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Neuropsychological Effects of Placebo Stimulants in College Students

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Neuropsychological Effects Of Placebo Stimulants in College Students

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ABSTRACT

The past 15 years has seen increases in the nonmedical use of prescription stimulants (NMUPS; e.g., Adderall, Ritalin, Focalin) across college students with rates reported between 6 and 34 percent. Many underestimate or ignore the serious side effects associated with stimulant medication. Furthermore, stimulant medications used to treat ADHD are classified as Schedule II drugs by the Drug Enforcement Agency as they provide beneficial outcomes when used as a prescription medication, but have a high potential risk for abuse, rendering the diversion and unprescribed use illegal. There is also the ethical dilemma that arises when students have access to prescription stimulants to use nonmedically for the purpose of cognitive enhancement. The present study measured the effect a placebo stimulant and one's personal expectancies have on subjective physiological changes and academic enhancement.

Undergraduate college students (N = 305) participated in a two-phase study. Phase I involved completing an online survey to gather distal study variables and screen participants for medical exclusionary criteria that precludes them from obtaining a stimulant prescription. Phase II required students to attend an in-person session in which they completed various physiological and neuropsychological measures (e.g., Physical Symptom Checklist, Digit Span, Passage Comprehension). Students were randomized to receive 30 milligrams of a placebo stimulant medication (experimental) or no medication (control). Following a 30-minute absorption period, participants completed another set of physiological and neuropsychological measures. A repeated measures-MANCOVA revealed no significant differences between groups from time 1 to 2 despite positive symptom changes in the experimental group. Expectancies moderated performance on some neuropsychological tasks. Future research should include more participants with a history of NMUPS and stimulant medication in addition to placebo.

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CHAPTER 1

Introduction

The past 15 years has seen increases in the nonmedical use of prescription stimulants (NMUPS; e.g., Adderall, Ritalin, Vyvanse, Focalin, Concerta) across college and high school students with rates reported between 6 and 34 percent (Teter, Falone, Cranford, Boyd & McCabe 2010; DeSantis, Webb & Noar &, 2008). Even larger percentages of upwards of 71.4% of students report knowing at least one peer who has nonmedically used stimulant medications with NMUPS behaviors being widely acceptable by students (Carroll, McLaughlin, Blake, 2006; DeSantis & Hane, 2010). In reality, many students either underestimate or choose to ignore the serious side effects that stimulant medication carries on the label, including heart attack, insomnia, personality changes and in rare cases, death. In 2008, DeSantis et al. found only 2% of their sample of 1,811 undergraduates believed NMUPS posed a serious health risk and using stimulants nonmedically was "very dangerous." Beyond the physical danger that students who use NMUPS are placing themselves at risk for, there are the more obvious legal issues. Stimulant medications used to treat ADHD (i.e., Adderall, Ritalin, Vyvanse, Concerta, etc) are classified as Schedule II drugs by the Drug Enforcement Agency as they provide beneficial outcomes when used as a prescription medication but also have a high potential risk for abuse. Furthermore, there is the ethical dilemma that arises when students have access to prescription stimulants to use nonmedically for the purpose of cognitive enhancement to ultimately improve academically. NMUPS occurs at higher frequencies at competitive colleges and those located in the northeast which begs the question, are students who nonmedically use prescription stimulants cheating? But the question also arises as to whether NMUPS actually improves performance and do any

changes in performance reflect the effects of stimulants or the expectation of improved performance.

To better understand how student's individual expectancies about taking stimulant medication nonmedically actually impacts performance, we completed the present study, in which students completed various physiological and neuropsychological measures before and after taking 30 milligrams of a placebo stimulant medication. To understand how NMUPS evolved, it is first necessary to understand the course of the ADHD diagnoses and the mainstreaming of stimulant medication. The following sections provide an historical review of the development of ADHD and the medication used to manage the associated symptoms. Because the medication is presently commonly abused, other substance abuse models can be applied to NMUPS to fully comprehend the role expectancies of the drug's effects may have on use patterns. This is followed by a rationale and description of the current study.

Literature Review

Prior to the 1960s, ADHD was not a well-established diagnosis due to unclear diagnostic criteria and little understanding of the etiology of the disorder. With the release of the DSM-III, the criteria for the disorder became clear and a better understanding of ADHD enabled the medical field to more accurately diagnosis and subsequently prescribe medication to help manage the symptoms. During DSM-III circulation, ADHD prevalence was approximately 9.6%; when DSM-IV was released with new criteria, ADHD prevalence increased to 17.8% which was based on teacher ratings of ADHD symptoms (Wolraich, Hannah, Pinnock, Baumgaertel & Brown, 1996). Stimulant medication began being prescribed for ADHD in the 1970s and has increased dramatically to the present day from 0.6% point prevalence in 1987 to 3.5% in 2008 (Zuvekas & Vitiello, 2012). In a weekly report, the CDC stated the prevalence of ADHD in

children aged 6-17 years was 8.4%, higher than previously estimated on findings from the National Health Interview Survey (Visser, Bitsko, Danielson, & Perou, 2012). It was not uncommon for children attending school in the 1990s to know peers who carried a diagnosis of ADHD and perhaps saw them leave the classroom in the mornings and afternoons to receive their medication from school nurses. This environment led to a generation of children who not only knew what ADHD was, but also bred knowledge regarding the medication used to treat ADHD. Children saw their ADHD peers who were generally hyper and distractible, take their medication and gain focus, and in some cases, improve academically. These knowledgeable children grew into teens and college students, entering a period of development wrought with sensation seeking, newfound independence and experimentation with alcohol and other substances (Kay & Darke, 2012; Arria, Caldeira, Vincent, O'Grady & Wish, 2008; Park, Mulye, Adams, Brindis, & Irwin Jr; 2006).

History of ADHD

Though not formally diagnosed or named ADHD, attentional problems have been recognized as early as 1775 by Melchior Adam Weikard and 1798 by Sir Alexander Crichton, a Scottish physician who penned a work entitled "An inquiry into the nature and origin of mental derangement: comprehending a concise system of the physiology and pathology of the humans mind and a history of the passions and their effects" in which he described attentional problems in his second chapter (Lange, Reichl, Lange, 2010). He describes symptoms including inattention, impulsivity, onset at birth with the symptoms diminishing over time, consistent with current research finding approximately 50% of individuals diagnosed with ADHD in childhood have a remittance of symptoms in adulthood (Okie 2006; Arolt, 2008). Though there continued to be no formal diagnosis, evidence of ADHD surfaced in children's literature as in "Fidgety

Phil" in 1845 and "Johnny Look in-the-air" in 1847, written by German physician Heinrich Hoffman (Lange, Reichl, Lange, 2010). Similar to Crichton's work, these stories described children with inattention and impulsivity symptoms that are recognized in the DSM-V as criteria for ADHD. It wasn't until 1902 that Sir George Frederic Still began lecturing "On Some Abnormal Psychical Conditions in Children" where he specifically cited children with a "defect of moral control but without a general impairment of intellect" (Still, 1902). His symptom list included passionateness, spitefulness – cruelty, jealousy, lawlessness, dishonesty, wanton mischievousness – destructiveness, shamelessness – immodesty, sexual immorality and visciousness and he cited 20 different child cases (Still, 1902). Though his criteria may be better accounted for by other disorders (i.e. Oppositional Defiant Disorder, Conduct Disorder) he did recognize the importance of this attentional symptom cluster.

In an article entitled "On a hyperkinetic disease of infancy" written in 1932, German physicians Franz Kramer and Hans Pollnow described a disorder akin to modern ADHD in which children exhibited increased motor activity and experienced great difficulty sitting still, though their movements were not goal-oriented and appeared aimless (Neumarker, 2005). They also detailed extreme distractibility and also connected these symptoms resulting in difficulty learning and the potential for decreased intelligence as a consequence. Teasing apart attentional and hyperactive symptoms from the "minimal brain dysfunction" category took the better part of the 20th century with the diagnosis of "Hyperkinetic reaction of childhood" added to the DSM-II in 1968. The description stated "the disorder is characterized by overactivity, restlessness, distractibility, and short attention span, especially in young children; the behavior usually diminishes by adolescence" (APA, 1968).

The evolution of the disorder continued with attentional deficits added as a necessary component renaming it Attention Deficit Disorder, with or without hyperactivity in the DSM-III (Barklay, 2006). This distinction illustrated the belief that hyperactivity was not critical to the diagnosis and that there were in fact different types with three main symptom clusters: impulsivity, hyperactivity and inattention. Following the release of the DSM-III, fallout came when it was realized that ADD was backed by little to no empirical evidence, thus for the DSM-III-R, the disorder was again altered to reflect the research that had been conducted. The new disorder was renamed Attention deficit – Hyperactivity Disorder with one symptom list as opposed to different symptom clusters. There was also an "undifferentiated ADD" diagnosis reflecting those who didn't exhibit primary hyperactivity. Research continued to provide further empirical foundations for the disorder and in DSM-IV, the diagnosis was again revised to reflect what practitioners were seeing in clinical work. Three subtypes of ADHD emerged: predominantly inattentive type, predominantly hyperactive-impulsive type, and combined type with symptoms of both dimensions (APA, 1994). This new categorization returned to the earlier diagnosis that differentiated clearly between inattentive and hyperactive types of ADHD and remained unchanged in DSM-V (APA, 2013). Additionally, research proved that the disorder is chronic and persistent for approximately 50% of individuals diagnosed in childhood. New neuroimaging techniques also found the disorder to have heritable factors in addition to structural abnormalities in the prefrontal cortex of the brain. Thus, it is likely that the rapid escalation of NMUPS was born out of the recognition and acceptability of ADHD in American culture with diagnoses increasing from 7% to 9% between 1998-2000 through 2007-2009 in children in the US (Akinbami, Liu, Pastor, Reuben, 2011) along with social learning theory

communicating the acceptability of NMUPS on college campuses across the US and both the positive expectancies and outcomes of NMUPS.

History of Prescription Stimulant Medication and ADHD

Medication to help manage ADHD symptomatology was born out of the work of Charles Bradley. In 1937 his work examining structural brain abnormalities in children at Emma Pendleton Bradley Home in East Providence, Rhode Island often caused severe headaches for which he prescribed Benzedrine sulfate, a stimulant medication. Bradley noted that behavior tended to improve with decreased emotionality, increased interest and focus. Subsequently, he conducted a drug trial with 30 children and was able to eventually identify children with "short attention spans, dyscalculia, mood lability, hyperactivity, impulsiveness and poor memory" as good candidates for the use of stimulant medications (Conners, 2000).

Interestingly, Bradley's findings on Benzedrine did not influence much in the field of medicine until Leandro Panizzon created methylphenidate in 1944. The drug underwent changes and was not ready for research using human subjects until 1954. The drug, named Ritalin by the Ciba Pharmaceutical Company, began being marketed in 1957 to treat chronic "fatigue, lethargy, depressive states, disturbed senile behavior, psychosis associated with depression and narcolepsy" (Leonard, McCarten, White, & King, 2004, p. 151). In the 1960s, the drug was prescribed to reverse symptoms related to barbiturate overdose and was then marketed as Ritonic, a mood enhancement medication containing methylphenidate, hormones and vitamins. The therapeutic use of Ritalin was researched in the 1950s and with prescriptions for hyperkinetic syndrome (the precursor to ADHD) steadily increasing from the 1970s through the 1980s. The percentage of elementary aged children prescribed stimulant medication was 1.07 in 1971. This percentage continued to rise hitting 5.96% in 1987. Similar trends were seen in 70s

and 80s in middle school (0.59% in 1975 increasing to 2.98% in 1993) and high school students (0.22% in 1983 and 0.70% in 1993; Jensen, 1999). Prescription stimulant medication rates continued to rise in adolescents with an annual growth of 6.5% from 1996-2008 (Zuvekas & Vitiello, 2012). It is estimated that approximately 3.5% of children in the US were prescribed stimulant medication in 2008 (Zuvekas & Vitiello, 2012). The largest spike in sales occurred in the 1990s with a 500% increase in sales. Similarly, Adderall, a competing drug created in the mid 1960s, saw an explosion in production. Between 1993 and 2000 Adderall and Dexedrine (the generic name for the product) production increased over 4,500%. Though several variations of these drugs have been made, Ritalin (Methylphenidate; Concerta) and Adderall (Dexedrine) continue to remain the two leading stimulant medications prescribed to treat ADHD symptoms and have consequently become the two most abused stimulant medications by college and high school students (NIMH, 2012; NIH, 2012). With parent-reported cases of ADHD estimated to be over 5 million in 2011 as reported by the National Survey on Children's Health (Bloom, Cohen, & Freeman, 2012) and the use of prescription stimulant medication as a first-line defense to manage the symptomatology with approximately 70% of children prescribed stimulant medication responding positively (Van der Oord, Prins, Oosterlaan, Emmelkamp, 2008; CDC, 2013); thus stimulant medication is available on college campuses more than ever before, creating an increased risk for misuse and abuse in a medication whose mechanism of action is not fully understood.

Effects of Stimulants

In ADHD individuals, stimulant medications act on the central nervous system with effects in the prefrontal cortex. It is not entirely understood how stimulant medication specifically reduces impulsivity and hyperactivity and increases attentional capacities. We do

know that methylphenidate (MPH) works to increase norepinephrine and dopamine in the presynapstic neuron by binding to transporter proteins and ultimately inhibiting or blocking reuptake of norepinepherine and dopamine, consequently increasing their volume in extraneuronal space (Wilens, 2006; Ritalin LA prescribing information). Similarly, the mechanism of action for Adderall (Dexedrine: DEX) is also not fully understood. The course is similar though the drug is potentially responsible for inhibiting reuptake of catecholamines as well.

The use of stimulant medication in the reduction of symptoms associated with ADHD has been repeatedly documented. These improvements occur across both Methylphenidate and Dexedrine with no significant differences in outcomes reported between the two (Brown, Amler, Freeman, Perrin, Stein, Feldman, Pierce & Wolraich, 2005). Benefits are limited to classroom behavior and academic performance, which is different than academic skills and applications (Loe and Feldman, 2007; Evans, Pelham, Smith, Bukstein, Gnagy, 2001). Specifically, children prescribed stimulant medication for ADHD have demonstrated positive changes on note-taking, quiz performance, written language and homework. Further, it is hypothesized that these short-term improvements on daily tasks could translate into marked long-term gains in academic achievement and daily functioning (Evans et al., 2001). Research has also documented significant increases in time spent on-task as opposed to distracted or being inattentive, as well as subjective reports of decreased confusion and increased alertness and concentration (Carlson, Pelham, Milich & Dixon, 1992; Kollins, English, Robinson, Hallyburton, Chrisman, 2009). Not surprisingly, stimulant medication paired with behavioral intervention strategies employed both at home and in the classroom lead to the best outcomes for ADHD individuals (Brown et al., 2005).

Despite the benefits of stimulant medications for those with ADHD, there are several serious side effects that are included on all medication labels. According to the drug manufacturer's website, contraindications for Ritalin and other stimulant medications includes "marked anxiety, tension, and agitation are contraindications to Ritalin, since the drug may aggravate these symptoms. Ritalin is contraindicated also in patients known to be hypersensitive to the drug, in patients with glaucoma, and in patients with motor tics or with a family history or diagnosis of Tourette's syndrome. Ritalin is contraindicated during treatment with monoamine oxidase inhibitors, and also within a minimum of 14 days following discontinuation of a monoamine oxidase inhibitor (hypertensive crisis may result)" (Novartis Pharmaceuticals Corporation, 2013). Frequent side effects endorsed in children and adults prescribed ADHD include loss of appetite, abdominal pain, weight loss, insomnia and tachycardia, dry mouth, headache, nervousness, mood swings, trouble sleeping and dizziness. More serious adverse reactions to the medication include seizures, changes in eyesight, blurred vision, motion and verbal tics, slowed growth in children, sudden death in patients with heart problems, stroke, increased blood pressure and heart rate. Additionally, users are directed to contact a doctor immediately if there are any "new or worse behavior and thought problems, new or worse bipolar illness, new or worse aggressive behavior or hostility," and specifically in "children and teenagers: new psychotic symptoms (such as hearing voices, believing things that are not true, are suspicious) or new manic symptoms (Shire US Inc, 2013).

Few studies have employed healthy, non-ADHD individuals to measure potential changes in behavior and cognitive enhancement as a result of MPH or DEX administration. In a study conducted by Kollins et al., (2009) findings suggested that reinforcing effects of MPH that would lead a person to want to continue use were significantly higher for individuals actually

diagnosed with ADHD as compared to healthy controls. This study along with past research illustrates that ADHD individuals consistently prefer MPH to placebo whereas there is no significant difference for individuals without ADHD. In another study utilizing healthy controls, Volkow and her team furthered findings suggesting the effect of Methylphenidate on dopamine is state-dependent (Volkow et al., 2004). The increased attention individuals report when nonmedically using prescription stimulants is accounted for by the fact that even small increases in dopamine may potentially explain the increase in the saliency of subject matter and the motivation to perform well on academic tasks in both healthy controls and ADHD individuals (Volkow et al., 2004).

