses, two scales were computed: a SS scale and a (lack of) premeditation scale. The SS scale was composed of 11 items; these items were similar to the original sensation seeking items on ImpSS, but included item 39 from the ImpSS “impulsivity” items and did not include item 50. The (lack of) premeditation scale was composed of 7 items; this scale is identical to the ImpSS “impulsivity” eight-item scale, but without item 39. The SS and (lack of) premeditation scale reliabilities were  $\alpha = .84$  and  $\alpha = .80$ , respectively. The two scales had an intercorrelation of .591.

### *Gender Differences*

Hierarchical regression analyses were conducted for SS and gender and for (lack of) premeditation and gender to look for gender differences in the effects. For each validation measure, either SS or (lack of) premeditation and gender were entered at Step 1 followed by a product term (SS/(lack of) premeditation times gender), which carries information about the interaction. The partial regression coefficients at Step 1 provide information about the unique effects of SS or (lack of) premeditation and gender, whereas the significance of the product term at Step 2 reveals the presence or absence of an interaction.

Out of 22 SS x gender interactions examined, only 3 were significant, which is close to what one would expect by chance. There were significant interactions between SS and gender for NEO-FFI extraversion, implicit attitudes toward marijuana, and money won on NCPT (see Table 6), which were subsequently probed to determine the direction of the interaction. Results showed that the relation between sensation seeking and NEO-FFI extraversion was stronger for females than males (see Figure 1). The effect of SS on extraversion was stronger for females ( $B = .029, t = 6.46, p < .001$ ) than males ( $B = .013, t = 2.39, p < .05$ ), but both were significant.

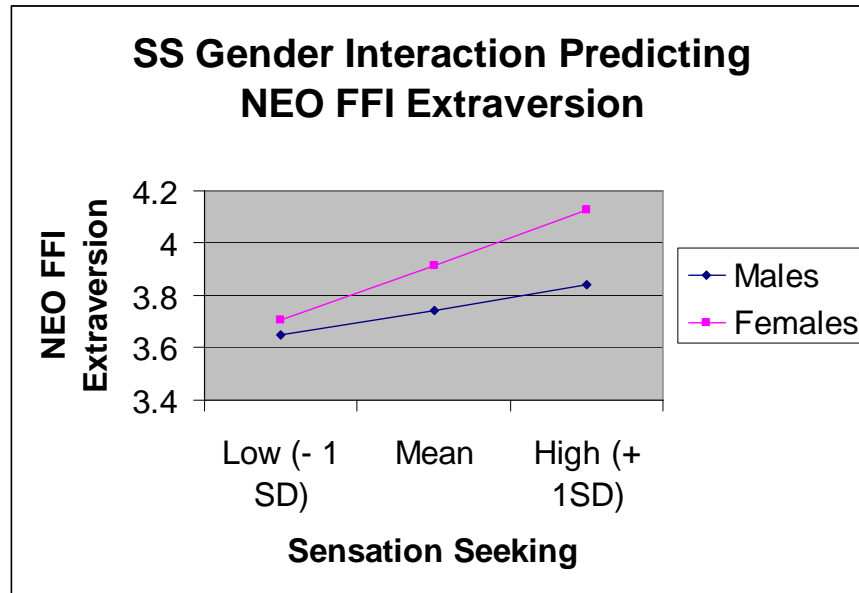
Table 5

*Confirmatory Factor Analyses of Impulsive Sensation Seeking Scale*

Model	Model $\chi^2$	df	$\Delta \chi^2$	Sign. of $\Delta$	90% CI RMSEA	CFI
Men and women together						
1. Model 1 (no error correlations)	1073.17	152			0.092-0.103	.759
2. Model 2 (no error correlations)	911.76	151	161.41, $df=1$ (vs. 1)	.001	0.084-0.095	.801
3. Model 1 with item 50 dropped	1015.02	135	58.15, $df=17$ (vs. 1)	<i>ns</i>	0.096-0.107	.764
4. Model 2 with item 50 dropped	831.78	134	183.24, $df=1$ (vs. 3)	.001	0.085-0.097	.813
5. Model 2 with item 50 dropped and item 39 moved to ES	723.18	134	291.84, $df=1$ (vs. 3)	.001	0.077-0.089	.842
6. Model 2 with item 50 dropped, item 39 moved to ES, and 7 error correlations	436.91	127	286.27, $df=7$ (vs. 5)	.001	0.056-0.068	.917
Men and women separately (two-group model)						
7. Fully constrained model	636.97	298				
8. Fully Unconstrained model	592.51	252	44.46, $df=46$ (vs. 7)	<i>ns</i>	0.041-0.051	.908

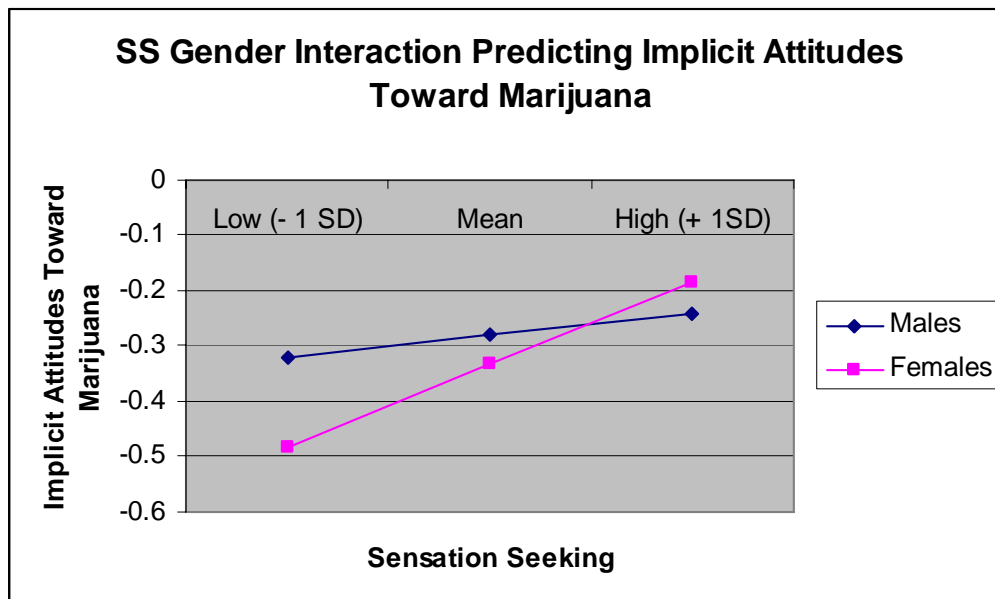
*Note.* The  $\Delta \chi^2$  column indexes the difference between nested models, the degrees of freedom for the test, and the number of models being compared. Model 1 = 1 Factor Solution. Model 2 = Zuckerman's 2 Factor Solution. Model 3 = Current Study 2 Factor Solution. ES = experience seeking. RMSEA = root mean square error of approximation. CFI = comparative fit index.

