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A comparison of attention bias paradigms related to insomnia

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A COMPARISION OF ATTENTION BIAS PARADIGMS

RELATED TO INSOMNIA

by
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Dedication

I would like to dedicate this to my parents, Micheal and Mary Maloney.

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I would like to thank Bonnie Angelone, Ph.D for all of her help and guidance through this thesis process. A thank you to Tomas Dinzeo, Ph.D for participating as a second reader and helping out whenever I asked. A final thank you to the 2013 cohort of Rowan's Clinical Mental Health Counseling, we got through it all and then some.

Abstract

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Attentional bias to sleep related stimuli by poor sleepers has been reported as a factor in initiating and maintaining sleep disturbance. In this study, three paradigms (Flicker, Posner, and Stroop) were used in comparison to further investigate the role of attentional biases in Primary Insomnia. Participants (n=117) were split into good sleepers and poor sleepers using a median split with the Pittsburgh Insomnia Rating Scale (PIRS). Using the Center for Epidemiologic Studies Depression Scale (CES-D) as the covariate, two-way mixed modality ANCOVAs were conducted for each paradigm revealing no significant differences in word type, quality of sleep, or the interaction of these variables. Using only the poor sleepers, a one-way ANOVA was conducted to compare the paradigms to each other revealing no significant difference in how attentional bias is measured by them. There does not seem to be a relationship to sleep distress and attentional bias in the current sample. The findings may suggest a difference in the perception of sleep distress for the college population.

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Chapter 1

Introduction

Primary Insomnia (PI) is a clinical diagnosis with a prevalence rate impacting approximately 6-10% of the general population (American Psychiatric Association [APA], 2000; Ohayon, 2002; Carey, Moul, Pilkonis, Germain, & Buysee, 2005; Gradinger, 2011), and 9.4% of college students are diagnosed with PI each year (Taylor et al., 2011; Johnson, Roth, Schltz, & Breslau, 2006). Symptoms of PI include a complaint of struggling to initiate sleep, difficulty maintaining sleep, or a lack of restorative sleep. These symptoms must persist for at least one month and cause clinically significant impairment to an individual (APA, 2000). Insomnia is prevalent as a primary, or main, disorder but it also presents co-morbidly or as a symptom of other mental health disorders. Insomnia impacts those with mood disorders, substance use disorders, eating disorders, and is frequently associated with general medical conditions (APA, 2000).

There are several factors of insomnia that are not simply translated into diagnostic criteria such as thoughts involving sleep, the impact of mood (especially depression) on sleep, and attention to objects, such as an alarm clock, during sleep onset (Carey et al. 2005; Pigeon, 2010; Woods, Machetti, Beillo, & Espie, 2009; Uchiyama et al., 2011). Along with current diagnostic criteria, research has focused on examining sleep as it relates to visual attention. (Spiegelhalder, Espie, Nissesn, & Reimann, 2008). Evaluating attention as it relates to insomnia helps extend the understanding of the function and diagnosis of insomnia. One such area of research has focused on the examination of attentional biases, which have been investigated with several psychological disorders.

Attentional bias refers to a person's tendency of attending to stimuli in the environment that are related to their area of concern (possibly threatening) compared to other, similar neutral or non-threatening stimuli (Smith, Larsen, Chartrand, Cacioppo, Katafiasz, & Moran, 2006). Often this is examined by looking at performance on one of several different kinds of visual tasks; some of these tasks ask participants to detect when a change to the stimulus occurs or when a new stimulus appears (McCabe, Gotlib, & Martin, 2000; McCabe & Gotlib, 1995; Rensink, 2002; Cole & Kuhn 2009). There have been studies of attention bias focusing on specific aspects of personality (Smith et al., 2006), as well as investigations involving specific diagnoses, such as Attention Deficit Hyperactivity Disorder (ADHD; Alvarez & Freides, 2004) and Anxiety (Bar-Haim, 2010). In addition, there have been studies to examine attention bias with depression, (McCabe & Gotlib, 1995) drug and alcohol usage (Sharma, Albery, & Cook, 2001; Jones, Macphee, Broomfield, Jones, & Espie, 2005), disordered eating (Faunce, 2010), and various anxiety disorders (Clarke, MacLeod, & Guastella, 2013). A study was conducted to compare if individuals diagnosed with Primary Insomnia (PI) would have an attentional bias for sleep related words in a dot probe task (MacMahnon, Broomfield, &Epsie, 2006). The researchers identified an attentional bias was evident for sleep related words in the PI group because the PI group responded more quickly to sleep words than good sleepers. Studies have employed many different tasks in making conclusions about the effect of attentional biases on personality characteristics and other mental health concerns.