Though stimulant medication is a Schedule II medication and prescriptions carry warning labels regarding misuse and the potential for dependency, little research exists on the abuse potential in healthy adults who use the medication sporadically. Utilizing tomography technology, preliminary findings suggest individuals with low D_2 receptors may be at a greater risk for abuse of psychostimulants as they have increased responding compared to individuals with average D_2 receptor levels (Volkow et al., 1999). Interestingly, several studies have illustrated the lack of reinforcing effects of MPH in non-ADHD adults who NMUPS, translating to minimal likelihood for abuse, which is contrary to the FDA and DEA reports. It seems as though in laboratory conditions, MPH does not act as a reinforcer as it does when specific environmental factors are manipulated as in the case of sleep deprivation. Part of the reinforcement may stem directly from expectancies and NMUPS history (Kollins, 2009).

Placebos and Expectancies

Prior research on various drugs and alcohol have repeatedly demonstrated the power expectancies can have on psychological and physical outcomes based solely on a person's

expectation to receive the drug or when administered a placebo. This research stemmed from the expectancy theory, which posits that a person will choose one action or course of behavior based on the expected outcomes from that action or behavior (Vroom, 1964). Vroom's research has been widely applied to several fields including job effectivity (Hackman & Porter, 1968), eating disorders and dieting behavior (Hohlstein, Smith, & Atlas, 1998), medical compliance (Burgoon, Birk & Hall, 2006) and countless other human behavior studies. Thus, expectancy theory suggests a mediational effect of expectations on the actual effects of a placebo (Stewart-Williams & Podd, 2004). Further, it is necessary to differentiate between positive and negative expectancies; whereas positive expectancies tend to increase the likelihood of drug use, negative expectancies tend to decrease the potential for use (Zambonanga et al., 2009). For college students, it is likely that many hold expectations regarding NMUPS once on a campus considering upwards of 71.4% report knowing a peer with an NMUPS history (Carroll, McLaughlin, Blake, 2006). It is likely that these students develop their set of expectancies in relation to NMUPS through observational learning where they see, hear about and talk to students who NMUPS for various reasons (Peralta & Steele, 2010). Research shows that students perceive NMUPS as a study aid to be the most acceptable motivation for use, though they generally maintain a neutral or positive view regarding NMUPS across motivations including as a weight loss aid or recreationally to get high (Lookatch, Moore & Katz, 2013). Either direct or vicarious experience with NMUPS has contributed to the belief, among college students, that stimulants make them "smarter" and able to remember larger amounts of information than they could had they not nonmedically used prescription stimulant medications (DeSantis et al., 2008; Partnership Editorial Staff, 2010).

In stimulant research specifically, several factors can vary the expectations a person has for the outcome of consuming stimulant medication. Actual use of a substance will lead to strengthening of the prior expectation, with subsequent uses leading to further reinforcement of positive expectations (Goldman, Del Bocca & Darkes, 1999; Stacy, Leigh & Weingardt, 1994; Williams, 2010). Additionally, changes in regional brain metabolism in placebo conditions when participants have been led to believe they will receive a stimulant medication have been documented (Volkow et al., 2006). The route of administration may also be an important factor in that individuals expecting to consume the drug intranasally report feeling high and stimulated at significantly higher levels as compared to those administered the drug orally (Looby & Earleywine, 2011; Lile, Babalonis, Emurian, Martin, Wermeling & Kelly, 2010). Interestingly, Volkow et al. (2003) found that when a person with a history of cocaine abuse is administered MPH and knows that is indeed the drug that is being administered, they report high subjective experiences of being high as compared to cocaine users administered MPH who are not told what the drug is prior to administration. This suggests that a person's expectancies of the effects of stimulant medication may be more salient than the actual drug itself.

Nonmedical use of prescription stimulants has become an increasingly growing problem on college campuses across the US with rates as high as 34% (DeSantis et al., 2008). Prior large scale survey research has highlighted specific demographic characteristics and personality factors as being associated with NMUPS, including participation in Greek life, attending college in the Northeast, being male and possessing impulsive personality traits (McCabe, Knight, Teter, & Wechsler, 2005; Garnier-Dykstra, Caldeira, Vincent, O'Grady, & Arria, 2012; McCabe & Teter, 2012; Teter, Falone, Cranford, Boyd & McCabe, 2010; Lookatch et al., 2012). These traits appear stable across research. Other factors associated with NMUPS include lower GPAs and

use of other substances such as marijuana and alcohol (Egan, Reboussin, Blocker, Wolfson, & Sutfin, 2012; Advokat, Guidry, & Martin, 2008). Moreover, students who hold positive expectancies and evaluations of NMUPS are more likely to report use than those who hold negative expectancies. This brings to light the question of whether it is truly stimulants that have a desired effect academically or if it is a student's expectancies that are key to the belief that stimulants improve academic performance. While past research has been helpful understanding qualitative information about NMUPS, there have been limited experimental research designs assessing the extent to which placebo stimulants impact cognitive functioning. In the only known study to examine this paradigm, Looby and Earlywine (2011) tested at-risk college students with no history of NMUPS on neuropsychological tasks including the Conner's Continuous Performance Test II, the California Verbal Learning Test - Second Edition, Digit Span and Digit Symbol Substitution Test and the Rivermead Behavioral Memory Test II, both with and without a placebo stimulant to see the impact the placebo stimulant had on performance. Other measures including the State-Trait Anxiety Inventory, Structured Clinical Interview for DSM Disorders were administered in addition to specific questions regarding number of hours slept the previous night. Participants needed to meet two or more of the following criteria to be defined as "at risk" and appropriate for the study: Greek involvement, a GPA of 3.5 or lower, at least one episode of binge drinking in the past 2 weeks, and/or cannabis use in the past month. Testing was completed over two laboratory visits and all participants were asked to abstain from caffeine and alcohol for at least eight hours prior to the session. Placebo MPH administration was counterbalanced between the first and second sessions with a believability mean score of 5.14 (on a scale from 0-9) that MPH was actually consumed for the experimental condition. The study revealed that the placebo significantly affected subjective

mood ratings and drug effects with increases in both pre and posttest ratings when comparing the experimental group to the control group. Cognitive functioning did not significantly differ across trials or groups. Experimental participants did not expect to perform better on either visit but all experimental and control participants did report subjectively thinking they performed better on the second administration. While this study is valuable and the first of its kind to measure differences both physiologically and on performance-based tasks, it did not include students who had prior experience with NMUPS or a variety of stimulant medications (i.e. only offered generic Ritalin). It is necessary to study the experiences of both students who have and have not abused stimulants to assess any differences in these two groups. Expectancies of both the positive and negative effects of NMUPS were not collected a priori which may help better understand the role expectancies have on the subjective and performance effects of the placebo. Further, expectancies strengthen with each use of a drug, thus studying both groups will enable us to measure the degree to which prior NMUPS may actually increase the physiological symptoms one experiences when consuming a stimulant placebo. Thus, the purpose of this study is to use placebo pills to determine the impact expectancies have on neuropsychological task performance (short-term memory, attention, comprehension and overall executive functioning). Thus, the overall objective of the present study was to assess the role expectancies played in the effects of nonmedical use of prescription stimulants for educational purposes. The specific aims of the present proposal were:

1. To test the hypothesis that, relative to controls, administration of a stimulant placebo would enhance performance on reading comprehension, short-term and working memory, and overall executive functioning in addition to subjective physiological symptoms.

2. To test the hypothesis that, relative to negative expectancies, positive expectancies of NMUPS would enhance task performance when given a placebo believed to be a stimulant.

CHAPTER 2

Methods

PHASE 1: Participants

Study participants were 305 college-aged students between 18 and 24 years of age enrolled in an Introductory Psychology course and registered in Sona, a protected, online research pool at the University of Tennessee. The number of participants was higher than needed for sufficient power in Phase II of the experiment as not all participants in Phase I met criteria for Phase II. In exchange for participation, students received one credit for completion of the online screener toward their Introductory Psychology requirements. Exclusionary criteria for participation included age (i.e., participants outside the age range of 18 to 24 were excluded), a current or past ADHD diagnosis or current prescription of stimulant medication for any reason. Though this represents a convenience sample, undergraduate college students report the highest rate of nonmedical prescription stimulant use and are the target population for the present research.

Measures

Demographic Questionnaire. A demographic questionnaire (Appendix A) was utilized to gain important information pertaining to personal characteristics of participants including participant age, sex, year in school, race/ethnicity, sexual orientation, income, education, religion, relationship status, height, weight, major, participation in Greek life, and prior drug use in the past 30 days.

Adult ADHD Self-Report Scale Symptom Checklist. This questionnaire was created by the World Health Organization and the Workgroup on Adult ADHD and consists of the symptoms designated by the DSM-IV-TR for Attention Deficit/Hyperactivity Disorder (Appendix B). For

each symptom, participants select one response (Never, Rarely, Sometimes, Often, Very Often) that best represents their behavior over the past six months. The measure is scored on a zero to four-point scale with scores of less than 16 representing individuals unlikely to have ADHD, scores between 17 and 23 likely to have ADHD and scores of 24 or greater highly likely to have ADHD. Though this measure was used as a self-report tool, it maintains high internal consistency for both self- and rater administration (Cronbach's alpha .88 and .89, respectively; Adler, Spencer, Faraone, Kessler, Howes, Biederman, Secnik, 2006).

Stimulant History Questionnaire. The principal investigator collaborated with another student to create this measure to fully comprehend college student's experiences with nonmedical use of prescription stimulants. It asks not only about their personal use history (or lack thereof), but also asks about knowledge of NMUPS, peer use, which medications specifically were used, motivation for use and likelihood of future use (Appendix C). Psychometric information is not yet available on this instrument.

Stimulant Expectancy Questionnaire. This qualitative questionnaire was developed by Lookatch, Dunne and Katz (2012) and mirrored after the work of Stacy and colleagues (1990) on the predictive validity of a person's alcohol expectancies when asked to self-generate the top three negative and positive consequences related to use (Appendix D). Similar to Stacy et al.'s procedure, this questionnaire asks participants to list the first three positive and negative consequences for NMUPS that came to mind and then to rate the likelihood of that consequence occurring on a seven-point Likert scale (expectancy rating) and finally, how good or bad that consequence would be if it did occur, also on a seven-point Likert scale (evaluation rating). An average expectancy and average evaluation score was created for each person based on the Likert scale ratings provided.

Medical Exclusionary Checklist. This inventory asks about various medical conditions, medication history and side effects experienced as a result of taking unprescribed stimulant medications (Appendix E). Additionally, there are several questions related to allergies to ingredients in stimulant medications and in the placebo pills to be administered in the experimental condition of the experiment.

Procedures

IRB approval was obtained from the University of Tennessee prior to beginning the study. Phase I was completed online and consisted of several screening measures to ensure participants were appropriate for Phase II of the experiment. Participants were made aware of the study via the Sona website explained in their Introductory Psychology course. The description of the experiment, which students read prior to enrolling, read as follows:

> If participants consent, the study will take approximately 60 minutes and students will earn 1 SONA credit that can be used toward the Introduction to Psychology research requirement. To complete the survey students will need to select a computer in a private location with reliable internet access. Interested participants will read this informed consent and then, if s/he agrees to participate, s/he will complete an online survey. Participants will answer the questions by selecting his/her choice of answers using a computer mouse. Participation in this study may qualify students for an in-person laboratory study that will take approximately 2 hours and students can earn 2 credits. REQUIREMENTS: Students must be between the ages of 18 and 24 and must NOT have a prior or current diagnosis of ADHD, or currently prescribed any stimulant medication.

Following enrollment, participants were redirected to an external website (www.*surveymonkey*.com) where they completed the study. Before being presented with the

survey, participants were able to read a consent form (Appendix F), which again informed them of any potential risks and/or benefits, as well as the confidential manner in which their data was protected. They were also informed that their participation was completely voluntary in nature and that they would not face any negative consequences, should they elect not to participate. Consent was obtained via a button at the bottom of the online consent page that allowed participants to click "Yes" or "No." If they selected "No," they were sent to a screen thanking them for their time and were allowed to exit the browser. A choice of "Yes" sent the participant to the first survey page of the study. Participants who selected "Yes" were also informed that they could exit the survey at any time. Individuals who consented to participate completed online questionnaires (Appendix B), including the following:

A) a demographic questionnaire,

B) Adult ADHD Self-Report Scale Symptom Checklist,

C) Stimulant History Questionnaire,

D) Stimulant Expectancy Questionnaire,

E) Medical Exclusionary Questionnaire.

Following completion of the online questionnaires, the principal investigator reviewed responses on the medical questionnaire, ADHD symptom questionnaire and questions regarding past diagnoses of ADHD to see if participants were eligible for Phase II. Participants determined to be ineligible based on current medication regimens indicated as risks if taken with a stimulant medication (MAOIs, cold medication, etc) or medical conditions that precluded him/her from taking stimulant medications (heart condition or other serious medical diagnoses), serious side effects experienced (hallucinations, paranoia) as a result of past NMUPS, current or past diagnoses of ADHD and stimulant medication prescriptions were informed via email that further

participation was contraindicated. Participants who met criteria for Phase II were emailed a brief description of Phase II and provided a code to enter and subsequently enroll in a Phase II timeslot on Sona. For participants who enrolled in Phase II, and thus provided identifying information to match Phase I responses with Phase II data, were assigned a numeric code for the purpose of maintaining confidentiality on the measures they completed in Phase I by the principal investigator.

PHASE 2: Participants

Of the 305 Phase I participants, 265 were invited to participate in Phase II of the study and approximately 166 of these students completed Phase II participation. In exchange for participation, students received two credits for completion of the in-person portion of the project toward their Introductory Psychology requirements. Exclusionary criteria for participation included age (i.e., participants outside the age range of 18 to 24 will be removed), a current or past ADHD diagnosis or current prescription of stimulant medication for any reason, medical conditions and current medications queried in Phase I that were generally not prescribed simultaneous to stimulant medications. Though this represents a convenience sample, undergraduate college students report the highest rate of nonmedical prescription stimulant use and were the target population for the present research.

Measures

Daily Sleep & Consumption Questionnaire. A short questionnaire was created specifically for this study and targeted participant's caffeine, alcohol, and cigarette use the day of the experiment (Appendix G). Participants were informed via email prior to attending Phase II not to use any of the substances the day of the experiment. Nicotine use was queried, but use of

cigarettes was not prohibited. Questions regarding sleep were also asked to control for alertness and fatigue.

d2 Test of Attention. This an attentional task based on visual cancellation in which the participant scanned a list of targets marking the desired targets. The test used the items processed and errors made to assess processing speed, rule compliance and overall concentration performance. The test is widely used in Europe proving to have excellent internal reliability along with construct validity and has been validated in the US as well, whose validation study found the total performance score to have an alpha of .97 (Bates & Lemay, 2004) with high internal consistency across samples (R > .90; Brickenkamp & Zillmer, 2010). These record forms do not exist electronically, thus, were not included in the appendices.

Paced Auditory Serial Attention Task. The PASAT was administered to assess participant's ability to process information and the rate at which processing occurs while also assessing sustained and divided attention (Gronwall, 1977). Participants listened to numbers from a recording and continuously added the last two numbers heard. The task occured twice, the first time with a number spoken at the rate of 3 seconds and then a second time with numbers spoken at a rate of 2 seconds. The test has been validated with age and IQ found to be significant factors in PASAT performance (Wiens, Fuller & Crossen, 1996). This was not a limiting factor as participants were aged between 18 and 24 and college students. The measure has used both in research and in clinical populations with test re-test coefficients between .90 and .97 for both short and long-term intervals with a Cronbach alpha of .90 over the course of four testing trials (Tombaugh, 1999; Tombaugh, 2006). These record forms do not exist electronically, thus, are not included in the appendices.

Passage Comprehension. To assess comprehension of written words and drawing inferences from material silently read, the Passage Comprehension section from the Woodcock Johnson III – Test of Achievement, Form A was administered. This test has a reliability of .88 in adults (Mather and Woodcock, 2001). The test was administered in full over two trials with items separated by difficulty. Cloze types of reading comprehension tasks have been found to serve as accurate measures of college student's reading abilities (Williams, Ari, Santamaria, 2011). Additionally, when comparing silent reading tasks to oral, there is no negative impact on efficiency or reading comprehension (McCallum, Sharp, Bell & George, 2004). These record forms do not exist electronically, thus, are not included in the appendices.

Digit Span. The Digit Span subtests from the WAIS-IV and WISC-IV were administered to measure short-term memory. Participants listened to and repeated back numbers read aloud to them serially or in reverse. The entire subtest was administered with no discontinue criteria applied for standardization purposes. Both versions of Digit Span have sound internal consistency ranging between .86 and .92 depending on the age of the participant. These record forms do not exist electronically, thus, were not included in the appendices.

Goldberg's Big 5 Inventory. This 50-item measure assesses five personality markers including conscientiousness, openness, extraversion, neuroticism and agreeableness (Appendix H). It employs a five-point Likert scale format for answering statements about one's personality. The inventory has good internal consistency and produces similar results to other personality measures (Gow, Whiteman, Pattie & Deary, 2005).

Physiological Symptom Checklist. This is a dichotomous, 23-item checklist consisting of negative side effects commonly reported as stated by the pharmaceutical companies producing stimulant medications for individuals using stimulant medication as prescribed to assess any

changes in physiological states throughout the duration of the experiment (Appendix I). This was created for this study to monitor physiological symptoms throughout Phase II.