Figure 1.



Additionally, the relation between SS and implicit attitudes toward marijuana was stronger for females than males (see Figure 2). The effect of SS on implicit attitudes toward marijuana was significant for females ( $B = .020, t = 4.48, p < .001$ ), but was not significant for males ( $B = .006, t = 1.00, ns$ ).

Figure 2.



Lastly, the relation between SS and money won on NCPT was stronger for males than females (see Figure 3). The effect of SS on money won approached significance for males ( $B = .039, t = 1.90, p = .06$ ) and was not significant for females ( $B = -.016, t = -.975, ns$ ).

Figure 3.

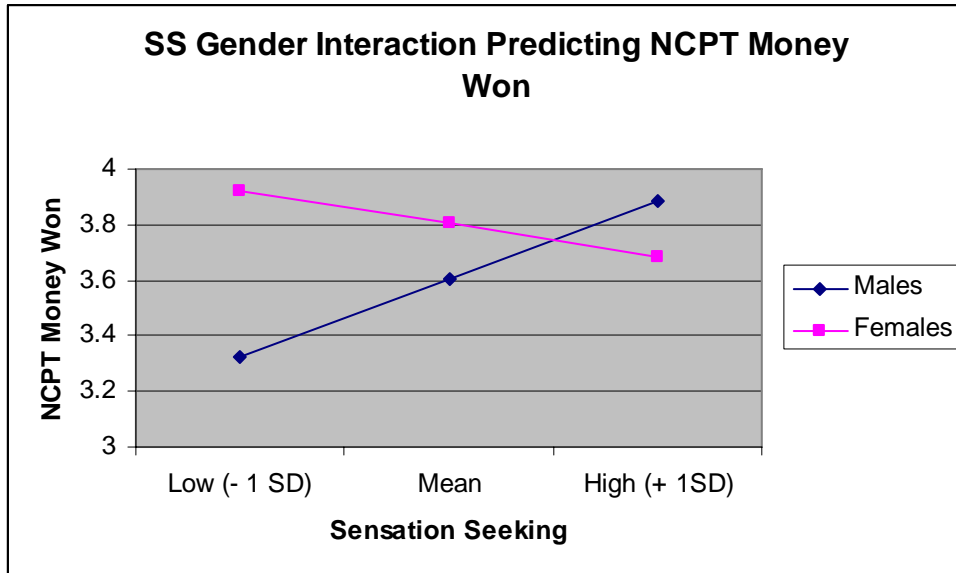


Table 6

*Gender Differences in the Relations Between Sensation Seeking and Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
NEO-FFI N:				
Step 1: SS	-.001	-.008		
G	.233**	.159**	.026**	
Step 2: SS x G	-.002	-.036	.026**	.000
FFMRF N:				
Step 1: SS	.011 <sup>†</sup>	.127 <sup>†</sup>		
G	-.038	-.028	.018	
Step 2: SS x G	.007	.135	.019	.002
NEO-FFI E:				
Step 1: SS	.022***	.303***		
G	.175**	.165**	.104***	
Step 2: SS x G	.016*	.365*	.116***	.012*
FFMRF E:				
Step 1: SS	.024***	.253***		
G	.271**	.187**	.087***	
Step 2: SS x G	-.006	-.113	.088***	.001
NEO-FFI O:				
Step 1: SS	.016***	.223***		

Table 6 continued

*Gender Differences in the Relations Between Sensation Seeking and Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
G	.014	.013	.049***	
Step 2: SS x G	-.010	-.224	.054***	.004
FFMRF O:				
Step 1: SS	.021***	.259***		
G	.019	.015	.066***	
Step 2: SS x G	-.007	-.142	.068***	.002
NEO-FFI A:				
Step 1: SS	-.012***	-.184***		
G	.172***	.172***	.072***	
Step 2: SS x G	.007	.176	.075***	.003
FFMRF A:				
Step 1: SS	.000	-.005		
G	.138 <sup>†</sup>	.110 <sup>†</sup>	.012	
Step 2: SS x G	-.003	-.054	.013	.001
NEO-FFI C:				
Step 1: SS	-.012**	-.156**		
G	.053	.046	.029**	
Step 2: SS x G	-.001	-.019	.029**	.000

Table 6 continued

*Gender Differences in the Relations Between Sensation Seeking and Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
FFMRF C:				
Step 1: SS	-.017**	-.182**		
G	-.048	-.034	.033*	
Step 2: SS x G	-.003	-.064	.033*	.000
UPPS Urgency:				
Step 1: SS	.245***	.277***		
G	1.36	.101	.080***	
Step 2: SS x G	-.007	-.013	.080***	.000
UPPS Premeditation:				
Step 1: SS	.256***	.411***		
G	.825	.088	.168***	
Step 2: SS x G	.004	.012	.168***	.000
UPPS Perseverance:				
Step 1: SS	.021	.033		
G	.742	.079	.007	
Step 2: SS x G	.146 <sup>†</sup>	.399 <sup>†</sup>	.020	.013 <sup>†</sup>
UPPS Sensation Seeking:				



Table 6 continued

*Gender Differences in the Relations Between Sensation Seeking and Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
Step 1: SS	.724***	.751***		
G	-1.06 <sup>†</sup>	-.072 <sup>†</sup>	.583***	
Step 2: SS x G	-.047	-.082	.583***	.000
Lifetime Delinquency:				
Step 1: SS	.010 <sup>†</sup>	.080 <sup>†</sup>		
G	-.667***	-.365***	.148***	
Step 2: SS x G	-.003	-.046	.148***	.000
Substance Use:				
Step 1: SS	.043***	.304***		
G	-.052	-.025	.095***	
Step 2: SS x G	-.012	-.132	.097***	.002
EATM:				
Step 1: SS	.285***	.238***		
G	-1.44*	-.081*	.069***	
Step 2: SS x G	-.024	-.033	.069***	.000
IATM:				
Step 1: SS	.014***	.201***		