Attentional biases are often examined using various paradigms, including the Posner paradigm, modified Stroop paradigm, Flicker paradigm, dot probe paradigm, rapid serial visual presentation (RSVP) task, and other audio visio tasks (Neubauer, Reinman, Mayer, & Angleitner, 1997; MacMahnon, Broomfield, &Epsie, 2006; Jones, Macphee, Broomfield, Jones,

& Espie, 2005; Bredmeir, Berenbaum, Most, & Simons, 2011). The Flicker Paradigms was first introduced by Rensink, O'Regan, and Clark (1997) as a change blindness task in order to examine the limits of visual attention. Observers compare two photos to spot the difference; the images are displayed in a flicker, with the original image, changed image and blank screen quickly presented in a loop until an individual identifies the change (Rensink 2002; Simons & Rensink, 2005;Rensink, O'Regan, & Clark, 1997). More recent research has employed this paradigm to examine attentional bias, for example Jones et al. (2005), showed observers an array of multiple objects, followed by that same array with an altered object, either sleep related (a bear was replaced by slippers) or neutral (gloves were replaced with a notebook). Participants were asked to report the change as quickly as possible. When a sleep related object was changed, poor sleepers responded more quickly than good sleepers. These findings among others suggest that poor sleepers attend to sleep related objects more quickly and frequently, which is evidence for an attentional bias (Marchetti, Biello, Broomfield, MacMahon, & Espie, 2006; Balagrove & Wilkinson, 2010; Jones, Macphee, Broomfield, Jones, & Espie, 2005). For those who may be suffering from insomnia their attention being maintained on sleep related objects (stuffed animals, clocks, or pillows) might lead to mental perseveration about sleep, and preventing sleep from initializing.

Another attentional paradigm commonly used to study attentional biases in individuals with insomnia is the Posner paradigm. In this task, two fields, outlined by individual black boxes, on the left and right side of the screen are presented to the participant with a fixation cross in the middle. Within one of the fields, a photograph or word is quickly flashed, followed by the flash of two dots, aligned vertically or horizontally, the dots are presented in the same or opposite field as the word or photograph. The participants' task is to determine whether the dots

were in a vertical or horizontal orientation. If the dots appear in the same box as the word or photograph it is considered a valid trial, if they appear in the opposite field it is considered an invalid trial (Posner, 1980). Typically, a slower response for invalid trials indicates a stronger attention bias. For example, Woods et al. (2009) used clock monitoring as the focus of a Posner paradigm. The picture used for the paradigm was an alarm clock displaying a time, either related (3:00 AM) or unrelated (1:00 PM) to sleep. Participants were separated as good and poor sleepers using the Pittsburgh Sleep Quality Index (PSQI). For poor sleepers, when the alarm clock displayed a sleep related time (e.g. 3:00 A.M.) participants had slower reaction times for invalid trials and quicker reaction times for valid trials. For good sleepers, there was no significant difference between sleep related and sleep unrelated times. This differing performance for good and poor sleepers suggests an attentional bias for sleep related stimuli (Woods et al., 2009).

In the original Stroop task, color words (blue, red, green, etc.) are presented in different colored ink (the word blue written in red ink) this causes interference in reporting the ink color over reading the written word due to conflicting sensory information (Stroop, 1935). In later versions this concept was modified to examine clinically relevant populations. This modification was referred to as the modified Stroop task or paradigm. In the modified Stroop paradigm individuals are shown clinically relevant (e.g. words related to a diagnosis), and non-threatening words written in different colors. Participants are then asked to report the color the word is presented in. An increase in attention bias for the clinically relevant words is observed as the participant responds more slowly to the emotionally activating word compared to neutral words (Spiegelhalder, Espie, & Riemann 2009). Typically, poor sleep quality was related to slower reaction times for sleep related words, (e.g. bed or pillow), compared to neutral, or non-sleep

words, (e.g. sky or tub). This shows that words related to sleep maintain a poor sleeper's attention better than non-sleep words.

Studies from our research lab have obtained differing results using the Flicker paradigm. Our research has indicated Flicker may provide evidence for attentional bias in separate ways, such that clinically impacted individuals respond slower to relevant stimuli. We have not yet compared different paradigms to examine this effect further. Other research has compared the modified Stroop task and a mixed visual auditory task, however, it is the only sleep related research that has compared two paradigms within the same experiment (Spiegelhalder et al., 2008). Comparing paradigms is important because it allows investigation into how the participants score on different attention paradigms. Using these 3 different paradigms with inherent methodological differences may be leading to inaccuracies in measuring and examining attentional biases. It is possible that one type of task is more accurate and stable than others in indicating an attentional bias. The Flicker paradigm in particular has been advantageous since it uses a repeated presentation of original and changed stimuli. However, using the Flicker paradigm to examine biases is relatively new and may or may not be a good measure to use in this this case. One reason for this speculation is that we have used the Flicker paradigm with alcohol, eating, and sleep related stimuli and this has consistently resulted in individuals with higher levels of symptomology demonstrating slower reaction times (not faster as in other studies) for clinically relevant (concern) stimuli. These differences have been observed when using complex life-like scenes. However, in the current study we have chosen the Flicker paradigm with clinically relevant words as the stimuli in an attempt to replicate findings in the literature and maintain continuity between paradigms. In addition, we plan to compare performance on the three most commonly used paradigms discussed here (Posner, modified

Stroop and Flicker). Comparing paradigms, especially in relationship to studying sleep, is an area with little research and should be expanded upon.