Subjective Performance Rating Scale. Following the first administration of all measures, participants answered a few questions pertaining to their thoughts on their performance on the four measures. Questions used a 7-point Likert scale with one being "could not have done worse" and seven being "could not have done better." Participants stated which task was the easiest and which task was the most difficult (Appendix J). After the second administration of the four measures, participants completed the same questionnaire with an added question addressing on which administration they believed they performed better.

Positive Symptom Rating Scale. This five-item, five-point Likert scale was developed for this project to assess the positive symptoms that are most commonly associated with NMUPS. It was administered to all participants, regardless of condition at 0, 15 and 30-minute time points between the first and second administration of measures (Appendix K).

Manipulation Check. A nine-item manipulation check to ensure the internal validity of the experiment was administered to all of those randomly assigned to the experimental condition. The measure asked the drug consumed and seven questions concerning the effects of the medication on various outcomes using a five-point Likert scale. Individuals in the control condition did not complete the manipulation check because they were not administered the pill and were immediately debriefed following the experiment (Appendix L).

Materials

ReliOn Automatic Blood Pressure Monitor. This device was used to automatically measure blood pressure and heart rate of participants at various points throughout Phase II of the experiment. It is a contraption that slides onto the wrist and lightly squeezes the wrist for

approximately 15 seconds and produces an electronic reading on the attached screen. The device is battery powered and clinically validated.

Placebo pills. The placebo pills were purchased empty and filled with cornstarch by the principal investigator while wearing latex free gloves. Capsules were hide gelatin and bovine spongiform encephalopathy free. Pills were stored in a locked cabinet in the laboratory in a locked safe and administered in labeled pill cases.

Procedures

Participants who completed Phase I of the study were eligible for Phase II of the study if they met all of the following conditions: 1) They denied an allergy to all of the listed ingredients and all of the medical conditions listed in Phase I, 2) they had not had any adverse reactions to stimulant medication if they have a history of use either prescribed or unprescribed, 3) denied a diagnosis of ADHD (or symptoms consistent with a diagnosis of ADHD) and 4) were within the 18-24 age range. When participants arrived at the laboratory (Austin Peay - Room 209) for Phase II of the study, they completed an informed consent form (Appendix M). Following consent, blood pressure and heart rate were measured using a wrist monitor (ReliOn Automatic Blood Pressure Monitor) along with completion of a physiological symptom checklist. Next, all participants were administered four neuropsychological tests:

a) The d2 Test of Attention,

b) Passage Comprehension subtest on the Woodcock Johnson – III,

c) Digit Span subtest from the Wechsler Adult Intelligence Scale - IV and

d) The Paced Auditory Serial Attention Task.

The order of administration was counterbalanced in a few different orders to minimize fatigue effects on task performance. Clients were then randomly assigned to either the control or

experimental condition. Participants were randomized using a website (randomizer.org) to randomize individuals to the control or experimental condition so that the ending sample had approximately equal cell sizes. Those receiving the placebo stimulant were told they were going to take a prescription stimulant medication (actual pill is cornstarch) to measure the effects it had on task performance. The ingredients of the capsule and cornstarch were embedded in the allergy questionnaire on the screening measures to minimize risk of an allergic reaction. Participants were asked if they had previously used stimulants nonmedically and were given the option to take one of three common, fast-acting brands (Ritalin, Adderall, Focalin). All participants in the experimental condition were given 30 milligrams; however, if an individual was positive for NMUPS history and had a specific reason for which s/he is uncomfortable consuming 30 milligrams, they could choose to take a lesser dosage of 10 or 20 milligrams. Immediately after taking the pill, participants completed the Positive Symptom Rating Scale and again completed it at 15 minutes post-pill, and 30 minutes. This measure was administered three times to enhance the external validity of the study by monitoring the effects generally garnered from nonmedical stimulant use in the time frame it is expected to take effect. During this time, participants also completed the Big 5 Inventory (Appendix H), Daily Sleep and Consumption Questionnaire (Appendix G), Subjective Performance Rating Scale (Appendix J), the Physiological Symptom Checklist (Appendix I) and had their blood pressure and heart rate measured again. Though it did not occur, if a participant's heart rate was above 160, which is considered to be in the higher ranges of acceptable heart rate when performing intense exercise workouts, the study would have been discontinued (National Heart Lung and Blood Institute). Following this 30-minute period to allow the stimulant to presumably take effect, participants completed the same four neuropsychological tasks (utilizing a Form B format) assessing the same four constructs as

above. Research assistants collected much of the in-person data. They were trained by the PI and utilized a script (Appendix O) to follow standardized protocol.

This task involved deception in that no participants received stimulant medication despite being informed that they consumed an active medication. This deception was necessary in assessing the role stimulant expectancies played in improved task performance in college students. Finally, participants completed a manipulation check (Appendix L) and were thoroughly debriefed about the study and use of deception (Appendix N). Due to the provocative nature of this experiment, the researchers were aware of the necessity of informing participants that they indeed were not given any stimulant medication and ensured they were not experiencing any negative physiological symptoms. If they did experience any symptoms, they were to be referred to student health services and escorted directly there if necessary or preferred (this did not occur). Participants were thanked for their participation and compensated with course credit via Sona for their psychology course.

CHAPTER 3

Data Analytic Plan

To test the first hypothesis that, relative to controls, administration of a stimulant placebo would enhance performance on reading comprehension, short-term and working memory, and overall executive functioning in addition to subjective physiological symptoms, a repeated-measures MANCOVA was conducted. Group assignment (Experimental vs. Control) served as the independent variable and Passage Comprehension, d2 Test of Attention, PASAT, Digit Span and Positive Symptom Rating Checklist scores were the dependent variables. Further, positive symptom changes (i.e. physiological symptoms) were assessed at each time point and a change score was created taking the third time point score and subtracting the first to assess overall change for each participant. Physical symptoms were tallied as these questions were dichotomous and similarly, a change score was calculated subtracting the first total from the third total. A MANcOVA was subsequently conducted to assess these between and within groups.

The second hypothesis stated that, relative to negative expectancies, positive expectancies of NMUPS would enhance task performance when given a placebo believed to be a stimulant. Because responses on the expectancy measure are qualitative, a multivariate analysis of variance was employed to examine the predictive value positive and negative expectancies have on differences in performance from the first and second task administrations. Several exploratory analyses were also conducted to examine empirical questions related to the primary aims.

CHAPTER 4

Results

Descriptive Statistics

Three-hundred five participants completed Phase I of the study. Of these, approximately 13% (n = 40) were excluded from further participation due to endorsement of one or more of the following: serious side effects from past NMUPS (i.e., hallucinations, paranoia, delusions, personality changes; n = 12), having a medical condition that would preclude prescriptions of stimulant medications (n = 7), significant anxiety or a history of serious drug abuse (n = 19), being prescribed a medication contraindicated with stimulant medications (n = 7) and/or allergies to stimulant medications or the substances used for the placebo pill (n = 7). Though 265 participants were invited to enroll in Phase II of the study, only 166 of these students accepted the invitation and completed Phase II. Because such a large proportion of invited participants did not enroll in Phase II, differences between those who completed the study and those who declined were examined. This analysis revealed a significant difference for self-reported NMUPS history $F(1, 259) = 5.00$, $p = .026$ and a trend for Greek life involvement $F(1, 261) = 3.15$, $p = .077$, such that those who chose not to complete Phase II were more likely to have previously used stimulants nonmedically ($M = 1.92$, $SD = .28$) and be involved in Greek life ($M = 1.87$, $SD = .34$) compared to those who did complete Phase II ($M = 1.82$, $SD = .39$; $M = 1.78$, $SD = .42$, respectively). Other factors that did not differ between the groups included GPA, sex, race, family income level and academic year.

Because the analyses only included the subset of participants who completed both Phases of the study, all findings below are based on the final sample of 166 participants. The sample was roughly evenly split between males and females (48.8% male) and mostly Caucasian

(73.5%), in their freshmen year of college (71.1%), and had a mean age of 18.78 (*SD* = 1.14) years (See Appendix A: Table 1). Additionally, because participation in Greek life has been shown to be a correlate of NMUPS, this demographic data was collected and showed that 22.3% reported participation in Greek life with 29.7% endorsing NMUPS; in contrast, only 14.9% of non-Greek participants reported NMUPS. The difference was significant $\chi^2(1) = 4.64$, $p = .031$; however, it was not controlled for as a covariate because the difference was consistent across the experimental and control group. The mean GPA for participants was 3.45 (*SD* = .56). Demographic variables were not found to vary by group and thus were not controlled for in the analyses. With rates of NMUPS generally reported to range from 6-34% (Teter, Falone, Cranford, Boyd & McCabe 2010; DeSantis, Webb & Noar &, 2008) in college samples, the roughly 18% of students in Phase II reporting lifetime NMUPS is consistent with past research; 19 of these individuals were randomly assigned to the experimental group (n = 86) and 11 to the control group (n = 80).

Sex was found to be a significant factor in subtest performance, with males performing better during both administrations of Passage Comprehension, the PASAT and Digit Span and was included as a covariate. The d2 Test of Attention did not differ by sex. Interestingly, sex was not associated with changes in performance across administrations, $F(1, 164) = .208$, $p = .649$. None of the other demographic factors were significant in the primary analyses and were not included as covariates.

Research has previously shown that the color of the pill administered in experimental settings can impact results (Bernard Roullet, 2005), thus two colors were offered in this experiment (Red and Blue). There were no differences found on subjective positive or physical symptom ratings between the colors administered when added as a between subjects variable.

There was a trend for the PASAT ($p = .076$), indicating that those who took red placebos performed slightly better than those who received blue; however there were not significant interactions with time or change in performance. Further, experimental participants were also provided the opportunity to select their stimulant of choice from a list of three (Focalin, Adderall, Ritalin) to enhance the likelihood that they would experience changes based on their prior knowledge about the drugs. Despite the majority of participants selecting Adderall (73.8%), analyses revealed no significant differences by the type of placebo medication administered on test performance.

Hypothesis 1

Hypothesis 1 stated that, relative to controls, the experimental group would show improved performance on reading comprehension, short-term and working memory, and overall executive functioning in addition to subjective physiological symptoms. Because men were found to perform significantly better than women across condition, sex was entered as a covariate. Examination of between and within group differences revealed no statistically significant differences across time (see Appendix A: Table 2); however, the control group appeared to perform somewhat better on the PASAT, d2 and Digit Span from Time 1 to Time 2, with a slight decrease on Passage Comprehension. Interestingly, when examining scores from Time 1 to Time 2, the experimental group performed slightly worse at Time 2 on the PASAT, Passage Comprehension and d2 Test of Attention with only slight improvements, though not significant, for Digit Span. The time by randomization interaction was not significant and controlling for sex did not influence the results.

The second part of Hypothesis 1 stated that the experimental group would experience more physiological changes than the controls. To assess this and ensure the occurrence of the

intended manipulation (that the placebo stimulant had a psychological and physical effects), measures were administered three times throughout Phase II. The Positive Symptom Checklist was administered after taking the placebo pill (and before being administered the second round of tests) to monitor changes one may expect to experience when taking a stimulant medication nonmedically. Positive symptoms commonly associated with stimulant use, including increased feelings of alertness, focus, energy, motivation and a more pleasant mood were also measured at three time points between the first and second measure administrations. The control and experimental groups significantly differed in their baseline ratings at Time 1 on Alertness (p = .004) and Focus (p = .041). The two groups significantly differed on Alertness (p < .001), Focus (p < .001) and Energy (p = .001) at Time 3 as well, with a trend for Motivation (p = .059). Significant changes from Time 1 to Time 3 for Alertness, Focus, Energy and Motivation (p < .001) were found for both within and between both groups. No significant change was found in Mood when analyzed as a within or between groups factor. Interestingly, the experimental group experienced significant increases in these positive symptoms whereas the control group reported significant declines in these four positive symptoms (See Appendix A: Table 3). Additionally, participants who reported greater changes in these positive symptoms did not actually perform any better or worse on the four primary performance measures across time. Thus, despite feeling as though they had increased alertness, focus, energy and motivation, these enhancements did not translate to improved neurocognitive functioning. The impact of positive symptom change scores were analyzed for each test. While Motivation did not change significantly across time, the change over time did impact Passage Comprehension performance (p = .031). Alertness trended toward significance for the PASAT (p = .053).

The physical symptom checklist was administered at the beginning of the experiment to assess baseline symptoms, the end of the absorption period, and following completion of the second task administration. The checklist included negative effects commonly reported when taking stimulants (i.e. increased heart rate, irritability, dizziness). Though physical symptoms are not generally endorsed and are often considered unfavorable. Change scores were calculated by subtracting the sum of symptoms endorsed at Time 1 from those endorsed at Time 3. These scores did not differ significantly for the experimental and control groups and did not differ significantly across time. Pulse was also collected at the same time points and did not differ at each specific time point. A change score was calculated from Time 1 to Time 3, which yielded no significant differences between groups.

Manipulation Check. To ensure experimental participants indeed felt the changes they endorsed during the absorption period of the experiment, a manipulation check was administered after completion of the tasks. Experimental participants rated how much the drug affected their attention, alertness, focus, energy, motivation and mood on a five-point Likert scale. These scores were matched against the five positive symptom change scores to ensure those who reported symptom change during the experiment, reported it after as well. Of the 86 experimental participants, ten participants endorsed changes during the absorption period and denied being affected in the manipulation check. Reasons cited by this group for a lack of drug effect includes "I'm not ADHD", "it didn't kick in yet", "I don't know" or having a tolerance due to prior NMUPS. Surprisingly, task performance was not significantly affected by subjective positive symptoms, such that if a person reported a great deal of change or no change, there was no difference in task performance.

Hypothesis 2

Hypothesis 2 stated, that relative to negative expectancies, positive expectancies of NMUPS would moderate task performance when given a placebo believed to be a stimulant, such that stronger positive expectancies would yield improved time 2 performance. Total positive and negative expectancy and evaluation (see Measures for definitions of each) scores were created by averaging the ratings each person provided for their respective positive and negative consequences. The most commonly reported reasons to use stimulants nonmedically included improved focus (53.6%), improved attention/concentration (52.5%), improved grades/better studying (27.7%) and to stay awake/increase alertness (27.0%). Positive expectancy ratings were found to significantly moderate change for the d2 Test of Attention, $F(1, 161) = 4.81$, $p = .030$, such that participants in the experimental condition with higher positive expectancies performed better across trials ($M = 16.73$, $SD = 36.17$) as compared to those with lower ratings ($M = 9.43$, $SD = 40.98$). Inversely, those in the control condition performed better when they reported lower positive expectancy ratings (Low: $M = 18.46$, $SD = 32.41$; High: $M = -1.09$, $SD = 42.23$). This finding should be interpreted with some caution as the multivariate test yielded a non-significant trend ($p = .064$). The other three measures were not significantly moderated by positive expectancies.

The positive evaluation rating, how "good" it would be for the positive consequences to occur, similarly yielded significance for Digit Span ($p = .032$), though interpreted with caution because it was based on a non-significant multivariate trend ($p = .072$). Experimental participants with higher positive evaluations demonstrated improved performance ($M = 1.00$, $SD = 2.66$) as compared to those with lower positive evaluations ($M = .11$, $SD = 2.89$). Again, the inverse was true for the controls where those with lower positive evaluations exhibited greater improvement

(M = 1.03, SD = 2.59) than those with higher positive evaluations (M = .13, SD = 2.46). No other tests were significantly moderated by positive evaluations.

Negative consequences initially reported included addiction/dependence (53.7%), health related consequences (43.9%), ethical/moral issues (i.e., cheating, illegality; 26.5%) and a lack of sleep (22.8%). Negative expectancies, based on likelihood scores, were found to moderate the change in performance on Passage Comprehension, $F(1, 163) = 14.32$, $p < .001$, such that experimental participants who rated the negative consequence as more likely exhibited improved performance (M = .72, SD = 1.81) as compared to those with lower negative expectancies (M = -.50, SD = 1.75). Controls performed in the opposite direction, with those who rated the consequence as more likely to happen demonstrating less improvement across Passage Comprehension (M = -.25, SD = 1.95) compared to those with lower negative expectancies (M = .84, SD = 2.11). Findings for negative evaluations yielded a trend, $F(1, 162) = 2.86$, $p = .054$, similar to the positive evaluations that should be interpreted with caution. Experimental participants who performed worse on Passage Comprehension (M = .03, SD = 2.19) had higher negative evaluation scores compared to experimental participants with lower negative evaluations (M = .34, SD = 1.55), indicating the worse the consequence, the worse the performance. As expected, individuals in the control group with higher negative expectancies earned higher scores on Passage Comprehension (M = .51, SD = 2.01) than those who rated the negative evaluations lower, or not as bad (M = -.32, SD = 2.10). There was also a trend for the moderation effect of negative evaluations on Digit Span performance, $F(1, 162) = 3.12$, $p = .054$. Again, experimental participants performed better when their respective negative evaluation ratings were lower (M = 1.02, SD = 2.77) as compared to those who evaluated the NMUPS consequences as more negative (M = .22, SD = 2.72). Interestingly, there was almost no

difference for the control group (High: M = .55, SD = 2.62; Low: M = .51, SD = 2.67). No other tests were moderated by negative expectancy or evaluation ratings.