Table 6 continued

*Gender Differences in the Relations Between Sensation Seeking and Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
G	-.049	-.048	.046***	
Step 2: SS x G	.015*	.348*	.056***	.011*
BART P:				
Step 1: SS	.054 <sup>†</sup>	.122 <sup>†</sup>		
G	-.872*	-.130*	.036*	
Step 2: SS x G	-.096	-.364	.047*	.011
BART E:				
Step 1: SS	.052*	.136*		
G	-.852*	-.149*	.046**	
Step 2: SS x G	-.023	-.101	.047**	.001
NCPT:				
Step 1: SS	.007	.039		
G	.339 <sup>†</sup>	.120 <sup>†</sup>	.015	
Step 2: SS x G	-.055	-.493*	.036 <sup>†</sup>	.021*
HMCT:				
Step 1: SS	-.226	-.008		
G	-10.74	-.024	.001	

Table 6 continued

*Gender Differences in the Relations Between Sensation Seeking and Validation Measures*

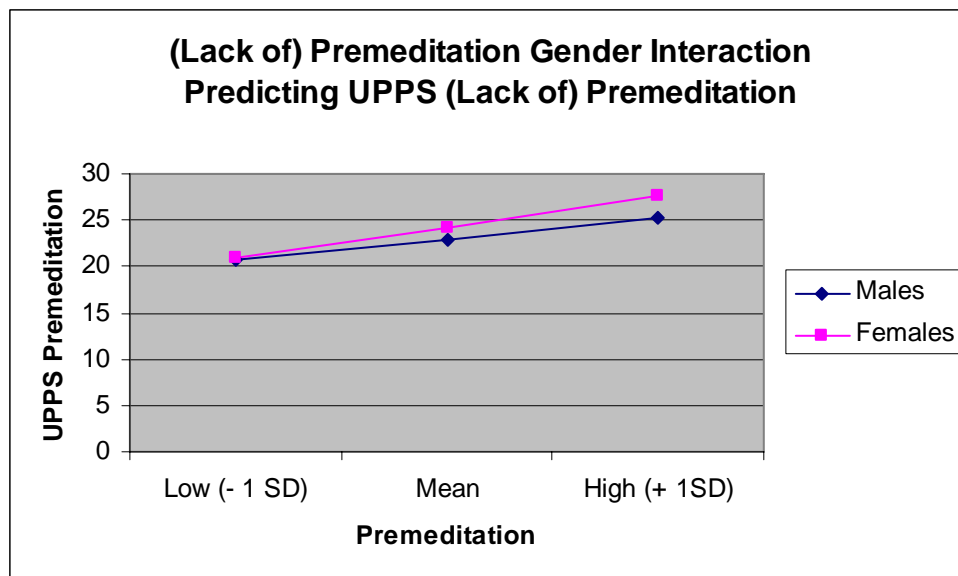
Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
Step 2: SS x G	2.02	.118	.002	.001

Note. SS = Sensation Seeking. G = Gender.

<sup>†</sup> $p < .10$  \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

Similarly, out of 22 (lack of) premeditation x gender interactions examined, only 3 were significant. There were significant interactions between (lack of) premeditation and gender for UPPS (lack of) premeditation and (lack of) perseverance and implicit attitudes toward marijuana (see Table 7), which were subsequently probed to determine the direction of the interaction. Results showed that the relation between (lack of) premeditation and UPPS (lack of) premeditation was stronger for females than males (see Figure 4), although the effect of (lack of) premeditation on UPPS (lack of) premeditation was significant for females ( $B = .769, t = 11.75, p < .001$ ) and males ( $B = .501, t = 5.54, p < .001$ ).

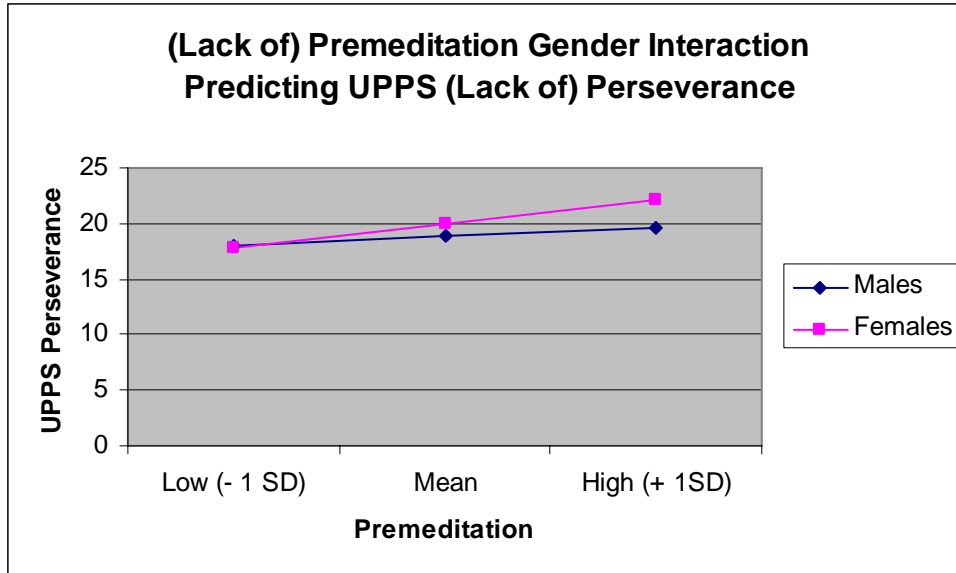
Figure 4.



Additionally, the relation between (lack of) premeditation and UPPS (lack of) perseverance was stronger for females than males (see Figure 5). The effect of (lack of)

premeditation on (lack of) perseverance was significant for females ( $B = .50, t = 6.19, p < .001$ ), but was not significant for males ( $B = .179, t = 1.75, ns$ ).

Figure 5.



Lastly, the relation between (lack of) premeditation and implicit attitudes toward marijuana was stronger for females than males (see Figure 6). The effect of (lack of) premeditation on implicit attitudes toward marijuana was significant for females ( $B = .029, t = 4.73, p < .001$ ), but was not significant for males ( $B = .009, t = 1.24, ns$ ).

Figure 6.