The present study will be using three different laboratory paradigms (Flicker, Posner, and modified Stroop) to examine the presence of attentional biases in the development and maintenance of insomnia using a sample of undergraduate students. It is hypothesized that there will be differences between good sleepers vs. poor sleepers for sleep vs. neutral words on each of the paradigms. For the Posner paradigm, poor sleepers will have a slower reaction time than good sleepers when sleep related words are presented for invalid trials. For the Flicker paradigm, poor sleepers will have a slower reaction time than good sleepers when presented with sleep related words (consistent with our previous lab findings). For the Stroop paradigm, poor sleepers will have quicker reaction times when presented with sleep related words. It is also hypothesized that there will be differences between the measurement of attention bias between paradigms.

Chapter 2

Method

Participants

Participants (N = 117) were students enrolled in an Introductory Psychology class at a mid-sized northeastern university in New Jersey. All participants volunteered and completed the tasks as part of their course requirements. Their ages ranged from 18 to 26 (M=19.5) and 54% identified themselves as female. This sample for ethnicity contained 70% Caucasian individuals, 10% African American, 7% Latin American, 10% Asian or Pacific Islander, and 3% identified another ethnicity. For class standing 58% were Freshman, 15% were Sophomores, 15% were Juniors, and 12% were Seniors.\

Measures

The participants were asked to complete two self-report surveys. The first was the Center for Epidemiologic Studies Depression Scale (CES-D: Radloff, 1977). This is a 20-item scale assessing depressive symptoms over the previous week based on a four point Likert rating ranging from 0 (rarely or none of the time) to 4 (all of the time). The CES-D has a range from 0 to 60. This item has four reversed scored items, and the summed score represents level of depression score. A score of less than 15 indicates minimal depression, a score from 15 – 21 represents mild to moderate depression, and a score over 21 indicates the possibility of major depression. Previously the CES-D was reported to have an internal consistency of ~.85 in the general population (Radloff, 1977).

Participants were also asked to complete the Pittsburgh Insomnia Rating Scale (PIRS: Moul, Pilkonis, Miewald, Carey, & Buysse, 2002; Moul, Hall, Pilkonis, & Buysee, 2004). This 65-item instrument is rated on a four point Likert-type scale from 0 (not bothered) to 3 (extremely bothered). The PIRS has three subscales as well as a total score that can be calculated. The first is a sleep distress subscale, which is how much distress the sleep disturbance is causing the individual. This is a 46-item subscale with a possible range from 0 (not bothered) to 138 (severely bothered). The 10-item sleep parameters subscale investigates duration and time to initialize sleep; this subscale has a range of 0 (good sleep) to 30 (disturbed sleep). The 9-item quality of life subscale monitors how the insomnia symptoms are impacting an individual's life, with a range from 0 (excellent) to 27 (poor). The total score is comprised of adding all 65 questions together ranging from 0 (good) to 195 (poor). Participants must answer 61 of the questions for the overall scale, 44 items on the sleep distress subscale, 9 items on the sleep parameters subscale, and 8 items on the quality of life subscale to obtain an accurate score. The PIRS has been shown to have good test-retest reliability as well as good concurrent validity with the Pittsburgh Sleep Quality Index (PSQI: Moul, Pilkonis, Miewald, Carey, & Buysse, 2002).

Visual Tasks

Participants completed the Posner paradigm, the modified Stroop task or the Flicker paradigm with the same set of words (word list can be found in Appendix A; developed from word sets found in Taylor, Espie, & White, 2003; Sagaspe et al., 2006). In the modified Stroop task the participant saw a word, either sleep related or neutral and their task will be to indicate the color of the presented word (green or red). In the Posner paradigm participants saw two outlined fields to the right and left of the fixation cross in the center. On each trial, a word

appeared in one of the outlined fields for 250ms followed by a blank screen for 50ms. Then two dots, either horizontal or vertical in orientation, appeared until the participant responded to whether the dots are horizontal or vertical. In the Flicker paradigm, which traditionally uses flickering pictures, participants saw a word with one difference, such as a letter that is changed in color or case (upper case to lower case). The first word was shown for 250ms followed by a gray mask for 80ms then the second word appeared for 250ms with another gray mask after. This process was repeated until the participant indicated seeing the change or 60 seconds elapsed. Examples of paradigms can be found in Figure 1.