Exploratory Analyses

Exploratory analyses were conducted to assess the impact of alcohol use, caffeine use and GPA on expectancies and change in performance. As previously discussed, GPA and other substance abuse are often associated with increased risk for NMUPS and were examined to see if they similarly played a role in the formation of expectancies students hold regarding nonmedical stimulant use. No previous research on caffeine and NMUPS exists. As many students utilize caffeinated beverages to aid in increased alertness and studying, it seemed logical that there could be a link between NMUPS expectancies and increased caffeine consumption. No findings were significant at the multivariate between subjects level, however some trends did emerge. Along with positive expectancies, self-reported alcohol use in the past 30 days moderated change in performance for Passage Comprehension $F(1, 159) = 3.74$, $p = .189$ and the PASAT $F(1, 159) = 3.08$, $p = .189$. Further examination revealed individuals with weaker positive expectancies and greater past 30-day alcohol use displayed the poorest change in performance with declines in overall performance (M = -.56, SD = 2.51) whereas control participants with higher alcohol use and lower positive expectancies demonstrated the greatest improvements in Passage Comprehension (M = .69, SD = 1.93). Broadly speaking, the experimental group performed worse across time on PASAT though not to a significant level. Individuals in the control condition with strong positive expectancies and lower alcohol use improved most across time on the PASAT (M = 4.35, SD = 10.07) whereas this same group in the experimental condition performed worse (M = -3.29, SD = 16.22).

Caffeine use contributed to a trend for the moderating effects of negative expectancies on the d2 Test of Attention, $F(1, 162) = 2.99$, $p = .086$ such that individuals with higher caffeine consumption performed better overall, and those in the control condition with weaker negative expectancies and higher caffeine consumption levels performed best ($M = 1.25$, $SD = 2.49$). Caffeine also moderated change in performance with negative evaluations again for the d2, $F(1, 162) = 5.80$, $p = .017$ and also Digit Span $F(1, 162) = 3.22$, $p = .075$. Those in the experimental group with lesser caffeine consumption and strong negative evaluations experienced the greatest change in performance ($M = 36.42$, $SD = 19.93$) and individuals with less caffeine consumption and strong negative evaluations exhibiting the least change in d2 performance ($M = -1.25$, $SD = 43.14$). Digit Span yielded similar patterns again revealing individuals with strong negative evaluations and less caffeine consumption with the greatest improvement from time 1 to time 2 ($M = 1.67$, $SD = 1.97$) and individuals with strong negative evaluations and the highest caffeine consumption declining in Digit Span performance over time ($M = -1.04$, $SD = 2.61$). These findings should be interpreted with caution given the lack of significance for the multivariate test. GPA did not significantly impact positive or negative expectancies or evaluations.

CHAPTER 5

Discussion

Nonmedical use of prescription stimulants is a considerable problem on college campuses across the US (McCabe, West, Teter & Boyd, 2014). Despite research documenting the neutral or negative impact of NMUPS on grades, positive student perception persists on the utility of stimulant medication to aid in studying and improving grades (Arria, Wilcox, Caldeira, Vincent, Garnier-Dykstra & O'Grady, 2013). The current study aimed to incorporate the positive and negative effect of expectancies and evaluations on task performance in a controlled, laboratory setting.

Hypothesis 1 assessed change in performance, positing participants who received a stimulant placebo following the initial administration of four tasks would exhibit improved task performance on the second administration and would endorse changes in physiological and positive symptoms commonly associated with stimulant medications. When examining performance alone, no significant differences were found between or within groups. The experimental group did not show change from time 1 to time 2. While an effect was expected, this finding supports the work of Looby and Earleywine (2011) where cognitive performance was not enhanced when receiving placebo methylphenidate. Surprisingly, experimental participants would be minimally expected to perform better at time point 2 due to learning, however, the opposite occurred. Experimental participants' performance declined somewhat on the d2 Test of Attention, PASAT and Passage Comprehension. This decreased performance may be the result of increased distraction resulting from a preoccupation with the stimulant that was received prior to task 2 administrations. An alternative hypothesis, which will be discussed below, is that the placebo had no significant effect. Interestingly, there was minimal

improvement on Digit Span. It may be that Digit Span was more susceptible to practice effects as it taps into short-term memory and attention, comparable to that of the PASAT and the d2.

Similarly, the control group did not yield any significant change in task performance from time 1 to time 2. Despite a lack of significance, the control group's scores did improve somewhat on the PASAT, d2 and Digit Span. This is expected as learning effects likely occurred from administration 1 to 2; however, the same cannot be said for Passage Comprehension. This is also the only task where learning may not occur as the task is fairly simplistic with participants providing a word to fill in the blank in a sentence. Furthermore, this task does not require the sustained attention and processing speed that the other three tasks require to perform well as the participant completes the task at his/her own pace and is not timed (Mather and Woodcock, 2001). Findings related to Passage Comprehension likely represent executive functioning changes unrelated to attention and concentration. It would be expected that the experimental group would also produce similar learning effects with minor improvements. A lack of improvement in the experimental condition suggests stimulant medication may not have the intended enhanced cognitive and subsequent positive academic effects that often fuel college students to use these drugs. Although no actual stimulant medication was administered, the experimental group should have, at minimum, performed similarly to the controls and this was not the case. This discrepancy warrants further exploration of the effect of placebo stimulants.

The second part of hypothesis 1 stated there would be significant physiological changes for the participants who received placebo stimulants. Experimental participants reported significant increases in alertness, focus, energy and motivation, all desired effects of taking stimulants both prescribed and unprescribed. Mood remained unaffected by the stimulant for the experimental condition. Improved mood is not as commonly reported as the other four positive

symptoms nor is it a goal of NMUPS when used as a study aid (McCabe & Cranford, 2012). Conversely, the control group saw significant declines across the same four positive symptoms with no significance in mood. Though they completed the same tasks (i.e. Sleep and Caffeine Consumption questionnaire, Subjective Performance Questionnaire, etc), many control participants appeared bored during this period, as they were not awaiting absorption and subsequent positive effects of a stimulant medication. While one may hypothesize that this diminished experience of positive symptoms could negatively impact task performance, the opposite was true as previously discussed and was not a confounding issue for this study. Experimental participants did not report significant changes in the physical symptom checklist. This does not necessarily indicate a lack of placebo stimulant effect as this checklist was comprised of negative side effects that are commonly associated with stimulant medications; thus, participants endorsed positive symptom changes but denied significant negative symptoms. One would expect a person to experience the targeted changes, defined as "positive symptoms" in the present study whereas people do not always experience the negative side effects from a medication as was the case with this placebo.

Hypothesis 2 stated relative to negative expectancies, positive expectancies of NMUPS would moderate task performance for individuals in the experimental condition who received a placebo stimulant. All participants cited reasons related to academic enhancement as positive expectancies illustrating that while recreational use does occur, the main reason college students are engaging in NMUPS is to improve grades through increased focus, attention, alertness and the ability to stay awake longer to study. The positive consequences participants cited were assessed as expectancy (likelihood) and evaluation (how good) ratings. Overall, positive expectancy scores did not impact Digit Span, Passage Comprehension or the PASAT and did

moderate performance on the d2. When examined further, differences in the strength of expectancy emerged by group with experimental participants endorsing strong positive expectancy ratings performing better. This finding can be interpreted as participants who believed a stimulant would enhance their performance and received a placebo did indeed exhibit more improvement, suggesting the placebo had an effect for these individuals on this task. As expected, control participants with lower positive expectancies demonstrated more significant improvements in task performance, as they did not expect a placebo would have much of an effect. These results provide further support for expectancy theory and prior findings that positive expectancies strengthen beliefs about use and increase the likelihood for use as compared to negative expectancies which may actually deter use (Zambonanga et al., 2009). Similar differences were found for the moderating effect of positive evaluations on Digit Span. These control group findings suggest that this group is not susceptible to the need for stimulant medications to enhance academic performance as they hold a stronger belief in their intrinsic abilities.

Negative consequences centered on risk of addiction, health complications and ethical problems with NMUPS. Negative expectancies moderated performance on Passage Comprehension for experimental participants with those rating the negative expectancy as more salient, outperforming their peers. These salient negative expectancies contribute to the diminished risk of use for these participants. It is also possible that participant performance was not altered because they didn't expect a stimulant to positively affect their performance and thus, did not rely on the substance to enhance performance. Again, the control group confirms this interpretation with the inverse finding. Negative evaluations also yielded similar findings on Passage Comprehension and Digit Span. Taken together, it appears that participants who held

stronger positive expectancies and weaker negative expectancies rely more on the stimulant than their own abilities to carry or enhance performance and often perform the same or slightly worse.

Findings were generally not consistent across measures, evaluations or expectancies. It is not clear why ratings moderate performance on some tasks and not others. Possible explanations for this may be the constructs that each task assessed. The PASAT was not moderated by either ratings despite yielding improved scores in the control group and declining scores in the experimental group. This task was extremely difficulty for many participants as it taxed simple math, working memory, processing speed and auditory processing abilities so may be more resistant to the impact of a placebo (Gronwall, 1977). The other measures assessed a variety of abilities and no obvious pattern explains why some measures are moderated by task performance for each evaluation and expectancy.

Despite nearly equal sex distribution across condition, men performed better across administration compared to women. While there are no previously documented significant gender differences in the tasks utilized in this study, research has shown men tend to be more competitive in laboratory settings (Niederle & Vesterlund, 2011). Though competition was not a targeted variable in this experiment, it could be that males perceived the need for competition as they were completing tasks at two time points indicating performance and improvement were being assessed. Further, men tend to be more confident when both approaching a task and when reflecting on their performance. These gender differences may serve to explain the sex differences found in the present study.

Limitations

The present study was not without limitations. Despite the many precautions exercised to maximize face and internal validity (i.e., locked safe to store medications, sign out sheet, scrub

uniform for research assistants, standardized procedures), the environment may not have appeared to be one in which stimulant medication could be administered (e.g., medical setting). This would subsequently lead students to experience lessened susceptibility to the placebo stimulant and could have contributed to the lack of enhanced neurocognitive performance. Additionally, the participants were all enrolled in an introductory psychology in which they learn about research methods and the use of placebos in experiments. While participants were asked not to discuss the experiment with their peers during debriefing, some may have shared the deception. Because deception was a critical piece of the experimental portion of the study, some students may have anticipated the pill was a placebo, thus reducing the effects.

The manipulation check served to assess believability of the study overall. No question directly asking "did you think the medication you consumed was a stimulant" or rating scale was included, as it was believed students would already be suspicious for reasons discussed previously and underrate the believability or deception. Most experimental participants endorsed changes on the positive symptom checklist during the absorption period with a small portion denying any change in symptoms (n = 11). Ten of these experimental participants again denied any effects on the manipulation check. This is likely explained by the fact that 9 of these 11 participants endorsed a history of NMUPS, with all 9 also included in the 10 who maintained their subjective reports of not experiencing any symptoms. These participants have seen stimulant medications before and despite the disclaimer that the medications would appear differently than prescription medications because it was for research purposes, they could easily identify the differences. These individuals listed reasons including having a tolerance to the medication, needing more time for the stimulant to take effect and feeling unaffected for not experiencing any significant change in positive symptomatology. This failure to maximize the

face validity of the experiment for individuals with a history of use renders the moderation of their expectancies inapplicable on task performance, as the placebo did not have its intended effect. It is noteworthy to mention that when removing these individuals from analyses, there were still no significant findings.

Despite the Phase I and Phase II consents discussing the possibility of taking stimulant medication, approximately six students became uncomfortable either during consent or randomization and refused continued participation in the study. This was a small group, but a research assistant pattern emerged. In these cases, the study was administered by a nontraditional college student in his mid-30s as compared to the other research assistants aged 18-24. All research assistants were trained by the PI over the course of several weeks and utilized a manual; however, reactions to the research assistant may have played a role in the anxiety levels of experimental participants following the absorption period and the effects they reported experiencing. Subjective reports are always sensitive to social desirability, which in this study would likely be to report significant changes in positive symptoms.

Future Directions

Further studies in this field should include more students who have engaged in NMUPS. This sample represented higher average levels of use (29.7%) common in college populations; however, it did not constitute a large enough sample size due to power issues to properly examine the moderating effects of positive and negative expectancies. The effect one's personal history has on their expectancies and subsequent task performance and enhancement would help to illuminate the findings of this study that suggest a negative or minimally neutral effect of stimulant medications on task performance. It may be that the experimental group's small decline in performance better represents anxiety and stress due to placebo stimulant consumption

because they have not experimented with unprescribed stimulants in the past instead of deleterious cognitive effects. As NMUPS increases across years spent in college, it would behoove researchers to employ recruitment strategies aimed at students from all years to gain access to richer NMUPS histories. Moreover, this would enable researchers to assess any changes that may occur in expectancies across college. It may be that students are more susceptible to the effects and expectancies of stimulants in the beginning of their education, rooted in a lack of experience and knowledge, whereas older students may be less susceptible as a result of personal experience or seeing peers experiment and the results they yield, though age was not a factor in the present study's findings.

Additionally, a study including actual stimulants to be administered and compared to a placebo and control group would allow for deeper examination of the role of expectancies in how a participant reports physiological changes. This would also aid in better accounting for changes related to the medication verse those related to expectancies on task performance aside from physical and positive symptoms. Appropriate dosages would need to be determined to accurately reflect what students are taking nonmedically to achieve the same desired effect both in and out of the laboratory. Dosage could serve as a serious barrier to face validity of the experiment if students are administered significantly lower or higher doses than what is typically taken for the purposes of academic gains.

Lastly, a battery consisting of measures with less construct overlap would be beneficial in isolating what specific abilities are enhanced or weakened by placebo or stimulant medication. This is a difficult task as stimulant medication mainly targets attentional capabilities; however, along with that, processing speed, working memory, and comprehension are all affected and should be measured. Integrating measures such as the Test of Variable Attention or the Conners'

Continuous Performance Task – Second Edition would further assess attention on computerized tasks. This is essential to understanding the effect of stimulants on performance as most tasks students are presently completing for classes utilize typing or online testing formats and would enhance face validity.

Conclusions

Despite the limitations of the present study, the findings reveal the significant role expectancies can play in college students' perceptions of the effects of stimulants. Participants in the experimental condition denied any of the common negative physical symptoms associated with stimulant medication and endorsed changes in positive symptomatology resulting from stimulants when administered a placebo. Even though they reported subjective improvements in focus, alertness, energy and motivation, overall students did not improve performance across task administrations which would have been expected given these significant positive symptom changes. This illustrates students' beliefs that stimulant medications that are perceived as cognitive enhancers are likely misconstrued. These findings are significant for college administrators who should begin to disseminate these findings to students as to deter NMUPS and reduce the high prevalence rates seen on most campuses. Providing students accurate information regarding stimulant abuse and both the health-related and legal/ethical issues associated with it could be an important first step. Many students learn about NMUPS once on campus from peers and older students, creating a culture of acceptance. Programs should be targeted at incoming freshman and emphasize the fact that NMUPS may not bolster their academic performance as has been promoted within campus culture.

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Appendices

Appendix A

Table 1.
Demographics and descriptive statistics across group conditions

	Control	Experimental	Total
N	80	86	166
Age, mean (SD)	18.78 (1.06)	18.79 (1.22)	18.78 (1.14)
Sex, No. (%)			
Male	41 (51.3)	40 (46.5)	81 (48.8)
Female	39 (48.8)	46 (53.5)	85 (51.2)
Race, No. (%)			
Caucasian	57 (71.3)	65 (75.6)	122 (73.5)
African American	11 (13.8)	4 (4.7)	15 (9.0)
Hispanic/Latino	1 (1.3)	2 (2.3)	3 (1.8)
Asian American	7 (8.8)	7 (8.1)	14 (8.4)
Indian/Middle Eastern	3 (3.8)	1 (1.2)	4 (2.4)
Mixed Race/Ethnicity	1 (1.3)	7 (8.1)	8 (4.8)
Academic level, No. (%)			
Freshman	51 (63.8)	67 (77.9)	118 (71.1)
Sophomore	19 (23.8)	9 (10.5)	28 (16.9)
Junior	7 (8.8)	7 (8.1)	14 (8.4)
Senior	2 (2.5)	2 (2.3)	4 (2.4)
5th Year and Up	1 (1.3)	1 (1.2)	2 (1.2)
Greek Participation (%)			
Yes	18 (22.5)	19 (22.1)	37 (22.3)
No	62 (77.5)	67 (77.9)	129 (77.7)
Average GPA	3.48 (.56)	3.42 (.57)	3.45 (.56)
NMUPS Hx (%)			
Yes	11 (13.8)	19 (22.1)	30 (18.1)
No	69 (86.3)	65 (75.6)	134 (80.7)

Note: NMUPS Hx = self-reported history of Nonmedical use of prescription stimulants
*indicates significant difference between groups

Table 2.

Measure Performance and Total Change Mean Scores

		Time 1	Time 2	Change Score
Paced Auditory Serial Attention Task	Control	92.59 (14.53)*	93.31 (15.06)*	.73 (11.19)*
	Experimental	86.93 (19.07)*	85.41 (17.77)*	-1.52 (15.24)*
Digit Span	Control	20.00 (3.62)	20.54 (3.79)	.54 (2.62)
	Experimental	18.73 (3.83)	19.20 (3.93)	.47 (2.81)
Passage Comprehension	Control	10.19 (1.88)	10.38 (1.86)	.19 (2.08)
	Experimental	9.71 (1.93)	9.86 (1.62)	.15 (1.88)
d2 Test of Attention	Control	226.73 (37.48)*	234.23 (40.12)	7.50 (39.17)
	Experimental	214.73 (45.53)*	227.80 (39.54)	13.07 (39.06)

*indicates significance at the $p < .05$ level

Table 3.