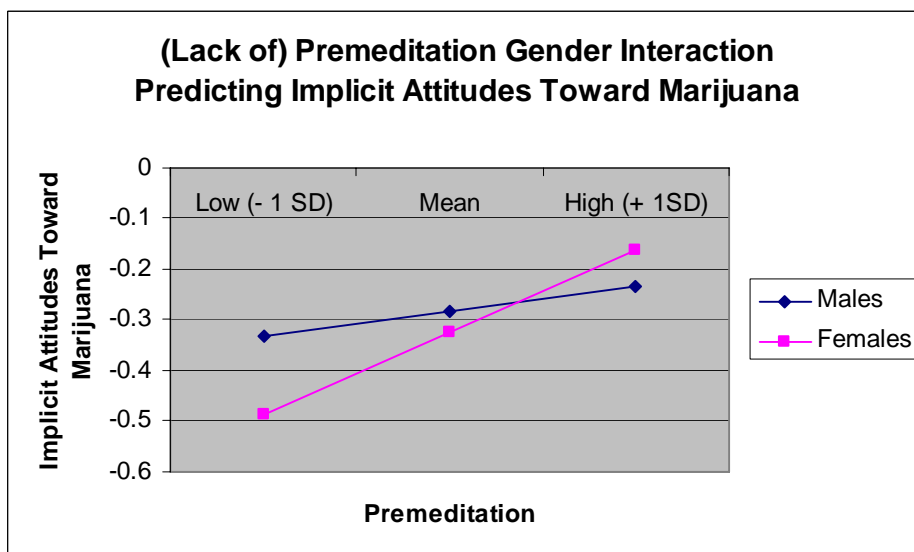


Table 7

*Gender Differences in the Relations Between (lack of) Premeditation and Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
NEO-FFI N:				
Step 1: PRE	.023**	.172**		
G	.280***	.190***	.054***	
Step 2: PRE x G	.005	.062	.055***	.001
FFMRF N:				
Step 1: PRE	.018 <sup>†</sup>	.117 <sup>†</sup>		
G	-.032	-.023	.015	
Step 2: PRE x G	.004	.044	.015	.000
NEO-FFI E:				
Step 1: PRE	.012*	.125*		
G	.151**	.142**	.030**	
Step 2: PRE x G	.013	.210	.034**	.004
FFMRF E:				
Step 1: PRE	.018 <sup>†</sup>	.110 <sup>†</sup>		
G	.253**	.175**	.036*	
Step 2: PRE x G	-.007	-.070	.036*	.000
NEO-FFI O:				

Table 7 continued

*Gender Differences in the Relations Between (lack of) Premeditation and Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
Step 1: PRE	.015**	.155**		
G	.008	.008	.024**	
Step 2: PRE x G	-.003	-.054	.024**	.000
FFMRF O:				
Step 1: PRE	.021*	.152*		
G	.011	.009	.023 <sup>†</sup>	
Step 2: PRE x G	-.004	-.046	.023 <sup>†</sup>	.000
NEO-FFI A:				
Step 1: PRE	-.023***	-.259***		
G	.153**	.153**	.104***	
Step 2: PRE x G	-.009	-.154	.107***	.003
FFMRF A:				
Step 1: PRE	-.022*	-.163*		
G	.103	.082	.038*	
Step 2: PRE x G	-.012	-.139	.040*	.002
NEO-FFI C:				
Step 1: PRE	-.048***	-.461***		
G	-.015	-.013	.211***	

Table 7 continued

*Gender Differences in the Relations Between (lack of) Premeditation and Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
Step 2: PRE x G	-.015	-.230	.216***	.005
FFMRF C:				
Step 1: PRE	-.061***	-.392***		
G	-.113	-.081	.149***	
Step 2: PRE x G	-.028	-.298	.157***	.008
UPPS Urgency:				
Step 1: PRE	.637***	.433***		
G	1.92*	.143*	.186***	
Step 2: PRE x G	-.080	-.090	.186***	.000
UPPS Premeditation:				
Step 1: PRE	.661***	.638***		
G	1.40**	.149**	.396***	
Step 2: PRE x G	.268*	.430*	.411***	.016*
UPPS Perseverance:				
Step 1: PRE	.371***	.359***		
G	1.30*	.138*	.131***	
Step 2: PRE x G	.321*	.518*	.153***	.023*

Table 7 continued

*Gender Differences in the Relations Between (lack of) Premeditation and Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
UPPS Sensation Seeking:				
Step 1: PRE	.716***	.446***		
G	-1.28	-.088	.221***	
Step 2: PRE x G	.000	.000	.221***	.000
Lifetime Delinquency:				
Step 1: PRE	.018*	.111*		
G	-.652***	-.357***	.154***	
Step 2: PRE x G	.000	-.001	.154***	.000
Substance Use:				
Step 1: PRE	.060***	.315***		
G	-.028	-.013	.101***	
Step 2: PRE x G	-.007	-.058	.101***	.000
EATM:				
Step 1: PRE	.417***	.225***		
G	-1.38*	-.077*	.063***	
Step 2: PRE x G	.066	.058	.063***	.000
IATM:				



Table 7 continued

*Gender Differences in the Relations Between (lack of) Premeditation and Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
Step 1: PRE	.020***	.214***		
G	-.040	-.039	.050***	
Step 2: PRE x G	.021	.362*	.063***	.012*
<hr/>				
BART P:				
Step 1: PRE	-.049	-.066		
G	-1.05*	-.157*	.025 <sup>†</sup>	
Step 2: PRE x G	.000	.001	.025	.000
<hr/>				
BART E:				
Step 1: PRE	-.031	-.049		
G	-1.00	-.175	.030*	
Step 2: PRE x G	.096	.254	.035*	.005
<hr/>				
NCPT:				
Step 1: PRE	.018	.060		
G	.361 <sup>†</sup>	.127 <sup>†</sup>	.017	
Step 2: PRE x G	-.085 <sup>†</sup>	-.465 <sup>†</sup>	.035 <sup>†</sup>	.051 <sup>†</sup>
<hr/>				
HMCT:				
Step 1: PRE	-4.72	-.097		

Table 7 continued

*Gender Differences in the Relations Between (lack of) Premeditation and Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
G	-17.49	-.040	.010	
Step 2: PRE x G	3.49	.119	.011	.001

Note. PRE = Premeditation. G = Gender.

<sup>†</sup> $p < .10$ , \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

*Zero-order correlations: Personality*

Bivariate correlations were conducted to determine SS's and (lack of) premeditation's relation to neuroticism, extraversion, openness, agreeableness, conscientiousness, UPPS urgency, UPPS (lack of) premeditation, UPPS (lack of) perseverance, and UPPS sensation seeking (see Table 8). Next, tests between dependent correlations were computed to compare the correlation with SS to the correlation with (lack of) premeditation for each criterion variable. As can be seen in the table, SS was significantly correlated with FFMRF neuroticism, NEO-FFI and FFMRF extraversion, openness, and conscientiousness, NEO-FFI agreeableness, and UPPS urgency, (lack of) premeditation, and sensation seeking. SS had its highest correlations with UPPS (lack of) premeditation and SS. In fact, SS's correlation with UPPS SS approached the maximum possible correlation given the reliability of the variables. (Lack of) premeditation was significantly correlated with NEO-FFI neuroticism and extraversion, NEO-FFI and FFMRF openness and agreeableness, and all UPPS scales. (Lack of) premeditation had its highest correlation with UPPS (lack of) premeditation and was strongly correlated with conscientiousness on both FFM measures.