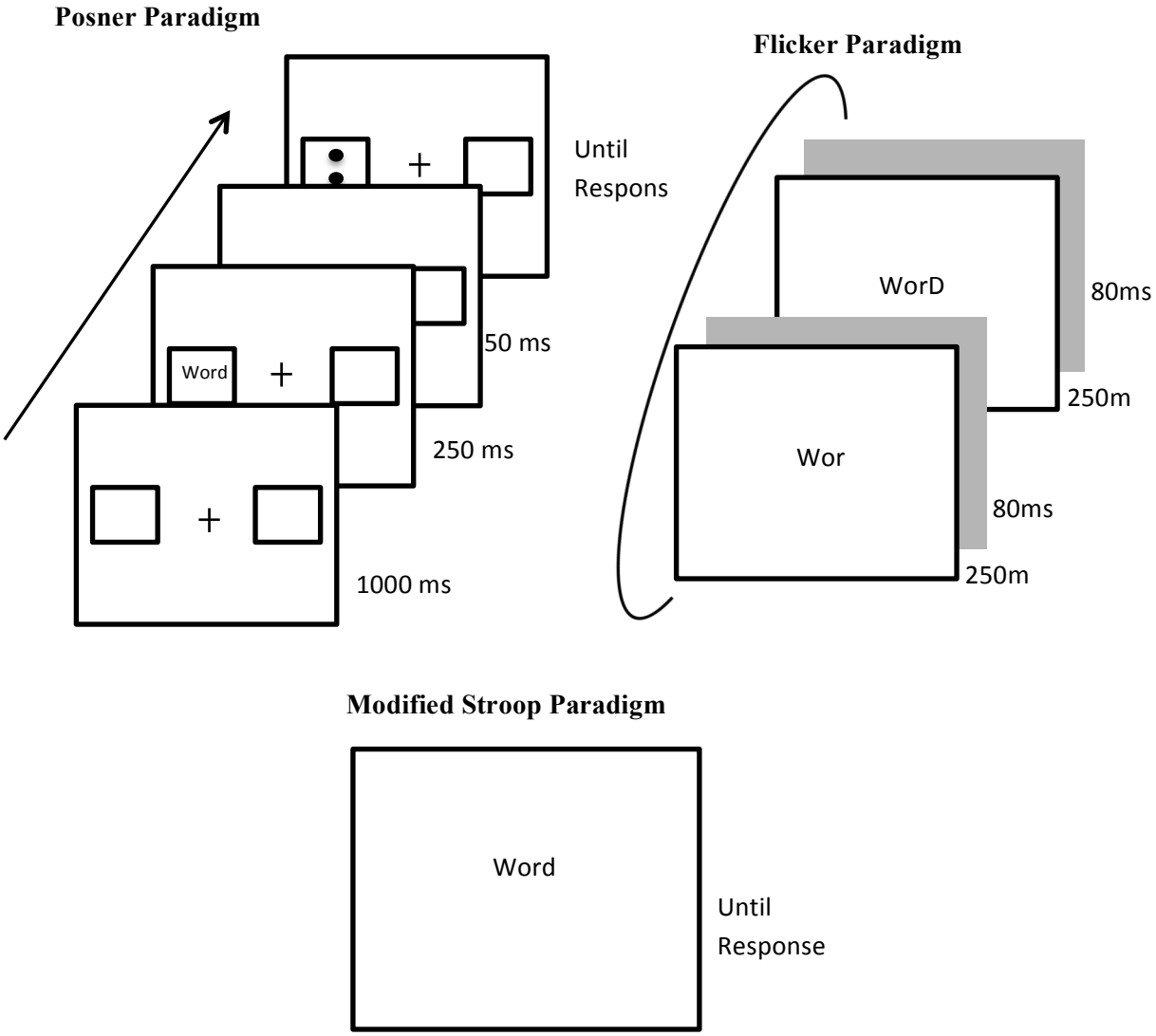

Figure1. Depiction of trial sequences for each paradigm.

Procedure

Participants completed the experiment in small groups of 1-10 people. The experimenter briefed participants and informed consent was obtained. The participants were randomly assigned to complete one of the paradigms, the Posner, Flicker, or modified Stroop

task. The participant completed the demographic survey, PIRS, and CES-D. The participants were debriefed, and given contact information for the counseling center.

Power Analyses

Estimated sample size was estimated using commercially available software (Power Calculator; G* Power: Faul, Erdfelder, Buchner, & Lang, 2009; Effect Size Generator, Devilly, 2004). Effect sizes were calculated based on an article by Spiegelhalder, Espie, Nissen, and Reiman (2008). Effect size for this study fell into the moderate range.

According to the power analyses, the minimum sample of 77 would be necessary to identify a significant relationship between insomnia severity and attention assuming a moderate effect size (r=.15), 2 predictors, word type and quality of sleep, in the model, and using a .05 confidence level to ensure a 95% likelihood of identifying the relationship. If these parameters are met the power for the proposed study would be .80 for the relationship, suggesting that the relationship would be sufficiently powered.