Positive Symptom Mean Scores

	Time 1		Time 2		Time 3		Total Change	
	Cont.	Exp.	Cont.	Exp.	Cont.	Exp.	Cont.	Exp.
Alert	3.61	3.26	3.48	3.45	3.15	3.76	-.46*	.50*
Focus	3.65	3.37	3.36	3.50	3.15	3.67	-.49*	.30*
Energy	3.16	2.95	2.95	3.20	2.82	3.29	-.33*	.34*
Motivation	3.28	3.05	3.19	3.26	3.03	3.30	-.26*	.26*
Pleasant Mood	3.83	3.78	3.89	3.87	3.82	3.90	.00	.12

Note. Total change scores were equated by subtracting the Time 1 score from the Time 3 score to assess change over the duration of the absorption period.
*indicates significance at the $p < .001$ level

Appendix B

Demographics Questionnaire

1. Age:_____

2. Sex/Gender: Female / Male

3. Member of a Greek Organization? Yes / No

4. Approximate Cumulative GPA: _____

5. Working? Yes Full-time
   Yes Part-Time
   No

6. Height: _____ Weight: _____

7. Academic Level: Circle One
   1. Freshman
   2. Sophomore
   3. Junior
   4. Senior

8. Ethnic/Racial Background: Circle One
   1. White/Caucasian
   2. Black/African-American
   3. Hispanic/Latino
   4. Asian-American
   5. Native American
   6. Indian/Middle Eastern
   7. Mixed Race/Ethnicity
   8. Other (please list):_____

9. Religious Background/Affiliation: Circle One
   1. Catholic (Non-Christian)
   2. Christian
   3. Jewish
   4. Muslim
   5. Buddhist
   6. Hindi
   7. Other (please list):_____

10. Family Income Level: Circle One
    1. Less than $50,000
    2. $50,001 - $100,000
    3. $100,001 - $150,000
    4. $150,001 - $200,000
    5. Greater than $200,001

11. What is your current marital status?
1. Not dating anyone right now
2. Dating
3. Married
4. Divorced/Widowed

12. If you are currently dating someone or are married, how long have you been with this person?

total number of MONTHS together _____

13. Sexual Orientation: Heterosexual / Gay / Lesbian / Bisexual

14. If you answered "bisexual" to question 9 AND you are currently dating someone, what is the gender of your current dating partner? Male / Female

15. Please indicate the number of times you have used each drug in the past 30 days:
Cigarettes ____
Stimulants (unprescribed) ____
Alcohol ____
Cocaine ____
Heroin ____
Marijuana ____
Pain Medications (unprescribed) _____
Anxiety Medications (unprescribed) _____
Other ____

Appendix C

Adult ADHD Self-Report Scale Symptom Checklist

Please answer the questions below, rating yourself on each of the criteria shown using the scale on the right side of the page. As you answer each question, place an X in the box that best describes how you have felt and conducted yourself over the past 6 months. Please give this completed checklist to your healthcare professional to discuss during today's appointment.

	Never	Rarely	Some - times	Often	Very Often
1. How often do you have trouble wrapping up the final details of a project, once the challenging parts have been done?					
2. How often do you have difficulty getting things in order when you have to do a task that requires organization?					
3. How often do you have problems remembering appointments or obligations?					
4. When you have a task that requires a lot of thought, how often do you avoid or delay getting started?					
5. How often do you fidget or squirm with your hands or feet when you have to sit down for a long time?					
6. How often do you feel overly active and compelled to do things, like you were driven by a motor?					
7. How often do you make careless mistakes when you have to work on a boring or difficult project?					
8. How often do you have difficulty keeping your attention when you are doing boring or repetitive work?					
9. How often do you have difficulty concentrating on what people say to you, even when they are speaking to you directly?					
10. How often do you misplace or have difficulty finding things at home or at work?					
11. How often are you distracted by activity or noise around you?					
12. How often do you leave your seat in meetings or other situations in which you are expected to remain seated?					
13. How often do you feel restless or fidgety?					
14. How often do you have difficulty unwinding and relaxing when you have time to yourself?					
15. How often do you find yourself talking too much when you are in social situations?					
16. When you're in a conversation, how often do you find yourself finishing the sentences of the people you are talking to, before they can finish them themselves?					
17. How often do you have difficulty waiting your turn in situations when turn taking is required?					
18. How often do you interrupt others when they are busy?					

Appendix D

Stimulant History Questionnaire

1. Have you ever used stimulants (for example: Adderall, Adderall-IR, Adderall-XR, Ritalin, methylphenidate, concerta, vyvanse, focalin) that were not prescribed to you?

YES NO

2. Do you personally know people that use stimulants that are not prescribed to them?

YES NO

3. If yes, how many people do you know that use stimulants unprescribed? (circle your answer)

1-5 6-10 11-15 16-20 21-25 26+

If "No" to question 1, skip to question *16
If "Yes" to question 1, continue below

4. How many times in the past 6 months have you used unprescribed stimulants?

_____

5. Which stimulants have you used that were not prescribed to you? (Please circle all that apply)

Adderall Adderall-XR Adderall-IR Vyvanse

Ritalin Methylphenidate Focalin
Concerta

Other(s):_____

6. To what extent did use stimulants that were not prescribed to you as a study aid?

1…….....2.....3.....4.....5.....
6
Not a reason at all Somewhat of a reason Not Sure Part of the reason The main reason The only reason

7. To what extent did yo use stimulants that were not prescribed to you for weight loss?

1…….....2.....3.....4.....5.....
6
Not a reason at all Somewhat of a reason Not Sure Part of the reason The main reason The only reason

8. To what extent did you use stimulants that were not prescribed to get high?

1…….....2.....3.....4.....5.....6

Not a reason at all | Somewhat of a reason | Not Sure | Part of the reason | The main reason | The only reason

9. To what extent did you use stimulants that were not prescribed to you for another reason?

1…….....2.....3.....4.....5.....6

Not a reason at all | Somewhat of a reason | Not Sure | Part of the reason | The main reason | The only reason

10. To what extent did you use stimulants be yourself?

1…….....2.....3.....4.....5.....6

Not a reason at all | Somewhat of a reason | Not Sure | Part of the reason | The main reason | The only reason

11. To what extent did you use stimulants with other people?

1…….....2.....3.....4.....5.....6

Not a reason at all | Somewhat of a reason | Not Sure | Part of the reason | The main reason | The only reason

12. To what extent did you use stimulants both alone and with others?

1…….....2.....3.....4.....5.....6

Not a reason at all | Somewhat of a reason | Not Sure | Part of the reason | The main reason | The only reason

13. Where do you primarily obtain the stimulant?

_____

_____

14. Based on your experiences, will you continue use in the future?

YES NO

15. How likely are you to use stimulants not prescribed to you?

1……..……2……3……...……4..……..……..5……..…….6…….……7

Extremely Unlikely	Unlikely	Somewhat Unlikely	Neutral	Somewhat Likely	Likely	Extremely Likely

If you answered questions 2-10, you have completed the survey. If you answered "No" to question 1, please answer questions 11-12.

16. Why haven't you used stimulants not prescribed to you?

_____

_____

17. Do you think you would use stimulants not prescribed in the future?

YES NO

12. How likely are you to use stimulants not prescribed to you?

1……..……2……..……3……..……4..……..……..5…….…….6……7						
Extremely Unlikely	Unlikely	Somewhat Unlikely	Neutral	Somewhat Likely	Likely	Extremely Likely

Appendix E

Stimulant Expectancy Questionnaire

POSITIVE CONSEQUENCES OF USE

The following questions ask about the POSITIVE CONSEQUENCES you think might result from using prescription medications for non-prescribed purposes:

STIMULANT MEDICATIONS, SUCH AS RITALIN, ADDERALL, OR CONCERTA		
RATING SCALE: 1 = not at all 2 = mildly 3 = mildly to moderately 4 = moderately 5 = moderately to very 6 = very 7 = extremely		
POSITIVE CONSEQUENCES	**LIKELIHOOD OF POSITIVE CONSEQUENCES**	**HOW GOOD ARE THOSE CONSEQUENCES**
In the spaces below, write down the first three **POSITIVE CONSEQUENCES** that might result from your use of stimulant medications (such as those used to treat ADHD) for non-medical purposes	Using the scale above, rate **HOW LIKELY** it is that this positive consequence will happen if you were to use a stimulant medication for non-prescribed purposes	Using the scale above, rate **HOW GOOD** it would be if you were to experience this consequence from using stimulant medications for non-prescribed purposes
1) Write the first positive consequence that comes to mind here:		
2) Write the second positive consequence that comes to mind here:		
3) Write the third positive consequence that comes to mind here:		

NEGATIVE CONSEQUENCES OF USE

The following questions ask about the NEGATIVE CONSEQUENCES you think might result from using prescription medications for non-prescribed purposes:

STIMULANT MEDICATIONS, SUCH AS RITALIN, ADDERALL, OR CONCERTA		
RATING SCALE: 1 = not at all 2 = mildly 3 = mildly to moderately 4 = moderately 5 = moderately to very 6 = very 7 = extremely		
NEGATIVE CONSEQUENCES	**LIKELIHOOD OF NEGATIVE CONSEQUENCES**	**HOW BAD ARE THOSE CONSEQUENCES**
In the spaces below, write down the first three **NEGATIVE CONSEQUENCES** that might result from your use of stimulant medications (such as those used to treat ADHD) for non-medical purposes	Using the scale above, rate **HOW LIKELY** it is that this Negative consequence will happen if you were to use a stimulant medication for non-prescribed purposes	Using the scale above, rate **HOW BAD** it would be if you were to experience this consequence from using stimulant medications for non-prescribed purposes
1) Write the first negative consequence that comes to mind here:		
2) Write the second negative consequence that comes to mind here:		
3) Write the third negative consequence that comes to mind here:		

PEER USE AND PERCEPTIONS OF USE

HOW OFTEN do you think that the AVERAGE STUDENT on your campus uses the following substances (Check the box that best represents your answer):									
	Never	**Once/ year**	**6 times/ year**	**Once/ month**	**Twice/ month**	**Once/ week**	**3 times/ week**	**5 times week**	**Every Day**
Tobacco (Smoke, Chew, Snuff)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Alcohol (Beer, Wine, Liquor)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Marijuana (Pot, Hash, Hash Oil)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Cocaine (Crack, Rock, Freebase)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Heroin	☐	☐	☐	☐	☐	☐	☐	☐	☐
Steroids	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other Illegal Drugs	☐	☐	☐	☐	☐	☐	☐	☐	☐
Prescription Stimulants to get high (Adderall, Ritalin, Concerta)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Prescription Stimulants to stay up and study (Adderall, Ritalin, Concerta)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Prescription Narcotics to get high (Oxycontin, Vicodin, Etc.)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Prescription Sedatives (Ativan, Klonopin, Etc.) to relax or fall asleep	☐	☐	☐	☐	☐	☐	☐	☐	☐

Do ANY of your CLOSE FRIENDS use the following substances (Check the box that best represents your answer):		
	YES	**NO**
Tobacco (Smoke, Chew, Snuff)	☐	☐
Alcohol (Beer, Wine, Liquor)	☐	☐
Marijuana (Pot, Hash, Hash Oil)	☐	☐
Cocaine (Crack, Rock, Freebase)	☐	☐
Heroin	☐	☐
Steroids	☐	☐
Other Illegal Drugs	☐	☐
Prescription Stimulants to get high (Adderall, Ritalin, Concerta)	☐	☐
Prescription Stimulants to stay up and study (Adderall, Ritalin, Concerta)	☐	☐
Prescription Narcotics to get high (Oxycontin, Vicodin, Etc.)	☐	☐
Prescription Sedatives (Ativan, Klonopin, Etc.) to relax or fall asleep	☐	☐

EXPERIMENTING WITH USE					
How do you think your close friends feel (or would feel) about you …					
	Strongly Disapprove	**Disapprove**	**Neither Disapprove Nor Approve**	**Approve**	**Strongly Approve**
… trying tobacco (Smoke, Chew, Snuff) once or twice	☐	☐	☐	☐	☐
…trying Alcohol (Beer, Wine, Liquor) once or twice	☐	☐	☐	☐	☐
…trying Marijuana (Pot, Hash, Hash Oil) once or twice	☐	☐	☐	☐	☐
…trying Cocaine (Crack, Rock, Freebase) once or twice	☐	☐	☐	☐	☐
…trying Heroin once or twice	☐	☐	☐	☐	☐
…trying Steroids once or twice	☐	☐	☐	☐	☐
…trying Other Illegal Drugs once or twice	☐	☐	☐	☐	☐
…trying Prescription Stimulants to get high (Adderall, Ritalin, Concerta) once or twice	☐	☐	☐	☐	☐
…trying Prescription Stimulants to stay up and study (Adderall, Ritalin, Concerta) once or twice					
…trying Prescription Narcotics to get high (Oxycontin, Vicodin, Etc.) once or twice	☐	☐	☐	☐	☐
…trying Prescription Sedatives (Ativan, Klonopin, Etc.) to relax or fall asleep once or twice	☐	☐	☐	☐	☐

OCCASIONAL USE					
How do you think your close friends feel (or would feel) about you …					
	Strongly Disapprove	**Disapprove**	**Neither Disapprove Nor Approve**	**Approve**	**Strongly Approve**
… using tobacco (Smoke, Chew, Snuff) occasionally	☐	☐	☐	☐	☐
…using Alcohol (Beer, Wine, Liquor) occasionally	☐	☐	☐	☐	☐
…using Marijuana (Pot, Hash, Hash Oil) occasionally	☐	☐	☐	☐	☐
…using Cocaine (Crack, Rock, Freebase) occasionally	☐	☐	☐	☐	☐
…using Heroin occasionally	☐	☐	☐	☐	☐
…using Steroids occasionally	☐	☐	☐	☐	☐
…using Other Illegal Drugs occasionally	☐	☐	☐	☐	☐
…using Prescription Stimulants to get (Adderall, Ritalin, Concerta) occasionally	☐	☐	☐	☐	☐
…using Prescription Stimulants to stay up and sudy (Adderall, Ritalin, Concerta) occasionally	☐	☐	☐	☐	☐
…using Prescription Narcotics to get high (Oxycontin, Vicodin, Etc.) occasionally	☐	☐	☐	☐	☐

…using Prescription Sedatives (Ativan, Klonopin, Etc.) to relax or fall asleep occasionally	☐	☐	☐	☐	☐

REGULAR USE					
How do you think your close friends feel (or would feel) about you …					
	Strongly Disapprove	**Disapprove**	**Neither Disapprove Nor Approve**	**Approve**	**Strongly Approve**
… using tobacco (Smoke, Chew, Snuff) regularly	☐	☐	☐	☐	☐
…using Alcohol (Beer, Wine, Liquor) regularly	☐	☐	☐	☐	☐
…using Marijuana (Pot, Hash, Hash Oil) regularly	☐	☐	☐	☐	☐
…using Cocaine (Crack, Rock, Freebase) regularly	☐	☐	☐	☐	☐
…using Heroin regularly	☐	☐	☐	☐	☐
…using Steroids regularly	☐	☐	☐	☐	☐
…using Other Illegal Drugs regularly	☐	☐	☐	☐	☐
…using Prescription Stimulants to get high (Adderall, Ritalin, Concerta) regularly	☐	☐	☐	☐	☐
…using Prescription Stimulants to stay up and study (Adderall, Ritalin, Concerta) regularly	☐	☐	☐	☐	☐
…using Prescription Narcotics to get high (Oxycontin, Vicodin, Etc.) regularly	☐	☐	☐	☐	☐
…using Prescription Sedatives (Ativan, Klonopin, Etc.) to relax or fall asleep regularly	☐	☐	☐	☐	☐

Does the atmosphere on this campus promote the use of…		
	YES	**NO**
Tobacco (Smoke, Chew, Snuff)	☐	☐
Alcohol (Beer, Wine, Liquor)	☐	☐
Other illegal drugs (e.g., marijuana, cocaine, heroin)	☐	☐
Prescription drugs (e.g., stimulants, sedatives, etc)for non-prescribed purposes (e.g., to get high; to stay up and study; to relax)	☐	☐

Appendix F

Medical Exclusion Questionnaire

Do you have any of the following medical conditions? (Mark an 'X' in the corresponding column)

	YES	NO
1. Heart disease or hardening of the arteries		
2. Moderate to severe high blood pressure		
3. Hyperthyroidism		
4. Glaucoma		

5. Do you have a history of drug abuse?

Yes No

6. Are you very anxious, tense, or agitated?

Yes No

7. Are you taking or have taken, within the past 14 days, an anti-depressant medicine called a monoamine oxidase inhibitor or MAOI?