Although SS and (lack of) premeditation were significantly correlated with many of the same scales, there were several important differences among the magnitudes of these correlations. In fact, SS's and (lack of) premeditation's correlations were significantly different from each other 79% (11/14) of the time. SS obtained significantly higher correlations with NEO-FFI extraversion,  $t(402) = 4.67, p < .001$ , FFMRF extraversion,  $t(236) = 2.53, p < .05$ , and UPPS sensation seeking,  $t(236) = 7.34, p < .001$ . (Lack of) premeditation obtained significantly

higher correlations with NEO-FFI neuroticism, ,  $t(402) = -4.30, p < .001$ , NEO-FFI agreeableness, ,  $t(402) = 2.00, p < .05$ , FFMRF agreeableness,  $t(236) = 2.66, p < .01$ , NEO-FFI conscientiousness, ,  $t(402) = 8.48, p < .001$ , FFMRF conscientiousness,  $t(236) = 3.54, p < .001$ , and UPPS urgency,  $t(236) = -2.56, p < .05$ , (lack of) premeditation,  $t(236) = -4.36, p < .001$ , and (lack of) perseverance,  $t(236) = -5.56, p < .001$ .

Table 8

*Bivariate Correlations and Dependent  $r$   $t$ -tests of Neuroticism, Extraversion, Conscientiousness, Lifetime Delinquency, Substance Use, Explicit Attitudes Toward Marijuana, Implicit Attitudes Toward Marijuana, Balloon Analogue Risk Task Outcomes, Newman's Card-Playing Task Outcomes, and Hypothetical Money Choice Outcomes for Sensation Seeking and (lack of) Premeditation*

Variable	SS	PRE	$t$
NEO-FFI N	-.031	.138**	-4.30***
FFMRF N	.131*	.121 <sup>†</sup>	.166
NEO-FFI E	.279***	.100*	4.67***
FFMRF E	.229***	.079	2.53*
NEO-FFI O	.221***	.154**	1.71 <sup>†</sup>
FFMRF O	.257***	.150*	1.81 <sup>†</sup>
NEO-FFI A	-.209***	-.286***	2.00*
FFMRF A	-.019	-.178**	2.66**
NEO-FFI C	-.163**	-.459***	8.48***
FFMRF C	-.178**	-.378***	3.54***
UPPS URG	.264***	.407***	-2.56*
UPPS PRE	.400***	.612***	-4.36***
UPPS PSV	.023	.335***	-5.56***
UPPS SS	.760***	.462***	7.34***

Table 8 continued

*Bivariate Correlations and Dependent  $r$   $t$ -tests of Neuroticism, Extraversion, Conscientiousness, Lifetime Delinquency, Substance Use, Explicit Attitudes Toward Marijuana, Implicit Attitudes Toward Marijuana, Balloon Analogue Risk Task Outcomes, Newman's Card-Playing Task Outcomes, and Hypothetical Money Choice Outcomes for Sensation Seeking and (lack of) Premeditation*

Variable	SS	PRE	$t$
LD	.133**	.175***	-1.06
SU	.308***	.317***	-.238
EATM	.250***	.239***	.318
IATM	.208***	.221***	-.332
BART P	.138*	-.038	2.95**
BART E	.155*	-.018	2.90**
NCPT	.026	.035	-.145
HMCT	-.005	-.090	.193

*Note.* NEO-FFI N = NEO Five Factor Inventory Neuroticism. FFMRF N = Five Factor Model Report Form Neuroticism. NEO-FFI E = NEO Five Factor Inventory Extraversion. FFMRF E = Five Factor Model Report Form Extraversion. NEO-FFI O = NEO Five Factor Inventory Openness. FFMRF O = Five Factor Model Report Form Openness. NEO-FFI A = NEO Five Factor Inventory Agreeableness. FFMRF A = Five Factor Model Report Form Agreeableness. NEO-FFI C = NEO Five Factor Inventory Conscientiousness. FFMRF C = Five Factor Model Report Form Conscientiousness. UPPS URG = Urgency. UPPS PRE = Premeditation. UPPS PSV = Perseverance. UPPS SS = Sensation Seeking. LD = Lifetime Delinquency. SU = Substance Use. EATM = Explicit Attitudes Toward Marijuana. IATM = Implicit Attitudes Toward Marijuana. BART P = Balloon Analogue Risk Task Pumps. BART E = Balloon Analogue Risk Task Explosions. NCPT = Newman's Card-Playing Task Money Won. HMCT = Hypothetical Money Choice Task.

<sup>†</sup> $p < .10$ , \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

*Zero-order Correlations: Deviance*

Bivariate correlations were conducted to determine SS's and (lack of) premeditation's relation to general deviance (lifetime delinquency and substance use) and explicit and implicit

attitudes toward marijuana (see Table 8). SS and (lack of) premeditation were both significantly correlated with all deviance variables, but both obtained their highest correlations with substance use. Next, tests between dependent correlations were computed to compare the correlation with SS to the correlation with (lack of) premeditation for each criterion variable. Interestingly, none of the magnitudes of SS's and (lack of) premeditation's relations to criterion variables were significantly different.

#### *Zero-order correlations: Laboratory Tasks*

Bivariate correlations were conducted to determine SS's and (lack of) premeditation's relation to laboratory task outcomes (see Table 8). SS was significantly related to BART average pumps/trial, but obtained its highest correlation with BART explosions. (Lack of) premeditation was not significantly related to any of the laboratory tasks. Next, tests between dependent correlations were computed to compare the correlation with SS to the correlation with (lack of) premeditation for each criterion variable. Because SS was significantly correlated with BART pumps and explosions and (lack of) premeditation failed to obtain any significant relations with criterion variables, it is not surprising that SS obtained significantly higher correlations with BART pumps,  $t(236) = 2.95, p < .01$ , and explosions,  $t(236) = 2.90, p < .01$ .

#### *Multiple Regressions*

In an effort to examine the unique contributions made by SS and (lack of) premeditation in predicting the validation measures and in a search for synergistic effects, a series of hierarchical regression analyses were conducted. For each validation measure, centered SS and centered (lack of) premeditation were entered at Step 1 followed by a product term (SS times premeditation), which carries information about the interaction. The partial regression coefficients at Step 1 provide information about the unique effects of SS and (lack of) premeditation, whereas the significance of the product term at Step 2 reveals the presence or absence of an interaction.