Chapter 3

Results

For the Posner and Stroop tasks, reaction time and correct responses were recorded for each trial. In addition, participants' accuracy on these tasks was above 95% correct for reporting color or alignment of dots, so the remainder of the analyses were conducted on reaction time. No exclusions were made for the Stroop or Posner paradigms. For the Flicker task only reaction time was recorded for each trial. Data was excluded for trials that were completed before the participant could see the complete Flicker (350ms and faster) and trials that took longer than 10000ms, which suggests participants did not see the change. This resulted in 14% of the trials being eliminated from the Flicker paradigm.

The total PIRS score was correlated to the CES-D for all three paradigms: Flicker ($n=41$; $r=.548$, $p<.01$), Posner ($n=37$; $r=.763$, $p<.01$), and Stroop ($n=39$; $r=.652$, $p<.01$). This suggests that the CES-D should be used as a covariate to account for depressive symptoms that may play a role in reaction time performance. Good and Poor sleepers were determined by splitting the PIRS using the median score for each paradigm Flicker (Mdn = 52), Posner (Mdn = 44), and Stroop (Mdn = 44), and then participants were separated into the two groups with higher scores indicating poor sleepers and lower scores being good sleepers.

Mixed Two-Way ANCOVAs were utilized to analyze the data with word type as the within subjects factor (sleep words, neutral words) and quality of sleeper as the between subjects variable based on the median split described above (good sleepers (GS) n=58, poor sleepers (PS) n=59) and the CES-D as the covariate. For the Flicker Paradigm (GS n=21, PS n=20) no significant difference was found for word type ($F(1,38) = 2.534$, $p=.12$), quality of sleeper (F

(1,38) = 1.230, p=.274), or for the interaction (F (1,38) = 2.193, p=.147; see Figure 2). Nor were there significant results for the Posner paradigm (GS n=19, PS n=18) for word type (F (1,31) = 0.525, p=.474), quality of sleeper (F (1,31) = 1.857, p=.183, or the interaction (F (1,31) = 0.074, p=.787; see Figure 3). No significant results were indicated by the Stroop paradigm (GS n=20, PS n=19) for word type (F (1,33) = 0.620, p=.628), quality of sleeper (F (1,33) = 2.980, p=.094), or the interaction (F (1,33) = 0.671, p=.419; see Figure 4).

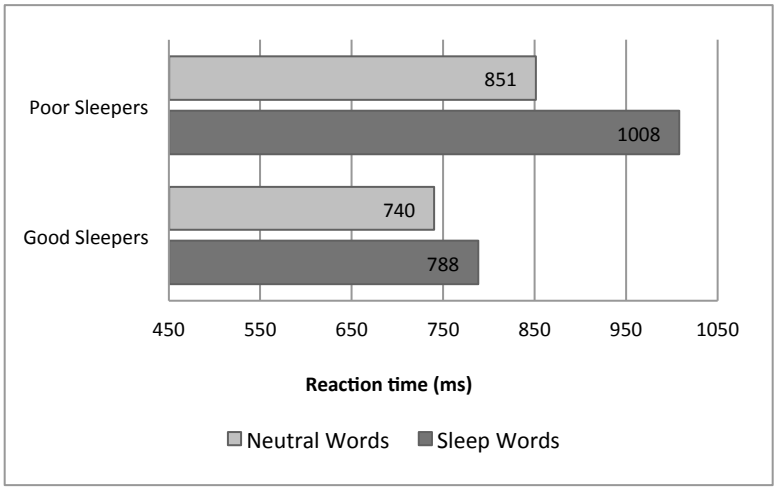

Figure 2 Mean reaction times for the Flicker paradigm grouped by quality of sleeper and word type.

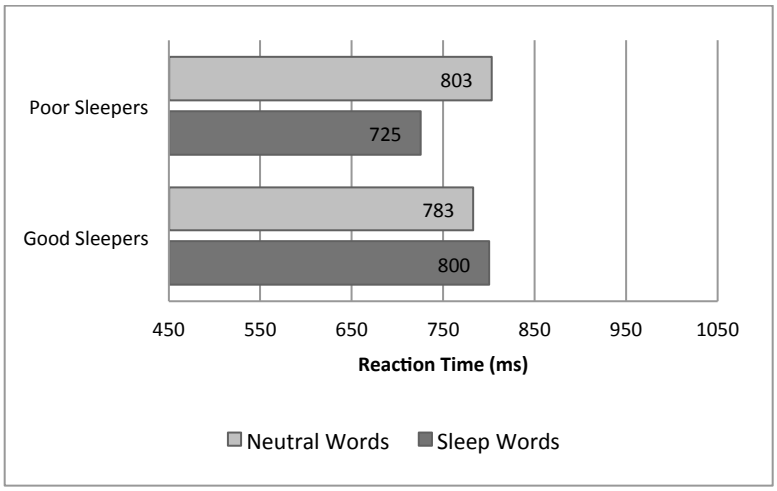

Figure 3 Mean reaction times for the Posner paradigm grouped by quality of sleeper and word type.