Yes No

8. Are you sensitive to, allergic to, or have you had a reaction to any other stimulant medicines?

Yes No

Are you currently (past 14 days) taking…(Mark an 'X' in the corresponding column)

	YES	NO
9. Anti-depressant medicines including MAOIs		
10. Anti-psychotic medicines		
11. Lithium		
12. Narcotic pain medicines		
13. Seizure medicines		
14. Blood thinner medicines		
15. Blood pressure medicines		
16. Stomach acid medicines		
17. cold or allergy medicines that contain decongestants		

Are you allergic to anything listed below? (Mark an 'X' in the corresponding column)

	YES	NO
18. Adderall		
19. Dextroamphetamine Saccharate		
20. Amphetamine Aspartate Monohydrate		
21. Dextroamphetamine Sulfate USP		
22. Amphetamine Sulfate USP		
23. Lactitol		
24. Microcrystalline cellulose		
25. Colloidal silicon dioxide		
26. Magnesium stearate		

Are you allergic to anything listed below? (Mark an 'X' in the corresponding column)

	YES	NO
27. Ritalin		
28. Lactose		
29. Polyethylene glycol		
30. Starch		
31. Sucrose		
32. Talc		
33. Tragacanth		
34. Cornstarch		
35. Magnesium stearate		

Have you experienced any of the following side effects **AS A DIRECT RESULT OF TAKING STIMULANT MEDICATION (prescribed or unprescribed)?** (Mark an 'X' in the corresponding column).

	YES	NO
Dry Mouth		
Loss of appetite		
Headache		
Insomnia		
Feelings of suspicion		
Paranoia		
Hallucinations		
High Blood pressure		
Rapid pulse rate		
Urinary tract Infection		
Dermatoses (infected or diseased skin)		

Infection or Viral infection		
Depression		
Restlessness		
Tremor		
Aggression		
Panic states		
Twitching or spasms		
Personality changes		
Delusions		
Dizziness		
Sweating		
Swelling of hands, feet or ankles		
Vomiting		
Dehydration		
Muscle pain		
Lower abdominal pain		
Nervousness (agitation, anxiety, or irritability)		

Appendix G

CONSENT FOR PARTICIPATION IN A RESEARCH PROJECT

Neuropsychological Effects of Stimulants - Screener

Invitation to Participate and Description of Project
You are invited to participate in an online screening measure asking demographic information, your experience of any symptomatology of ADHD, your use of prescription stimulant medication and your expectancies of nonmedical prescription stimulant use. You have been invited to participate because you are between 18 and 24 years of age and currently an undergraduate at the University of Tennessee. Additionally, **you are not currently prescribed stimulant medication, nor do you have a diagnosis (current or previous) of ADHD**. Your participation in the study will last approximately 60 minutes and will require you to complete confidential questionnaires.

In order to decide whether or not you wish to be a part of this research study, you should know enough about its risks and benefits to make an informed judgment. This consent form gives you detailed information about the research study: its purpose, the procedures that will be performed, any risks of the procedures, and possible benefits. Once you understand the study, you will be asked if you wish to participate; if so, you will be asked to provide consent.

Description of Procedures
If you decide to participate, you will be asked to complete an online questionnaire regarding some demographic background information and behaviors, including drug use, as well as your expectations regarding nonmedical use of prescription stimulants (Adderall, Ritalin). **You have the right to withdraw from the study at any point.**

Risks and Inconveniences
A risk of study participation is the possibility that providing information about your past/current drug use behavior may be upsetting. You may decide to end your participation in the study at any time. The possible loss of confidentiality for participating in this study is minimal. This means that none of the information you might share regarding any sensitive aspects revealed through participation will be shared with anyone other than the research staff, including university officials, parents, or police. To ensure that the information you provide us remains confidential, it will be identified with a numeric code only and stored in a locked file cabinet.

Benefits
There are no direct benefits to participating in this study.

Compensation
Your participation will last approximately 60 minutes. Thus, you will receive 1 SONA credit points in your General Psychology course for completing this study. Additionally, based on your responses, you may qualify for an in-person laboratory experiment in which you will have the ability to earn 2 SONA credits.

Alternative Treatments
In case of any discomfort from participating in this study, you can expect to receive the following treatment or care which will be sought after by you and provided at your expense: Assistance from the UT Counseling Center (974-2196) or the UT Psychological Clinic (974-2161).

Confidentiality
To ensure that the information you provide us remains confidential, the data you provide will be identified with a numeric code only and stored in a locked file cabinet. Personal identifiable information, such as the email address you will provide in order to receive credit through the HPR system, will be stored in a locked file cabinet separate from the answers you provide. You will not be personally identified in any reports or publications that may result from this study. None of the information you provide us will be shared with anyone other than the research staff, including university officials, parents, or police. The only exception to confidentiality is the duty to notify the appropriate authorities in compliance with state law if we become aware of the possibility of a participant posing an imminent risk to him or herself or another, or if we become aware of the possibility that child maltreatment is occurring.

Voluntary Participation
You are free to decide whether or not to participate in this study and free to withdraw from the study at any time. Refusal to participate will not result in any penalties.

Authorization
I have read this form thoroughly and I voluntarily agree to participate in this study as indicated by my responding to the online consent prompt.

I can print a copy of this consent form for my records or contact Sam Lookatch to receive a copy at slookatc@utk.edu.

If you have further questions about this project, please contact Sam Lookatch at slookatc@utk.edu. For research-related problems or questions regarding subjects' rights, the Institutional Review Board may be contacted through the Compliance Office at 974-3466.

Appendix H

Sleep and Caffeine Consumption Questionnaire

1. What time do you generally go to bed during the week? _____a.m. / p.m.

2. What time do you generally wake up during the week? _____a.m. / p.m.

3. On average, how many hours of sleep do you get per night during the week? _____

4. What time do you generally go to bed on weekends? _____a.m. / p.m.

5. What time do you generally wake up on weekends? _____a.m. / p.m.

6. On average, how many hours of sleep do you get per night on the weekends? _____

7. How many hours of sleep *would you ideally like to get* on average? _____

8. Do you consider yourself a:

Morning Person Evening Person Neither

9.Do you smoke cigarettes?

Yes No

10. When was your last cigarette? _____

11. Do you drink alcohol?

Yes No

12. Have you consumed any alcohol in the past 24 hours?

Yes No

13. Which of the following beverages do you drink?

Coffee (latte, cappuchino, espresso) Tea

Soda Energy Drinks (Red bull, Monster)

14. How many ounces of the above beverages do you generally consume in **one** day?

8 ounces 12 ounces 16 ounces 20 ounces

24 ounces 36 ounces 37+ ounces

15. Did you drink any of these beverages today?

Yes No

Appendix I

BIG-5

Indicate how strongly you agree or disagree to the questions below.

	Strongly Disagree 1	2	Neutral 3	4	Strongly Agree 5
1. I am the life of the party.	O	O	O	O	O
2. I feel little concern for others.	O	O	O	O	O
3. I am always prepared	O	O	O	O	O
4. I get stressed out easily.	O	O	O	O	O
5. I have a rich vocabulary.	O	O	O	O	O
6. I don't talk a lot.	O	O	O	O	O
7. I am interested in people.	O	O	O	O	O
8. I leave my belongings around.	O	O	O	O	O
9. I am relaxed most of the time.	O	O	O	O	O
10. I have difficulty understanding abstract ideas.	O	O	O	O	O
11. I feel comfortable around people.	O	O	O	O	O
12. I insult people.	O	O	O	O	O
13. I pay attention to details.	O	O	O	O	O
14. I worry about things.	O	O	O	O	O
15. I have a vivid imagination.	O	O	O	O	O
16. I keep in the background.	O	O	O	O	O
17. I sympathize with others' feelings.	O	O	O	O	O
18. I make a mess of things.	O	O	O	O	O
19. I seldom feel blue.	O	O	O	O	O
20. I am not interested in abstract ideas.	O	O	O	O	O
21. I start conversations.	O	O	O	O	O
22. I am not interested in others' problems.	O	O	O	O	O
23. I get chores done right away.	O	O	O	O	O
24. I am easily disturbed.	O	O	O	O	O
25. I have excellent ideas.	O	O	O	O	O
26. I have little to say.	O	O	O	O	O
27. I have a soft heart.	O	O	O	O	O
28. I often forget to put things back in their proper place.	O	O	O	O	O
29. I get upset easily.	O	O	O	O	O
30. I do not have a good imagination.	O	O	O	O	O

	Strongly Disagree 1	2	Neutral 3	4	Strongly Agree 5
31. I talk to a lot of different people at parties.	O	O	O	O	O
32. I am not really interested in others.	O	O	O	O	O
33. I like order.	O	O	O	O	O
34. I change my mood a lot.	O	O	O	O	O
35. I am quick to understand things.	O	O	O	O	O
36. I don't like to draw attention to myself.	O	O	O	O	O
37. I take time out for others.	O	O	O	O	O
38. I shirk my duties.	O	O	O	O	O
39. I have frequent mood swings.	O	O	O	O	O
40. I use difficult words.	O	O	O	O	O
41. I don't mind being the center of attention.	O	O	O	O	O
42. I feel others' emotions.	O	O	O	O	O
43. I follow a schedule.	O	O	O	O	O
44. I get irritated easily.	O	O	O	O	O
45. I spend time reflecting on things.	O	O	O	O	O
46. I am quiet around strangers.	O	O	O	O	O
47. I make people feel at ease.	O	O	O	O	O
48. I am exacting in my work.	O	O	O	O	O
49. I often feel blue.	O	O	O	O	O
50. I am full of ideas.	O	O	O	O	O

Appendix J

Physical Symptom Checklist

Are you currently experiencing any of the following symptoms? (Mark an 'X' in the corresponding column)

	YES	NO
Dry Mouth		
Loss of appetite		
Headache		
Feelings of suspicion		
Paranoia		
Hallucinations		
High Blood pressure		
Rapid pulse rate		
Depressed		
Restlessness		
Tremor		
Aggressive		
Panic		
Twitching or spasms		
Delusions		
Dizziness		
Sweating		
Swelling of hands, feet or ankles		
Nausea		
Dehydration		
Muscle pain		
Lower abdominal pain		
Nervousness (agitation, anxiety, or irritability)		

Blood Pressure: Sys. _____ Dia. _____

Pulse: _____

Appendix K

Performance Rating Scales - A

Digit Span: The task in which you heard a series of numbers that you needed to repeat back both forwards and then backwards.

d2 Test of Attention: The task in which you had to identify the letter 'd' and mark it when it had 2 slashes either above, below or both

Paced Auditory Serial Attention Task: The task in which you heard numbers and had to continuously add the last two numbers heard together

Passage Comprehension: The task that required you to read a sentence and identify an appropriate word to go in the blank

1. Which task was the easiest?

Digit Span	Paced Auditory Serial Attention Task
d2 Test of Attention	Passage Comprehension

2. Which task was the most difficult?

Digit Span	Paced Auditory Serial Attention Task
d2 Test of Attention	Passage Comprehension

Please rate how you felt you performed on each task:

3. Digit Span

1……2……..…3……..….4……..5…….…..6…….…..7

Could not have done *WORSE* — Could not have done *BETTER*

4. d2 Test of Attention

1……2……..…3……..….4……..5…….…..6…….…..7

Could not have done *WORSE* — Could not have done *BETTER*

5. Paced Auditory Serial Attention Task

1……2……..…3……..….4……..5…….…..6…….…..7

Could not have done *WORSE* — Could not have done *BETTER*

6. Passage Comprehension

1……2……..…3…….….4……..5…….…..6…….…..7

Could not have done *WORSE* — Could not have done *BETTER*

Performance Rating Scales - B

Digit Span: The task in which you heard a series of numbers that you needed to repeat back both forwards and then backwards.

d2 Test of Attention: The task in which you had to identify the letter 'd' and mark it when it had 2 slashes either above, below or both

Paced Auditory Serial Attention Task: The task in which you heard numbers and had to continuously add the last two numbers heard together

Passage Comprehension: The task that required you to read a sentence and identify an appropriate word to go in the blank

1. Which task was the easiest?

Digit Span — Paced Auditory Serial Attention Task

d2 Test of Attention — Passage Comprehension

2. Which task was the most difficult?

Digit Span — Paced Auditory Serial Attention Task

d2 Test of Attention — Passage Comprehension

Please rate how you felt you performed on each task:

3. Digit Span

1……2……..…3…….….4……..5…….…..6…….…..7

Could not have done *WORSE* — Could not have done *BETTER*

4. d2 Test of Attention

1……2……..…3…….….4……..5…….…..6…….…..7

Could not have done *WORSE* — Could not have done *BETTER*

5. Paced Auditory Serial Attention Task

1……2……3……4……..5……..6……..7

Could not have done *WORSE* — Could not have done *BETTER*

6. Passage Comprehension

1……2……3……4……..5……..6……..7

Could not have done *WORSE* — Could not have done *BETTER*

7. Circle which administration you believe you performed better on for each test?

Digit Span: First Second

d2 Test of Attention: First Second

Paced Auditory Serial Attention Task: First Second

Passage Comprehension: First Second

Appendix L

Positive Symptom Rating Scale

Before the pill begins to take effect, I'd like you to rate where you are right now on the following feelings:

1) How alert are you feeling right now?

1	2	3	4	5
Not at all				very alert

2) How focused are you feeling right now?

1	2	3	4	5
Not at all				very focused

3) How much energy do you feel you have right now?

1	2	3	4	5
None at all				very energized

4) How motivated are you feeling right now?

1	2	3	4	5
Not at all				very motivated

5) How pleasant is your mood right now?

1	2	3	4	5
Not pleasant				very pleasant

I'd like you to pay attention to these five symptoms over the next 20 minutes. We will go through the rating scale again in 10 minutes, 15 minutes and 20 minutes to assess the extent to which the medication has taken effect. (Circle the first time point in black, second time point in blue, third in red and fourth in purple).

Appendix M

Manipulation Check

1. What was the medication you consumed?

Adderall Ritalin

2. Were the tests on the second portion of the testing easier or harder?

1…….…….2…….....….3…….…….4…….5
Much Easier Easier Same Harder Much harder

3. How much did the drug affect your attention?

1…….…….2…….....….3…….…….4…….5
Did not affect me at all Greatly affected me

4. How much did the drug affect your alertness?

1…….…….2…….....….3…….…….4…….5
Did not affect me at all Greatly affected me

5. How much did the drug affect your focus?

1…….…….2…….....….3…….…….4…….5
Did not affect me at all Greatly affected me

6. How much did the drug affect your energy level?

1…….…….2…….....….3…….…….4…….5
Did not affect me at all Greatly affected me

7. How much did the drug affect your motivation?

1…….…….2…….....….3…….…….4…….5
Did not affect me at all Greatly affected me

8. How much did the drug affect your mood?

1…….…….2…….....….3…….…….4…….5
Did not affect me at all Greatly affected me

9. If you answered 1 or 2 to the previous questions, why do you think the drug did not have any effect on you?

_____

Appendix N

CONSENT FOR PARTICIPATION IN A RESEARCH PROJECT

Neuropsychological Effects of Stimulants – Laboratory Experiment

Invitation to Participate and Description of Project

You are invited to participate in an in-person laboratory experiment in which you may be administered a stimulant medication to determine its effects on performance. You have been invited to participate because you are between the ages of 18 and 24, are not currently prescribed stimulant medication, and do not have a diagnosis (current or previous) of AD/HD. Your participation in the study will last approximately 2 hours and will require you to complete neuropsychological measures and possibly consume a stimulant medication.

In order to decide whether or not you wish to be a part of this research study, you should know enough about its risks and benefits to make an informed judgment. This consent form gives you detailed information about the research study: its purpose, the procedures that will be performed, any risks of the procedures, and possible benefits. Once you understand the study, you will be asked if you wish to participate; if so, you will be asked to provide consent.

Description of Procedures

If you decide to participate, you will be asked to complete some neuropsychological measures (executive functioning, short-term memory, comprehension and attention), questionnaires regarding demographic background information and physical symptoms. You may also be asked to swallow a pill (a stimulant medication) and then complete additional questionnaires. **You have the right to withdraw from the study at any point.**

Risks and Inconveniences

A risk of study participation is the possibility of the loss of confidentiality. Although none of the information you might share during the course of this study will be shared with anyone, your name will be linked to the information you provide until the study is completed. To ensure that the information you provide us remains confidential, it will be identified with a numeric code only and stored in a locked file cabinet. Only the research team will be able to connect your name with your information during the study. Once the study is complete, the file linking your name with your information will be destroyed. A risk of study participation is the potential side effects of consuming a stimulant that is unprescribed. There is also the risk of side effects from consuming a stimulant medication nonmedically. Your physical health will be monitored throughout the study and study participation will be discontinued if necessary. An escort to student health services is available if necessary.

Benefits

Participants have a chance to contribute to a scientific study that may help people in the future.

Compensation

Your participation will last approximately 2 hours. Thus, you will receive 2 SONA credit points in your General Psychology course for completing this study.

Alternative Treatments

In case of any discomfort from participating in this study, you can expect to receive the following treatment or care which will be sought after by you and provided at your expense: Assistance from Student Health Services (865-974-3135) the UT Counseling Center (974-2196) or the UT Psychological Clinic (974-2161).

Confidentiality

To ensure that the information you provide us remains confidential, the data you provide will be identified with a numeric code only and stored in a locked file cabinet. Personal identifiable information, such as the email address you will provide in order to receive credit through the HPR system, will be stored in a locked file cabinet separate from the answers you provide. You will not be personally identified in any reports or publications that may result from this study. None of the information you provide us will be shared with anyone other than the research staff, including university officials, parents, or police. The only exception to confidentiality is the duty to notify the appropriate authorities in compliance with state law if we become aware of the possibility of a participant posing an imminent risk to him or herself or another, or if we become aware of the possibility that child maltreatment is occurring.