Results showed important divergences between SS and (lack of) premeditation, which complemented our correlational findings. With regard to the FFM indices, SS was strongly positively related to both indices of extraversion, whereas (lack of) premeditation was significantly negatively related to NEO-FFI extraversion and unrelated to FFMRF extraversion (see Table 9). (Lack of) premeditation was strongly negatively related to both indices of conscientiousness, whereas SS was significantly positively related to NEO-FFI

conscientiousness and unrelated to FFMRF conscientiousness. (Lack of) premeditation was also significantly positively related to NEO-FFI neuroticism, whereas SS was significantly negatively related to NEO-FFI neuroticism. Additionally, SS was significantly positively related and (lack of) premeditation was unrelated to both indices of openness. Lastly, (lack of) premeditation was significantly negatively related and SS was unrelated to both indices of agreeableness.

With regard to the UPPS, SS was significantly positively related and (lack of) premeditation was unrelated to UPPS sensation seeking. Conversely, (lack of) premeditation was strongly positively related to UPPS (lack of) perseverance, whereas SS was significantly negatively related to UPPS (lack of) perseverance. Lastly, (lack of) premeditation was significantly positively related to UPPS urgency and (lack of) premeditation, whereas SS was unrelated to UPPS urgency and (lack of) premeditation.

On deviance measures (lack of) premeditation was significantly positively related to lifetime delinquency and implicit attitudes toward marijuana, whereas SS was unrelated to lifetime delinquency and implicit attitudes toward marijuana. Interestingly, SS and (lack of) premeditation both had similar relations in direction and magnitude to substance use and explicit attitudes toward marijuana. On laboratory tasks SS was significantly positively related to BART average pumps/trial and explosions, whereas (lack of) premeditation was significantly negatively related to BART average pumps/trial and explosions.

Table 9

*Synergistic Effects of Sensation Seeking and (lack of) Premeditation on Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
NEO-FFI N:				
Step 1: SS	-.023**	-.231**		
PRE	.039***	.295***	.048***	
Step 2: SS x PRE	.001	.072	.053***	.005

FFMRF N:

Table 9 continued

*Synergistic Effects of Sensation Seeking and (lack of) Premeditation on Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
Step 1: SS	.008	.091		
PRE	.010	.070	.020 <sup>†</sup>	
Step 2: SS x PRE	-.001	-.032	.021	.001
NEO-FFI E:				
Step 1: SS	.028***	.391***		
PRE	-.016*	-.165*	.093***	
Step 2: SS x PRE	.000	.021	.093***	.000
FFMRF E:				
Step 1: SS	.026**	.272**		
PRE	-.012	-.075	.056**	
Step 2: SS x PRE	.000	-.005	.056**	.000
NEO-FFI O:				
Step 1: SS	.016**	.216**		
PRE	.001	.008	.049***	
Step 2: SS x PRE	.000	.014	.049***	.000
FFMRF O:				
Step 1: SS	.021**	.253**		

Table 9 continued

*Synergistic Effects of Sensation Seeking and (lack of) Premeditation on Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
PRE	.001	.006	.066***	
Step 2: SS x PRE	.001	.081	.072**	.006
NEO-FFI A:				
Step 1: SS	-.002	-.028		
PRE	-.024***	-.267***	.082***	
Step 2: SS x PRE	-.001	-.077	.088***	.006
FFMRF A:				
Step 1: SS	.010	.121		
PRE	-.034**	-.246**	.042**	
Step 2: SS x PRE	.001	.079	.047*	.006
NEO-FFI C:				
Step 1: SS	.021***	.274***		
PRE	-.067***	-.644***	.251***	
Step 2: SS x PRE	.000	.016	.252***	.001
FFMRF C:				
Step 1: SS	.005	.053		
PRE	-.063***	-.408***	.145***	



Table 9 continued

*Synergistic Effects of Sensation Seeking and (lack of) Premeditation on Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
Step 2: SS x PRE	.001	.049	.147***	.002
UPPS Urgency:				
Step 1: SS	.043	.049		
PRE	.559***	.380***	.168***	
Step 2: SS x PRE	-.011	-.063	.171***	.004
UPPS Premeditation:				
Step 1: SS	.049	.079		
PRE	.587***	.567***	.378***	
Step 2: SS x PRE	-.002	-.015	.379***	.001
UPPS Perseverance:				
Step 1: SS	-.152**	-.245**		
PRE	.489***	.474***	.153***	
Step 2: SS x PRE	.002	.012	.153***	.000
UPPS Sensation Seeking:				
Step 1: SS	.707***	.734***		
PRE	.074	.046	.579***	
Step 2: SS x PRE	.001	.004	.579***	.000

Table 9 continued

*Synergistic Effects of Sensation Seeking and (lack of) Premeditation on Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
Lifetime Delinquency:				
Step 1: SS	.003	.028		
PRE	.026*	.156*	.031**	
Step 2: SS x PRE	.000	.007	.031**	.000
Substance Use:				
Step 1: SS	.025**	.172**		
PRE	.038**	.200**	.117***	
Step 2: SS x PRE	.001	.057	.120***	.003
EATM:				
Step 1: SS	.201***	.168***		
PRE	.259**	.139**	.075***	
Step 2: SS x PRE	.021	.097*	.084***	.009*
IATM:				
Step 1: SS	.007	.107		
PRE	.014*	.148*	.055***	
Step 2: SS x PRE	.001	.050	.057***	.002
BART P:				
Step 1: SS	.105**	.236**		

Table 9 continued

*Synergistic Effects of Sensation Seeking and (lack of) Premeditation on Validation Measures*

Model	B	$\beta$	R <sup>2</sup>	R <sup>2</sup> $\Delta$
PRE	-.127	-.172	.039*	
Step 2: SS x PRE	.000	-.004	.039*	.000
BART E:				
Step 1: SS	.092**	.244**		
PRE	-.098*	-.156*	.041**	
Step 2: SS x PRE	-.002	-.022	.041**	.000
NCPT:				
Step 1: SS	.002	.009		
PRE	.009	.030	.001	
Step 2: SS x PRE	.001	.035	.002	.001
HMCT:				
Step 1: SS	2.08	.070		
PRE	-6.37	-.130	.011	
Step 2: SS x PRE	.301	.047	.113	.002