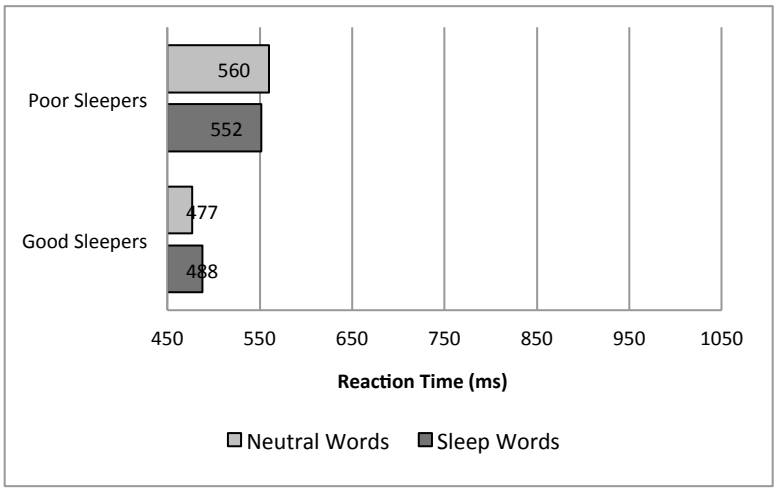

Figure 4 Mean reaction times for the Stroop paradigm grouped by quality of sleeper and word type.

In order to compare whether there were differences in how each paradigm measured attentional biases, a one-way ANOVA was conducted on an attentional bias difference score for

each paradigm. The difference score was calculated for individuals in the poor sleep group only in each paradigm Flicker (M=157 SD=275), Posner (M=79, SD=273), and Stroop (M= -8, SD=49). For each participant, a difference score was calculated in accordance with the typical attention bias finding for that particular paradigm. Mean reaction time for the neutral images was subtracted from the mean reaction time for sleep images or vise versa. As such, for the Flicker and Stroop tasks, a positive score indicates sleep stimuli were reacted to more slowly than neutral stimuli and a negative score indicates that neutral stimuli were reacted to more quickly than sleep stimuli. For the Posner paradigm, a positive score indicates that the participants reacted more slowly to neutral stimuli than sleep stimuli. The farther away from zero the difference score (in either direction depending on the particular paradigm), the higher opportunity for an attentional bias to exist. This difference score was used to conduct a one-way ANOVA comparing the paradigms. No significant difference was indicated between the paradigms ($F(2, 53) = 2.690$, $p=.078$).

Chapter 4

Discussion

This study applied three different paradigms to examine how each may differentially measure attentional biases toward sleep related words. There was no evidence of an attentional bias using any one of the three paradigms (non-significant interactions for sleep quality and word type). In addition, there was no difference between each paradigm in the way attentional biases are measured. This suggests that the paradigms are similar in the measurement of attentional biases even though we found no evidence for an attentional bias with the paradigms individually. No interaction between word type and sleep quality implies that there is no attentional bias toward the sleep related stimuli in the current study. These paradigms utilized single word stimuli in each trial and showed no evidence that poor sleepers were biased toward sleep related stimuli.

Results of this study indicate that attention paradigms may not an effective measure of insomnia severity imply that treatments such as attention bias modification (ABM) alone may not be effective in treating insomnia. However other studies have found attentional bias for poor sleepers therefor there may be treatment benefit in ABM. ABM has been frequently used to treat anxiety disorders and Attention Deficit Hyperactivity Disorder (ADHD) and has been speculated to be an effective treatment for insomnia (March, 2010). It is usually conducted by presenting an individual with two concurrent stimuli (one clinically relevant and one neutral) followed by a cue that the participant is asked to attend to. Eye trackers and location-reporting devices are used to monitor an individual's reaction to the stimuli. Through repeated exposure and alterations in timing (presenting the neutral stimuli shortly before the threatening stimuli) cause the individual