Voluntary Participation

You are free to decide whether or not to participate in this study and free to withdraw from the study at any time. Refusal to participate will not result in any penalties.

Authorization

I have read this form thoroughly and I voluntarily agree to participate in this study as indicated by my signature below.

I can print a copy of this consent form for my records or contact Samantha Lookatch to receive a copy at slookatc@utk.edu.

If you have further questions about this project, please contact Samantha Lookatch at slookatc@utk.edu. For research-related problems or questions regarding subjects' rights, the Institutional Review Board may be contacted through the Compliance Office at 974-3466.

_____ _____

Signature Date

Appendix O

Debriefing

The purpose of this experiment is to measure the effects expectancies of stimulant medication used for nonprescribed purposes have on performance. There were no actual stimulant medications administered in the course of this experiment. Deception was necessary to successfully test the role the expectancies of taking a stimulant medication have on a person both physiologically and mentally. The contents of the stimulant placebo were corn starch and should not medically cause any side effects.

If you have any further questions or concerns, please contact Sam Lookatch at slookatc@utk.edu. Additionally, if you are feeling ill or are in need of medical attention, please inform the research assistant and you will be escorted to Student health immediately.

Appendix P

DISS PHASE II PROCEDURE MANUAL

Prior to the session, you will receive an email with the participant's name, their participant ID number which will be on each packet of materials for the session. Additionally, their NMUPS history will be provided which will be important during the break.

The order of forms will be:

- Consent
- Physical Symptom Checklist I/Blood Pressure/Heart rate monitor
- d2 Test of Attention/Digit Span/Passage Comprehension/PASAT (counterbalanced)
- Pill Administration (if applicable)
- Positive Symptom Rating (at 0, 10, 15, 20 minutes)
- Big 5
- Daily Sleep and Caffeine Questionnaire
- Subjective Performance Rating Scale I
- Physical Symptom Checklist II/Blood Pressure/Heart rate monitor (20 mins)
- d2 Test of Attention/Digit Span/Passage Comprehension/PASAT (counterbalanced)
- Physical Symptom Checklist III/Blood Pressure/Heart rate monitor
- Subjective Performance Rating Scale II
- Manipulation Check Questionnaire
- Debriefing

ADMINISTRATION CHECKLIST

O Consent*
O Caffeine, Alcohol, cold medicine or antacid use?
O Take belongings
O Physical Symptom Checklist I*
O Blood Pressure

Administration 1:

O d2 Test of Attention* (These 4 measures will be counterbalanced)
O Digit Span
O Passage Comprehension
O PASAT

Break:

O Pill Administration (if applicable)
O Medication Log
O Positive Symptom Rating*
O Big 5*
O Positive Symptom Rating (10 minutes)
O Subjective Performance Rating Scale I*
O Positive Symptom Rating (15 minutes)

- O Daily Sleep and Caffeine Questionnaire*
- O Positive Symptom Rating (20 minutes)
- O Physical Symptom Checklist II*
- O Blood Pressure

Administration 2:

- O d2 Test of Attention* (These 4 measures will be counterbalanced)
- O Digit Span
- O Passage Comprehension
- O PASAT

Closing:

- O Physical Symptom Checklist III*
- O Blood Pressure
- O Subjective Performance Rating Scale II*
- O Complete any unfinished Break measures*
- O Manipulation Check Questionnaire*
- O Debriefing
- O Give back belongings

Arrival:

You should be present 20-30 minutes prior to the session to prepare adequately for the participant. You will need to:

- Place a chair outside of 209
- Hang the "*experiment in progress*" sign on the 209 door
- Pull out corresponding packet for participant and blood pressure monitor
- Ensure all "medications" are prepped in the locked filing cabinet
- Ensure all materials (monitor, medications, forms, scripts, stopwatch) are organized for administration

Students are instructed to arrive on time for their appointments and to wait in a chair outside of Room 209. When students arrive:

- Ensure that the participant is the correct person who appears for the session
- Ask participants if they need to use the restroom prior to the session
- Participants will have been asked to minimize caffeine consumption in the 4 hours prior to the session and to not have consumed alcohol for 24 hours, when they arrive, ensure that they have followed this. Ask **"Have you had any alcoholic beverages in the last 24 hours? Have you had any caffeine in the past 4 hours?"** If yes, tell them the session will need to be rescheduled as they did not adhere to session requirements. If no, continue.
- Remind participants of confidentiality of their responses in Phase I and II by saying, **"I just want to take a minute to remind you that your answers on Phase I and Phase II will be connected using your email and subject ID, but after today, your**

name and email will not be used to identify your data and all information you have provided is confidential and anonymous."

- Present *Consent Form* to participant and state, **"because this is a separate experiment with different tasks, you will need to complete another consent form. Please read over this and ask any questions you may have about the procedure."**
  - If no questions, continue on with procedures.
  - If participant asks questions answer to the best of your ability. If they ask if they will be taking a pill, tell them they are randomized after the first completion of tasks. ***DO NOT TELL THEM PRIOR TO ADMINISTRATION OF THE FIRST SET OF TASKS IF THEY WILL BE RECEIVING THE MEDICATION!*
  - Ask participants to silence any electronic devices and have them place all of their belongings in the Participant Box. Say, **"I'm going to ask that you put your bag(s) and any electronic devices including your phone in this box for the duration of the experiment. Please turn off all electronics before putting them in the box. This is necessary as I will need your full attention and focus on the tasks that you will be completing and we don't want any distractions."**

What to say if…
If a participant asks how they are doing during testing administration, do not say good or bad. These are appropriate responses to his question:

"I don't actually score the measures so I am not sure."
"Just try and do your best."
"I can tell your working really hard so please just keep doing the same."
"Unfortunately, because this is for research and we are not administering the full batteries of these measures, we cannot share results."

If a person asks what group they are in:

"You will be randomized after the first administration and will find out if you are in the control or experimental group at that time."

If a person asks if the medication is real:

"The medication we use is real. They are obtained from the pharmaceutical companies that produce them and this study has been approved by UT's IRB. "

Administration 1

Following consent, all participants will be administered the *Physical Symptom Checklist I* and their blood pressure/heart rate will be taken using the monitor. If heart rate is above 160 bpm, the participant cannot participate. Additionally, if at any point throughout the session, the participants' heart rate exceeds 160 bpm, the session will need to end for the safety of the participant.

Hand the checklist and say **"please check yes or no if you are currently experiencing any of these symptoms."** When they are finished, say, "**Now I am going to measure your blood**

pressure and heart rate using this wrist monitor on your left wrist, you will feel a slight squeeze." Place the monitor on the left.

- If the left wrist has a watch or jewelry, ask the participant to kindly remove this for the duration of the session as this will be taken at three different time points.

Next, tell the participant you are going to begin task administration and which task you will be starting. The order will be counterbalanced for each participant so will vary with each session.

**If a participant asks how they are doing during testing administration, do not say good or bad. These are appropriate responses to his question:
"I don't actually score the measures so I am not sure."
"Just try and do your best."
"I can tell your working really hard so please just keep doing the same."
"Unfortunately, because this is for research and we are not administering the full batteries of these measures, we cannot share results."

<u>d2 Test of Attention</u>
You will need your directions, a stopwatch/timer and the recording blank. The participant will need a pencil for this task.

Directions: **"With the help of the following task, I would like to see how well you can concentrate on a particular task."** Place d2 recording blank in front of participant. **Please pay attention. After the word 'examples' on your recording blank you see three small letters marked with dashes. These are the letter 'd' as in dog and each is marked with two dashes. The first 'd' has two dashes on the top, the second has two on the bottom, and the third 'd' has one dash on the top and one on the bottom, still making two dashes all together. I would like you to cross out every letter 'd' that has two dashes by making a single line through the letter. Try doing this first with the three examples, then try the practice line. You are not supposed to cross out the other letters. Thus a 'd' which has more than two or fewer than two dashes should not be crossed out, and the letter 'p' as in pig should never be crossed out, no matter how many dashes it has. Do you have any questions right now?"** Repeat any directions or answer any questions if applicable. Hand client pencil now.

"Let's take a look at whether you have crossed out all the right letters. Every one of the letters in the practice line has a number underneath it. I'll slowly read out the numbers of the letters, which you were asked to cross out. You can see whether you have overlooked any of the letters, or whether you have perhaps crossed out too many. For example you were expected to cross out the first letter because it is a 'd' with two dashes on the top, then the third letter because it is a 'd' but this time with one dash above and one dash below which makes two all together, then the letters numbered 5,6,9, 12, 13, 17, 19 and 22. Did you cross out all of these numbers? Did you cross out more or fewer letters? If so, you can correct these mistakes by crossing the letter out with a second line. Do you have any questions?"

"Please do not turn your recording blank over yet. Please put your pencil down for a moment and listen carefully. On the other side of your recording blank, you will see 14

lines with the same letters you have worked on in the practice line. For each one of the 14 lines you should start on the left side, work to the right and cross out each 'd' with two dashes. This is exactly the same task you did in the practice line. Start with the first line. After 20 seconds I'll say 'stop next line' and you will stop working on that line and immediately start working on the next line. After another 20 seconds, I'll say 'stop next line' and you will immediately start working on the next line. Work as quickly as you can without making mistakes."

"Now please turn the page over so that the first line is on top. In the upper left hand corner you will see an arrow pointing to where you should start working on the first line. Pick up your pencil and when I give the order, start working on the first line. Ready, set, go!" Start the timer when you say "go!" and after 20 seconds, say "stop, next line" which is repeated every 20 seconds until the test is completed at which point timing is stopped. The timer should not be stopped at the end of every line, since this would provide extra time. You will say, "stop, next line" at 20 seconds, 40, seconds, 1 minute, 1.20, 1.40, 2 minutes, 2.20, 2.40, 3 minutes, 3.20, 3.40, 4 minutes 4.20 and 4.40 minutes. Make sure to take the pencil back from the client.

Passage Comprehension

You will use the directions sheet with a picture of a stick figure and a house along with the corresponding Passage Comprehension A or B reading sheet for this task. Your recording blanks will be separate for A and B. On your answer sheet, circle the correct answer the participant provides. If they provide an incorrect response that is provided on the form, circle the incorrect answer. If it is not listed, write down the incorrect response and check the number so it is obvious this item was incorrect.

Directions: **Look at this picture** point to the sentence and say: **Listen. This says, "The house is bigger than the…**(pause)." Point to blank line in sentence. **What word belongs in the blank space?**

Correct answers include: man, woman, lady, boy, girl, child, daddy, mommy, person, figure

Error: **The answer is "man." The house is bigger than the man." Now try it again. The house is bigger than the…**(pause). Point to blank line in sentence. **What word belongs in the blank space?**

Now, read this item to yourself and tell me one word that goes in the blank (point to the first item)**.** Do not read items or tell subjects any words during this test. If no response after 30 seconds, point to the next item and say: **"Let's try this one."** Do not give the participant any indication if the answer is correct or incorrect. Just encourage them to try their best on the task.

Following the first response, instruct the participant to continue with the following items by saying, "**You can continue on with the following items."**

If the participant's response is listed under the "Q" response title, this stands for query and you should say, **"tell me another word."** If the participant states an incorrect answer, circle the

incorrect answer and it is wrong, if the participant states a correct answer, circle the correct answer and it is right.

Digit Span

There will be two parts to Digit Span: forward and backward. You will use the form to write down participant responses and s/he will not be doing any writing for this task. Write down exactly what the participant says on the form. If the participant says they do not remember or know the numbers, write 'DK' in the blank. If they guess numbers, write them down.

Directions Forward: **I am going to say some numbers. Listen carefully, and when I am through, I want you to say them right after me. Just say what I say.**
Directions Backward:
Now I am going to say some more numbers. But this time when I stop, I want you to say them backward. For example, if I say 7-1-9, what would you say?

(Examinee responds 9-1-7, say "**That's right.**")

If examinee responds incorrectly, say: **No, you would say 9-1-7, I said 7-1-9, so to say it backward, you would say 9-1-7. Now try these numbers. Remember, you are to say them backward: 3-4-8**

(Examinee responds 8-4-3, say "**That's right.**")

PASAT

You will be using the computer and a recording form for this task. The participant will not need any materials.
Form Completion: To complete the form, place a check next to all correct answers (✓). Write in any incorrect responses in the space provided. Place a dash when no response was given (-). If the patient corrects him/herself after giving a response, count the amended answer as the response. The amended response is the one that will be used in determining the total correct, regardless of whether it was the correct or incorrect response. Slash through the old response and write in 'SC' with a circle around it to indicate that the patient self-corrected.

Directions: **"On this recording you are going to hear a series of single digit numbers that will be presented at the rate of one every 3 seconds. Listen for the first two numbers, add them up, and tell me your answer. When you hear the next number, add it to the one you heard on the recording right before it. Continue to add the next number to each preceding one. Remember, you are not being asked to give me a running total, but rather the sum of the last two numbers that were spoken on the recording."**
"For example, if the first two numbers were '5' and '7', you would say '12.' If the next number were '3', you would say '10.' Then if the next number were '2', you would say '5.'
If the participant is having difficulty understanding these instructions, write 5, 7, 3 and 2 on a sheet of paper and repeat the instructions, demonstrating how the task is done.

"This is a challenging task. If you lose your place, just jump right back in – listen for two numbers in a row and add them up and keep going. There are some practice items at the beginning of the recording. Let's try those first."

-Play the sample items, stopping the recording after the last practice item. Repeat the practice items if necessary until the subject understands the instructions (up to three times).

- If the participant begins to give you a running total, stop the practice immediately and explain the task again emphasizing that s/he is not give you a running total. Then start the practice items again from the beginning.

- If the participant merely makes a math error, do not stop the tape; continue with the practice items. After two consecutive no responses, prompt him/her to resume by saying, **"Jump back in with the next two numbers you hear."**

Once it is clear that the participant possesses sufficient understanding of the task, begin Part I. Before staring Part I, remind the participant by saying, **"Now that you've done the practice items, we're going to begin the test. Remember if you get lost, just jump back in because I can't stop the test once it has begun."** Discourage talking and oral calculations during the test; only the patient's answers should be spoken aloud. *The participant may need prompting to continue the test if s/he gets lost. After 5 consecutive no responses, redirect the patient quickly by saying **"jump back in**" but do not stop the tape.*

Before Part 2 say**, "There is a second part to this test, identical to the first, except that the numbers will come a little faster, one every 2 seconds. Let's try some practice items."** Following the practice items, say, **"Now that you've done the practice items, we're going to begin the test. Remember if you get lost, just jump back in because I can't stop the test once it has begun."**

BREAK

Following administration of all 4 measures, ask the participant if s/he needs to use the bathroom. After this, follow either the experimental or control script.

<u>EXPERIMENTAL SCRIPT</u>: You were randomized to the experimental condition today which means you will be administered a stimulant medication.

<u>Use history:</u> **I see from your Phase I answers that you have used stimulants not prescribed to you in the past. Do you remember the name and dosage of the medication you used? What was your experience with that medication? Would you like to take that again or take a different medication today?** (If no preference go with "Ritalin" or "Adderall") **To ensure you feel the effects of the medication, we prefer to administer a 30 mg dose, do you have any objections to this dose?** If no objection, obtain pills in container case and bottle of water and say, "**Please put out your hand, I will dump the pills from the case into your hand so that I do not touch them. You can take the stimulants with this water. Please do so now."** Watch the participant take all pills. Then state, "**I know this pill does not look like _____(name of the stimulant used for the participant), because this is not for prescription purposes, we obtain research grade stimulant medication."**

- If there is an objection, ask what the discomfort is and allow the person to take a lesser dose (either 10 or 20 milligrams). If the person would like to take a smaller dosage, let them know we only have medications in the form of 10 milligram increments and that that is not possible.

- Complete the *Medication Log* with the name of the stimulant, dosage, date and time and your initials.

NO Use history: **I see from your Phase I answers that you have not used stimulants not prescribed to you in the past. We have a variety of stimulant medications, what would you like to take?** (If no preference go with "Ritalin" or "Adderall") **Do you have any objection to take a 30 mg dose? This is the dosage we would prefer to use to ensure you will feel the effects of the stimulant, so if you do not have any objections, you will be taking three, 10 milligram pills.** If no objection, obtain pills in container case and bottle of water and say, "**Please put out your hand, I will dump the pills from the case into your hand so that I do not touch them. You can take the stimulants with this water. Please do so now."** Watch the participant take all pills.

- If there is an objection, ask what the discomfort is and allow the person to take a lesser dose (either 10 or 20 milligrams). If the person would like to take a smaller dosage, let them know we only have medications in the form of 10 milligram increments and that that is not possible.

- Complete the *Medication Log* with the name of the stimulant, dosage, date and time and your initials.