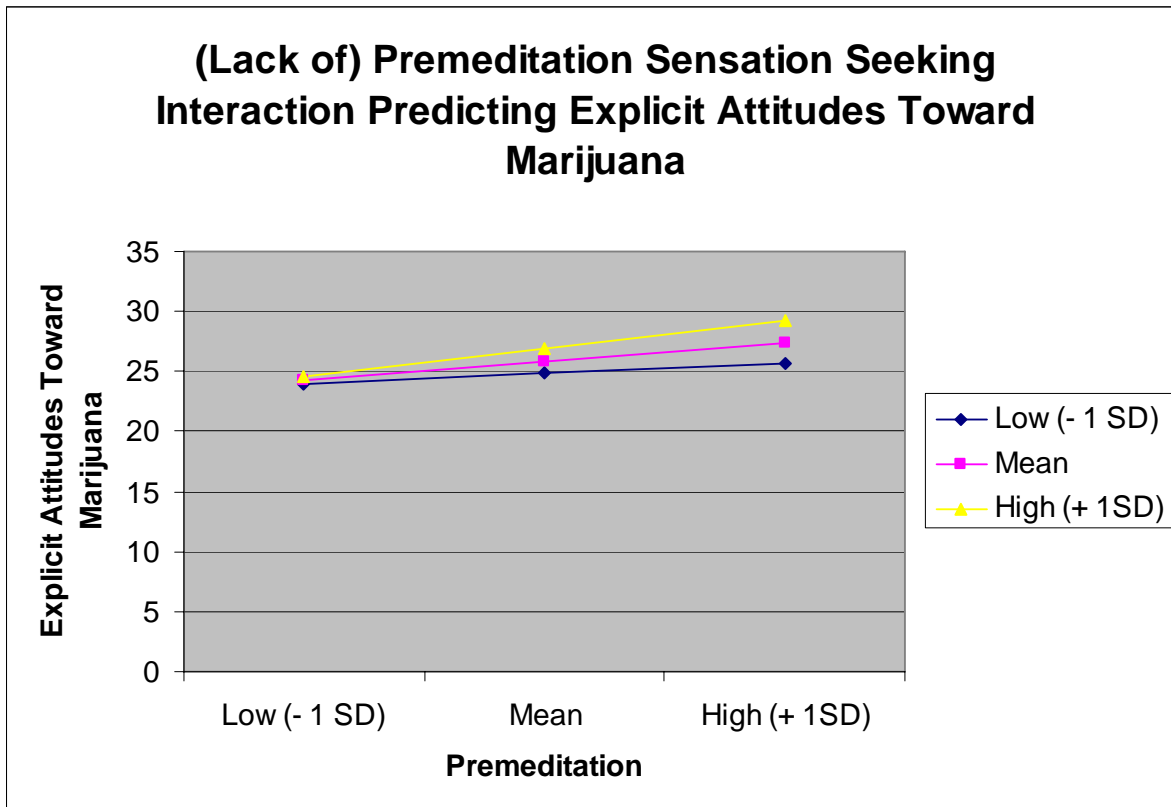
Note. SS = Sensation Seeking. PRE = Premeditation.

<sup>†</sup> $p < .10$  \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

Of 19 interactions examined, only one was significant. There was a significant interaction between SS and (lack of) premeditation for explicit attitudes toward marijuana (see

Table 9), which was subsequently probed to determine the direction of the interaction. Results showed that the relation between (lack of) premeditation and explicit attitudes toward marijuana is stronger for high sensation seekers than low sensation seekers (see Figure 7). Simple slope analyses revealed that the effect of (lack of) premeditation on explicit attitudes toward marijuana was significant for high sensation seekers ( $B = .372, t = 3.78, p < .001$ ), but was not significant for low sensation seekers ( $B = .067, t = .577, ns$ ). Similarly, the relation between SS and explicit attitudes toward marijuana is stronger for high (lack of) premeditation than low (lack of) premeditation (see Figure 8). Simple slope analyses revealed that the effect of SS on explicit attitudes toward marijuana was significant for high (lack of) premeditation ( $B = .312, t = 4.35, p < .001$ ), but was not significant for low (lack of) premeditation ( $B = .116, t = 1.76, ns$ ).

Figure 7.



## Chapter 4: Discussion

### *Implications*

This study provided good evidence for the multifaceted nature of Zuckerman's ImpSS scale. Confirmatory factor analyses showed two-factor models (composed of SS and (lack of) Premeditation) fit better with the data than one-factor models. Furthermore, correlations and dependent *r* t-tests demonstrated important divergences between SS and (lack of) premeditation on numerous variables, particularly those pertaining to personality. Most notably, SS and (lack of) premeditation evidenced clear differences in their relations with extraversion and conscientiousness. As hypothesized, SS was significantly positively related to both indices of extraversion as well as significantly more related to extraversion than (lack of) premeditation. In fact, in multiple regression analyses, when SS and (lack of) premeditation were entered simultaneously, (lack of) premeditation failed to significantly predict extraversion in one case and predicted extraversion in the other case, but with a negative coefficient as compared with SS's positive coefficient. Thus, multiple regression analyses only further elucidated SS's and (lack of) premeditation's differential relations to extraversion. Clearly, SS is associated with high levels of extraversion whereas (lack of) premeditation is either unrelated or somewhat negatively related to extraversion.

Also as expected, correlations showed that (lack of) premeditation was significantly negatively related to conscientiousness as well as significantly more related to conscientiousness than SS, which once again demonstrates SS's and (lack of) premeditation's divergence from each other. Multiple regression analyses demonstrated their divergence even more clearly. When SS and (lack of) premeditation were entered simultaneously, SS and (lack of) premeditation both significantly predicted conscientiousness, but with opposite coefficients. Clearly, SS is associated with high conscientiousness and (lack of) premeditation is associated with low conscientiousness. Similar divergences are evident in SS's and (lack of) premeditation's relations to other FFM domains of personality. SS and (lack of) premeditation also diverged in their relations to FFM openness and agreeableness. Correlation, dependent *r* t-test, and regression analyses all suggest that openness is part of SS whereas agreeableness is part of (lack of) premeditation.

Dependent *r* t-tests further demonstrated the divergence between SS and (lack of) premeditation with regard to the UPPS. SS was significantly more related to UPPS SS than (lack

of) premeditation and (lack of) premeditation was significantly more related to UPPS (lack of) premeditation than SS. Furthermore, multiple regression analyses underscored these divergences by showing that when SS and (lack of) premeditation were entered simultaneously, (lack of) premeditation failed to predict UPPS SS and SS failed to predict UPPS (lack of) premeditation. These results corroborate the findings with the FFM indices; SS appears to be well aligned with extraversion and (lack of) premeditation with conscientiousness. Additionally, dependent *r* tests demonstrated that (lack of) premeditation was significantly more related to UPPS urgency and (lack of) perseverance. In multiple regression analyses, when SS and (lack of) premeditation were entered simultaneously, SS failed to predict UPPS urgency and significantly predicted UPPS (lack of) perseverance, but with a negative coefficient as compared to (lack of) premeditation's positive coefficient. Clearly, SS and (lack of) premeditation diverge a great deal in most domains of the FFM.