to attend to the neutral stimuli instead of the disorder relevant stimuli. This has been shown to be effective with disorders such as ADHD, Anxiety, and alcohol use but has not been tested for effectiveness with insomnia. Alcohol dependence has been successfully treated using ABM, this may provide a methodology for creating AMB for sleep. Eberl et al. (2013) used ABM along with CBT in an inpatient facility for individuals with alcohol dependence and found that ABM added to the effectiveness of therapy and maintained long-term effects more often. This research presented participants with a succession of pictures of either alcoholic containers or soft drink containers. The participants were asked to record the orientation of the picture; for landscape orientation, participants pushed a joystick, and for portrait they pulled the joystick. Pictures were oriented, such that the participant must push the joystick for all alcohol containers and pull the joystick for all soft drink containers. The push of the joystick is an avoidance measure and a pull of the joystick is an acceptance movement. With this persistent repetition, participants' attention biases were modified. This resulted in a reduction in participants' alcohol intake. Another study was conducted using a modified Stroop format to train attention and ABM training reduced the bias toward alcohol related stimuli for hazardous and harmful drinkers. In Fadardi and Cox's (2009) research they presented participants with a picture of alcoholic or non-alcoholic containers outlined in one of four colors which participants were asked to report. After two series of 50 trials of reporting on both, participants are asked to report only the color of the outline for non-alcoholic beverages while ignoring the alcoholic ones for 50 trials. This achieved a change by providing positive feedback to quicker reaction times in the third series on the non-alcoholic drinks and negative feedback when responding to an alcoholic container or slightly more than their average on non-alcoholic containers. Though previous research has found a bias toward sleep stimuli, the current study may be evidence that ABM treatment alone

would not be sufficient (Jones et al., 2005; Marchetti et al. 2006). An evidenced based alternative to ABM is short term Cognitive Behavioral Therapy (CBT; Gellis, Arigo, & Elliott, 2013).

CBT for insomnia and other sleep problems focuses upon creating a sleep schedule and maintaining use of the bed for only sleep (Wang, Wang, & Tsai, 2005). This has been shown effective and lessens anxiety around sleep or lack of sleep. Someone experiencing sleep difficulty can experience symptomatic relief from counseling in as few as 7 sessions. These sessions often focus on treatment such as creating a sleep schedule and domain setting, or making the bed a "temple for sleep." Having evidenced based and effective treatment for Insomnia is important, as six to ten percent of the population met the criteria for Insomnia disorder and that number only grows when comorbidity is factored in (American Psychiatric Association, 2013). Certain populations are at a higher risk of developing symptoms of insomnia. One such group is the college population due to change of lifestyle and freedom that does not demand an exact schedule for sleep.

Insomnia often appears to be a common aspect of college life due to high workload and frequent reports of sleepless nights (Taylor et al., 2011). Up to this point, research surrounding Insomnia and sleep distress utilizes healthy controls compared to a clinically impacted population either in or seeking treatment for insomnia. College students more often function as the "health controls" though this may not be an accurate control group with good sleep habits. The college population may engage in avoidant insomnia, meaning, in the setting of undergraduate institutions, it is expected to frequently engage in fewer hours of sleep therefore the perceived impact of the sleep deprivation is lessened due to norming expectations. This may alter the perception of what poor sleep is, in this population. For instance, if staying up till 3 AM

to finish a project is something a college student expects to do even with a 9 AM class the next day they may not experience the same distress level as someone who lies awake without sleep or an individual in the workforce that must remain up late to finish work from their job. On the same token, college students can find reasons to stay up later, whether it be socializing, class work, or just browsing the Internet. This altered perception could have had an impact on this study in that college students could be under reporting sleep distress due to these expected norms. This means that the connotation of poor sleep is different to this interest group than it may be to those in treatment for insomnia symptoms. An individual suffering from insomnia, that is not in college, and has fewer distractions for avoiding sleep, may find the distress in Insomnia to be more clinically impairing. The impact from these differences on this study may be significant. This could cause the targeted population (college students) to not have the activation through attention bias as has been previously shown to exist (Marchetti et al., 2006; Jones et al., 2005). This difference in perception of the symptoms of insomnia may impact the responses on self-report measures, especially accurate reports of sleep distress for this population.

Though the Pittsburgh Insomnia Rating Scale (PIRS) is a self-report measure that looks at symptoms of insomnia in a few different ways, it has been shown to align with the PSQI and other sleep inventories; however, it is still a new measure. The focus of the PIRS may be on different symptoms that are more difficult to assess through attention paradigms. Another factor this measure may have had on the current study was the lack of cut off scores for level of impairment. The research in this paper utilized a median split to differentiate good sleepers from poor sleepers, as there were no previous clinical criteria in place. This may have resulted in a grouping of scores that was not representative of the symptomatic implications of the measure of

the participants. In addition, the PIRS may not be sensitive enough to reveal college students' potentially altered perception of sleep quality and distress. This measure may have been a limitation in the focus of the symptoms of insomnia because of its focus on more clinically relevant symptomology.

Limitations

One of the limitations of this study was the utilization of single word stimuli. This type of stimuli may not have yielded the same response as a complex scene or picture, as have been used in previous research. There was no linguistic interpretation of the words used for the neutral and sleep categories to ensure frequency of use, knowledge, and definition of sleep and neutral stimuli were weighted equally. The word stimuli may have also been too simplistic, resulting in frequent fast reaction times due to the low level processing needed to view and understand each stimulus. The words alone may not evoke the same emotional responses needed when an individual views a picture with multiple factors. It is also a possible the participants access the characteristics of the word without the development of a definition or involving any emotional or cognitive implication the word may share with the experienced sleep distress. The simplicity of identifying and responding to a word may have caused a floor effect (everyone reacting quickly) in the present study, particularly for the Stroop paradigm; thus we may have obtained an inaccurate picture of differences for the attentional paradigms. Other limitations may include the use of self-report measures and the utilization of a college sample with no clinical comparision.