Following pill administration, you will administer the *Positive Symptom Rating Scale, Big-5*, *Subjective Performance Rating Scale, Daily Sleep and Caffeine Questionnaire* and *Physical Symptom Checklist II*. Show the participant the Positive Symptom Rating Scale and say, "**Before the pill begins to take effect, I'd like you to rate where you are right now on some commonly reported symptoms experienced when people use stimulants nonmedically I will be checking in with you several times so please rate how you are feeling in the moment. On a scale from 1 – 5 with 1 being not at all and 5 being very alert, how alert are you feeling right now, in this moment?** Circle their ranking in black ink. Read through the rest of the questions in the same format. Read the form upside to the client so they can see the scale though you are circling the responses. Then say, "**I'd like you to pay attention to these five symptoms over the next 20 minutes. We will go through the rating scale again in 10 minutes, 15 minutes and 20 minutes to assess the extent to which the medication has taken effect. In the meantime, I have some forms for you to complete.** Hand client the Big-5 and say, "**On this questionnaire, please indicate how strongly you agree or disagree to the questions listed using the scale provided. Please be sure to answer all questions. I will be back in 10 minutes to go over the Positive Symptom Rating Scale again.** Leave the room and close the door behind you.

When you return, collect the Big 5 if it is completed and go over the Positive Symptom Rating scale again repeating the directions, "**I'd like to again have you rate where you are right now on the same feelings to see if the stimulants are taking effect on you. Please rate on a scale from 1 – 5 with 1 being not at all and 5 being very alert, how alert are you feeling right now, in this moment?** Circle their ranking in blue ink. Read through the rest of the questions in the same format. Read the form upside to the client so they can see the scale though you are circling the responses. Hand the participant the *Subjective Performance Rating Scale* and say, "**Please complete this form regarding which tasks you think you performed best on and answer all questions and I will return in 5 minutes."** Leave the room and close the door behind you.

When you return, collect the completed sheets and go over the Positive Symptom Rating scale again repeating the directions, "**I'd like to again have you rate where you are right now on the same feelings to see if the stimulants are taking effect on you. Please rate on a scale from 1 – 5 with 1 being not at all and 5 being very alert, how alert are you feeling right now, in this moment?** Circle their ranking in red ink. Read through the rest of the questions in the same format. Read the form upside to the client so they can see the scale though you are circling the responses. Hand the participant the *Daily Sleep and Caffeine Questionnaire* and say, "**Please complete this form regarding your sleep and daily caffeine usage. Answer all questions and I will return in 5 minutes."** Leave the room and close the door behind you.

When you return, collect the completed sheets and go over the Positive Symptom Rating scale again repeating the directions, "**For the last time, I'd like to have you rate where you are right now on the same feelings to see if the stimulants are taking effect on you. Please rate on a scale from 1 – 5 with 1 being not at all and 5 being very alert, how alert are you feeling right now, in this moment?** Circle their ranking in purple ink. Read through the rest of the questions in the same format. Read the form upside to the client so they can see the scale though you are circling the responses. Hand the participant the *Physical Symptom Checklist II* and say, "**please check yes or no if you are currently experiencing any of these symptoms."** Once completed, say, **"Now I am going to measure your blood pressure and heart rate using this wrist monitor, you will feel a slight squeeze."** Place the monitor on whichever wrist does NOT have anything on it. If heart rate is above 160 bpm, the participant cannot participate. Additionally, if at any point throughout the session, the participants' heart rate exceeds 160 bpm, the session will need to end for the safety of the participant.

If the person has not yet finished the measures, take them at the 20 minute mark and let the person know they can finished them after the second administration of the neuro battery.

If the person is not reporting any changes, say, **"Generally, people start to experience changes by 20 minutes, though you aren't experiencing any changes yet, we are going to begin on the second administration of the tasks."**

***************OR***************

<u>CONTROL SCRIPT</u>: You were randomized to the control condition today which means you will not be administered a stimulant medication. A portion of participants are randomized to the control condition so we can see the true effect of the medication. We will need to do all of the same procedures as if you were in the experimental condition so here is a bottle of water for you to drink throughout the break.

You will now administer the *Positive Symptom Rating Scale,* Big-5, *Subjective Performance Rating Scale* and *Physical Symptom Checklist II.* Show the participant the Positive Symptom Rating Scale and say, "**Though you were not administered a stimulant we still need to complete the same forms. I will be checking in with you several times on some symptoms commonly reported when people use stimulants nonmedically. I'd like you to rate where you are right now on the following feelings: On a scale from 1 – 5 with 1 being not at all and 5 being very alert, how alert are you feeling right now, in this moment?** Circle their

ranking in black ink. Read through the rest of the questions in the same format. Read the form upside to the client so they can see the scale though you are circling the responses. Then say, "**I'd like you to pay attention to these five symptoms over the next 20 minutes. We will go through the rating scale again in 10 minutes, 15 minutes and 20 minutes to assess the extent to which the medication has taken effect. In the meantime, I have some forms for you to complete.** Hand client the Big-5 and say, "**On this questionnaire, please indicate how strongly you agree or disagree to the questions listed using the scale provided. Please be sure to answer all questions. I will be back in 10 minutes to go over the Positive Symptom Rating Scale again.** Leave the room and close the door behind you.

When you return, collect the Big 5 if it is completed and go over the Positive Symptom Rating scale again repeating the directions, "**I'd like to again have you rate where you are right now on the same feelings. Please rate on a scale from 1 – 5 with 1 being not at all and 5 being very alert, how alert are you feeling right now, in this moment?** Circle their ranking in blue ink. Read through the rest of the questions in the same format. Read the form upside to the client so they can see the scale though you are circling the responses. Hand the participant the *Subjective Performance Rating Scale* and say, "**Please complete this form regarding which tasks you think you performed best on and answer all questions and I will return in 5 minutes."** Leave the room and close the door behind you.

When you return, collect the completed sheets and go over the Positive Symptom Rating scale again repeating the directions, "**I'd like to again have you rate where you are right now on the same feelings. Please rate on a scale from 1 – 5 with 1 being not at all and 5 being very alert, how alert are you feeling right now, in this moment?** Circle their ranking in red ink. Read through the rest of the questions in the same format. Read the form upside to the client so they can see the scale though you are circling the responses. Hand the participant the *Daily Sleep and Caffeine Questionnaire* and say, "**Please complete this form regarding your sleep and daily caffeine usage. Answer all questions and I will return in 5 minutes."** Leave the room and close the door behind you.

When you return, collect the completed sheets and go over the Positive Symptom Rating scale again repeating the directions, "**For the last time, I'd like to have you rate where you are right now on the same feelings. Please rate on a scale from 1 – 5 with 1 being not at all and 5 being very alert, how alert are you feeling right now, in this moment?** Circle their ranking in purple ink. Read through the rest of the questions in the same format. Read the form upside to the client so they can see the scale though you are circling the responses. Hand the participant the *Physical Symptom Checklist II* and say, "**please check yes or no if you are currently experiencing any of these symptoms."** Once completed, say, **"Now I am going to measure your blood pressure and heart rate using this wrist monitor, you will feel a slight squeeze."** Place the monitor on whichever wrist does NOT have anything on it. If heart rate is above 160 bpm, the participant cannot participate. Additionally, if at any point throughout the session, the participants' heart rate exceeds 160 bpm, the session will need to end for the safety of the participant.

If the person has not yet finished the measures, take them at the 20-minute mark and let the person know they can finish them after the second administration of the neuro battery.

ADMINSTRATION II

Say, "**Now we will be repeating the four tasks in the same order but utilizing different forms. We will start with**... (tell the participant which task you will be starting). Directions are as follows:

d2 Test of Attention

You will need your directions, a stopwatch/timer and the recording blank. The participant will need a pencil for this task.

Directions: **"With the help of the following task, I would like to see how well you can concentrate on a particular task."** Place d2 recording blank in front of participant. **Please pay attention. After the word 'examples' on your recording blank you see three small letters marked with dashes. These are the letter 'd' as in dog and each is marked with two dashes. The first 'd' has two dashes on the top, the second has two on the bottom, and the third 'd' has one dash on the top and one on the bottom, still making two dashes all together. I would like you to cross out every letter 'd' that has two dashes by making a single line through the letter. Try doing this first with the three examples, then try the practice line. You are not supposed to cross out the other letters. Thus a 'd' which has more than two or fewer than two dashes should not be crossed out, and the letter 'p' as in pig should never be crossed out, no matter how many dashes it has. Do you have any questions right now?"** Repeat any directions or answer any questions if applicable. Hand participant pencil.

"Let's take a look at whether you have crossed out all the right letters. Every one of the letters in the practice line has a number underneath it. I'll slowly read out the numbers of the letters which you were asked to cross out. You can see whether you have overlooked any of the letters, or whether you have perhaps crossed out too many. You were expected to cross 1, 3, 5, 6, 9, 12, 13, 17, 19 and 22. Did you cross out all of these numbers? Did you cross out more or fewer letters? If so, you can correct these mistakes by crossing the letter out with a second line. Do you have any questions?"

"Please do not turn your recording blank over yet. Please put your pencil down for a moment and listen carefully. Like last time, on the other side of your recording blank, you will see 14 lines. For each one of the 14 lines, start on the left side, work to the right and cross out each 'd' with two dashes. After 20 seconds I'll say 'stop next line' and you will stop working on that line and immediately start working n the next line. After another 20 seconds, I'll say 'stop next line' and you will immediately start working on the next line. Work as quickly as you can without making mistakes."

"Now please turn the page over so that the first line is on top. In the upper left hand corner you will see an arrow pointing to where you should start working on the first line. Pick up your pencil and when I give the order, start working on the first line. Ready, set, go!" Start the timer when you say "go!" and after 20 seconds, say "stop, next line" which is repeated every 20 seconds until the test is completed at which point timing is stopped. The timer should not be stopped at the end of every line, since this would provide extra time. You will say, "stop, next

line" at 20 seconds, 40, seconds, 1 minute, 1.20, 1.40, 2 minutes, 2.20, 2.40, 3 minutes, 3.20, 3.40, 4 minutes 4.20 and 4.40 minutes. Take pencil away from participant.

Passage Comprehension

You will use the directions sheet with a picture of a stick figure and a house along with the corresponding Passage Comprehension A or B reading sheet for this task. Your recording blanks will be separate for A and B. On your answer sheet, circle the correct answer the participant provides. If they provide an incorrect response that is provided on the form, circle the incorrect answer. If it is not listed, write down the incorrect response and check the number so it is obvious this item was incorrect.

Directions: **Look at this picture** point to the sentence and say: **Listen. This says, "The house is bigger than the…**(pause)." Point to blank line in sentence. **What word belongs in the blank space?**

Correct answers include: man, woman, lady, boy, girl, child, daddy, mommy, person, figure

Error: **The answer is "man." The house is bigger than the man." Now try it again. The house is bigger than the…**(pause). Point to blank line in sentence. **What word belongs in the blank space?**

Now, read this item to yourself and tell me one word that goes in the blank. Do not read items or tell subjects any words during this test. If no response after 30 seconds, point to the next item and say: **"Let's try this one."** Do not give the participant any indication if the answer is correct or incorrect. Just encourage them to try their best on the task.

Digit Span

There will be two parts to Digit Span: forward and backward. You will use the form to write down participant responses and s/he will not be doing any writing for this task. Write down exactly what the participant says on the form. If the participant says they do not remember or know the numbers, write 'DK' in the blank. If they guess numbers, write them down.

Directions Forward: **I am going to say some numbers. Listen carefully, and when I am through, I want you to say them right after me. Just say what I say.**

Directions Backward:

Now I am going to say some more numbers. But this time when I stop, I want you to say them backward. For example, if I say 7-1-9, what would you say?

(Examinee responds 9-1-7, say "**That's right.**")

If examinee responds incorrectly, say: **No, you would say 9-1-7, I said 7-1-9, so to say it backward, you would say 9-1-7. Now try these numbers. Remember, you are to say them backward: 3-4-8**

(Examinee responds 8-4-3, say "**That's right.**")

PASAT

You will be using the computer and a recording form for this task. The participant will not need any materials.

Form Completion: To complete the form, place a check next to all correct answers (✓). Write in any incorrect responses in the space provided. Place a dash when no response was given (-). If the patient corrects him/herself after giving a response, count the amended answer as the response. The amended response is the one that will be used in determining the total correct, regardless of whether it was the correct or incorrect response. Slash through the old response and write in 'SC' with a circle around it to indicate that the patient self-corrected.

Directions: **"On this tape you are going to hear a series of single digit numbers that will be presented at the rate of one every 3 seconds. Listen for the first two numbers, add them up, and tell me your answer. When you hear the next number, add it to the one you heard on the tape right before it. Continue to add the next number to each preceding one. Remember, you are not being asked to give me a running total, but rather the sum of the last two numbers that were spoken on the tape."**
"For example, if the first two numbers were '5' and '7', you would say '12.' If the next number were '3', you would say '10.' Then if the next number were '2', you would say '5.' If the participant is having difficulty understanding these instructions, write 5, 7, 3 and 2 on a sheet of paper and repeat the instructions, demonstrating how the task is done.

"This is a challenging task. If you lose your place, just jump right back in – listen for two numbers in a row and add them up and keep going. There are some practice items at the beginning of the tape. Let's try those first."

-Play the sample items, stopping the tape after the last practice item. Repeat the practice items if necessary until the subject understands the instructions (up to three times).

- If the participant begins to give you a running total, stop the practice immediately and explain the task again emphasizing that s/he is not give you a running total. Then start the practice items again from the beginning.

- If the participant merely makes a math error, do not stop the tape; continue with the practice items. After two consecution no responses, prompt him/her to resume by saying, **"Jump back in with the next two numbers you hear."**

Once it is clear that the participant possesses sufficient understanding of the task, begin Part I. Before staring Part I, remind the participant by saying, **"Now that you know how to do the task, we're going to begin. Remember if you get lost, just jump back in because I can't stop the test once it has begun."** Discourage talking and oral calculations during the test; only the patient's answers should be spoken aloud. *The participant may need prompting to continue the test if s/he gets lost. After 5 consecutive no responses, redirect the patient quickly by saying* ***"jump back in****" but do not stop the tape.*

Before Part 2 say**, "There is a second part to this test, identical to the first, except that the numbers will come a little faster, one every 2 seconds. Let's try some practice items."**
Following the practice, say, **"Now that you know how to do the task, we're going to begin. Remember if you get lost, just jump back in because I can't stop the test once it has begun."**

ENDING

Hand the participant the *Physical Symptom Checklist III* and ask, "**Please complete this form once again with how you are feeling at this moment."** Once finished, "**I will take your blood pressure and heart rate one final time."**

Hand the participant the *Subjective Performance Rating Scale* and say, "**Please complete this form regarding which tasks you think you performed best on and answer all questions."**

Lastly, if the participant was in the experimental condition, hand the client the *Manipulation Check* and say, "**We want to know how you felt the pill affected you, please complete this questionnaire."**

If the person did not complete all measures from the break, have them finish these measures at this time.

You will now need to debrief the participant. Read the *debriefing form* to the participant and ask, "**Do you have any questions? This debriefing form is yours to take."** If they have no questions, ask them to "**please do not discuss the experiment with other students as we are still collecting data and due to the deceptive nature of the experiment, it would harm the purpose if students were aware they were taking a placebo and not an actual stimulant medication."** If they choose not to take the form, just recycle it for another participant.

Give the participant back his/her belongings from the Participant box.

SCORING PROCEDURES

All scoring can be done during the break if you have time or following the experiment. Scoring should occur the same day as the administration.

<u>d2 Test of Attention</u>
Use the 2 scoring keys for this that overlay the answer sheet. In the TN column, tally the total number of correct slashes. In the E1 column, total the number of slashes that were skipped over and in the E2 column, total the number of slashes that were made and shouldn't have been. Make sure you total across each row and then grand totals at the bottom of the scoring.

<u>PASAT</u>
Total the number correct, the number wrong, and the number of items with no responses for the first and second parts of the test separately and then combine them for overall scores. This can be written on the bottom of the testing form.

<u>Digit Span</u>
Total the number correct (each number has 2 trials, 1 point per trial). Write the number correct at the top of the page and circle it.

<u>Passage Comprehension</u>
At the top of the scoring page/packet, put the total number correct and circle the number.

Vita

Samantha Jayne Lookatch was born in Waukesha, WI to her parents Sandra and Richard Lookatch. She is the third of four children: Sara, William and Alexander. Sam attended Bethesda Elementary School, Morgan Butler Middle School and then Waukesha West High School. Subsequently, she earned a Bachelor's degree in Psychology and Women's Studies from the University of Wisconsin, Madison. She earned her degree in three years in May 2007. After taking a year off, she headed east to earn her Master of Arts in Clinical Psychology at Towson University under the mentorship of Dr. Elizabeth Katz. While working on her MA, Sam became interested in substance abuse research and completed an internship at Johns Hopkins, working with pregnant women struggling with addiction, and with adults in an intensive outpatient program. Upon completion of her MA program in May 2010, Sam took a position as a substance abuse counselor in the program she had previously interned at Johns Hopkins.

In 2011, she decided to continue her graduate work and accepted a graduate teaching assistantship in Clinical Psychology at The University of Tennessee, Knoxville, where she began working under the mentorship of Dr. Todd Moore. Along with pursuing her PhD in Clinical Psychology, Sam decided to pursue a Graduate Certificate in Women's Studies as well, and completed this coursework in May 2015. Following completion of course requirements, Sam was accepted to complete an internship at Hazelden/Betty Ford Foundation starting August 2015. This marks the final step in satisfying requirements for her doctoral degree and she plans to graduate in December 2016.