Additionally, SS and (lack of) premeditation were differentially effective in predicting deviance. Although zero-order correlations evidenced no significant differences between SS's and (lack of) premeditation's relations to deviance, multiple regression analyses demonstrated that when SS and (lack of) premeditation were entered simultaneously, only (lack of) premeditation remained a significant predictor of lifetime delinquency. Thus, as hypothesized, (lack of) premeditation appears to be the most useful in predicting general deviance (e.g. fighting, stealing). Despite (lack of) premeditation's being a significant predictor of implicit attitudes toward marijuana, both SS and (lack of) premeditation provided significant unique variance in predicting substance use and explicit attitudes toward marijuana. Thus, as hypothesized, both SS and (lack of) premeditation are similar in predicting substance use. However, the fact that they appear to account for different aspects of substance use related variables provides further evidence for their divergence and the utility of viewing them as distinct constructs.

The divergences between SS and (lack of) premeditation were also evident in their relations with laboratory tasks. As hypothesized, SS was a significantly better predictor of BART outcomes. In fact, when SS and (lack of) premeditation were entered simultaneously, (lack of) premeditation failed to predict BART average pumps. In other words, the underlying behavioral process associated with individuals high in SS tends to cause them to take a great deal of risks on the BART, while the outcome of the underlying process associated with individuals

high in (lack of) premeditation is less clear cut. With regard to Newman's Card-Playing Task, (lack of) premeditation was not a significantly better predictor of its outcomes, which ran contrary to our hypothesis. Furthermore, neither SS nor (lack of) premeditation provided significant unique variance in predicting outcomes on Newman's Card-Playing Task. Thus, although the risk-taking inherent to the BART appears to be clearly linked to SS, it remains difficult to determine how SS and (lack of) premeditation operate in other laboratory tasks.

Although there have been inconsistent findings with regard to gender (Eysenck & Zuckerman, 1978; Zuckerman et al., 1972; Zuckerman et al., 1978), sensation seeking's and (lack of) premeditation's relations appeared to be generally similar across gender. Confirmatory factor analyses evidenced good fit between models for men and women. Furthermore, there were few interactions between SS/(lack of) premeditation and gender. Thus, SS and (lack of) premeditation typically have similar predictive ability within men and women.

The numerous divergences between SS and (lack of) premeditation provide preliminary evidence that combining the two constructs in the ImpSS scale may be a mistake. In fact, results from our multiple regression analyses suggest that there is little to be gained by integrating the two constructs. The plethora of independent effects for SS and (lack of) premeditation outline the importance of each construct in predicting personality, deviance, and laboratory tasks. This finding agrees with previous work that has shown each construct as a useful predictor of these variables (Breen & Zuckerman, 1999; Carrol & Zuckerman, 1977; Eysenck & Zuckerman, 1978; Fisher, 1973; Hoyle, Fejfar, & Miller, 2000; Langewisch & Frisch, 1998; Lejuez et al., 2005; Lynam & Miller, 2004; Miller et al., 2003; Whiteside & Lynam, 2003; Zuckerman, 1974; Zuckerman et al., 1972; Zuckerman et al., 1980; Zuckerman et al., 1976). However, the dearth of synergistic effects between SS and (lack of) premeditation is perhaps most notable. The fact that SS and (lack of) premeditation do not combine to form anything that improves their predictive abilities over their additive effect strongly suggests that there is nothing gained from viewing the two constructs together as ImpSS. Thus, not only do the constructs appear to be fundamentally different in their relations to larger personality domains, but they also may sacrifice clarity if combined. That is, combining the constructs only obscures the unique, specific relations between SS and (lack of) premeditation and other variables and ignores the multifaceted nature of the larger concept of "impulsivity."

Previous research has certainly alluded to the multifaceted nature of the broad construct of “impulsivity” (Carver, 2005; Carver & White, 1994; Eysenck & Eysenck, 1978). However, as was evidenced by the current study, the UPPS model (Whiteside & Lynam, 2001) provided the clearest framework for understanding impulsivity. SS and (lack of) premeditation mapped onto and diverged in much the same way as UPPS SS and (lack of) premeditation, respectively. This demonstrated both that impulsivity is multifaceted and that ImpSS fails to capture the entire construct of impulsivity. Thus, framing discussions of impulsivity in the context of its UPPS subtypes may be useful in understanding and communicating the construct effectively.

#### *Study Limitations and Future Directions*

A valid criticism of the current study is that behavioral paradigms were not ecologically valid or high enough in sensation value to relate to sensation seeking (ceiling effect for behavioral paradigms?) (Coventry & Brown, 1993). However, support for this criticism has only been upheld in gambling paradigms (Breen & Zuckerman, 1999). Nevertheless, the study could have been strengthened by obtaining participant ratings of sensation value or taking physiological measurements of arousal (e.g. skin conductance).

Another limitation was the homogeneity of the sample. Although the total sample size was large, the sample lacked representation of minority groups. Thus, no hypotheses could be tested pertaining to race differences in impulsivity. Similarly, only one previous study has examined SS in people of different sexual orientations and results were limited to a small sample of homosexual males (Zuckerman & Myers, 1983). Thus, it would have been useful to assess for sexual orientation in order to provide more information about homosexual men and women’s SS and deviant behavior.

Future directions include an examination of the relation between SS, (lack of) premeditation, and the subscales of Zuckerman’s SSS Form V. By examining these relations we could empirically determine whether SS and (lack of) premeditation are captured by the SSS or if Zuckerman included an aspect of impulsivity in ImpSS that was not included in the SSS. Furthermore, our measures of personality were largely limited to the FFM whereas much of Zuckerman’s previous work utilized Eysenck’s three-factor EPQ. Despite the considerable overlap between the EPQ and FFM, including the EPQ would allow for replication of Zuckerman’s previous findings as well as provide further evidence for the divergence of SS and (lack of) premeditation. The dearth of studies including laboratory tasks has made relations with



SS and (lack of) premeditation difficult to determine. Thus, future studies should also incorporate more laboratory tasks into examinations of SS and (lack of) premeditation as well as other measures (e.g. UPPS, SSS, I-7) to elucidate their true relations.

## Reference Notes

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