Future research could continue to investigate insomnia and other clinically distressing topics using multiple paradigms. Though the between group differences were small in this

study; it would be prudent to conduct a similar experiment involving individuals seeking treatment for insomnia as this population may display a greater difference in sleep quality from good sleepers. It may also be helpful to have all participants conduct trials in all 3 of the paradigms to investigate the possibility of a within subjects difference on these paradigms. Continuing this line of research with methodology used in previous research for the Flicker and Posner paradigm would be of interest to investigate as well. Utilizing pictures for the Flicker paradigm will align with previous evidence of attentional bias and could be of use for comparison when methodology between paradigms is controlled. Similarly, with the Posner paradigm utilizing a familiar object (i.e. alarm clock) for the initial stimuli may result in differences that were not shown in the current study. The assertion of insomnia presenting differently in college students is worthy of further investigation and conceptualization. However, this study provides a basis for the methodology in comparing attentional paradigms that has not previously been conducted. This research also helps broaden the use the PIRS measure.

Appendix A

Sleep Words		Neutral Words	
Sleep	Mattress	Button	Trajectory
Dream	Bed	Address	Path
Snore	Deep	Sandwich	Geometry
Snooze	Blanket	Set	Suggestive
Sleepwalker	Tired	Bottle	Save
Nightmare	Tuck-in	Shuffle	Copy
Insomnia	Rest	Intellect	Grain
Waking	Silence	Nation	Barn
Darkness	Stay-up	Cream	Stamp
Pajamas	Relaxation	Praise	Guild
Doze	Morning	Pear	Foam
Bedroom	Fatigue	Balcony	Amber
Exhausted	Restless	Point	Badge
Sheet	Wakeful	Texture	Ball
Laying	Dark	Drawing	Commerce
Night	Naps	Leaf	Banana
Yawn	Alert	Guess	Nature
Pillow	Fall	Roaster	Dear
Worn-out	Slumber	Shovel	Salad
Bedding	Close	Frame	Playful

References

Alvarez, J. A., & Freides, D. (2004). Research on attention deficit hyperactivity disorder using the covert orienting paradigm of posner. *Developmental Neuropsychology, 26*(2), 627-645. doi:10.1207/s15326942dn2602_6

American Psychiatric Association (Ed.). (2000). *Diagnostic and statistical manual of mental disorders fourth edition text revision*. Arlington, VA: Author.

American Psychiatric Association. (2013) Diagnostic and Statistical manual of mental disorders fifth edition, Arlington, VA: Author)

Bar-Haim, Y. (2010). Research review: Attention bias modification (ABM): A novel treatment for anxiety disorders. *Journal of Child Psychology and Psychiatry, 51*(8), 859-870. doi:10.1111/j.1469-7610.2010.02251.x

Blagrove, M., & Wilkinson, A. (2010). Lucid dreaming frequency and change blindness performance. *Dreaming, 20*(2), 130-135. doi:10.1037/a0019248

Bredemeier, K., Berenbaum, H., Most, S. B., & Simons, D. J. (2011). Links between neuroticism, emotional distress, and disengaging attention: Evidence from a single-target RSVP task. *Cognition and Emotion, 25*(8), 1510-1519. doi:10.1080/02699931.2010.549460

Carey, T. J., Moul, D. E., Pilkonis, P., Germain, A., & Buysse, D. J. (2005). Focusing on the experience of insomnia. *Behavioral Sleep Medicine, 3*(2), 73-86. doi:10.1207/s15402010bsm0302_2

Cavanaugh, J., & Wurtz, R. H. (2004). Subcortical modulation of attention counters change blindness. *The Journal of Neuroscience, 24*(50), 11236-11243. doi:10.1523/JNEUROSCI.3724-04.2004

Clarke, P. F., MacLeod, C., & Guastella, A. J. (2013). Assessing the role of spatial engagement and disengagement of attention in anxiety-linked attentional bias: A critique of current paradigms and suggestions for future research directions. Anxiety, Stress & Coping: An International Journal, 26(1), 1-19. doi:10.1080/10615806.2011.638054

Cole, G. G., & Kuhn, G. (2009). Appearance matters: Attentional orienting by new objects in the precueing paradigm. *Visual Cognition, 17*(5), 755-776. doi:10.1080/13506280802611582

Devilly, G.J. (2004). *The Effect Size Generator for Windows: Version 2.3 (computer programme)*. Centre for Neuropsychology, Swinburne University, Australia.

Eberl, C., Wiers, R. W., Pawelczack, S., Rinck, M., Becker, E. S., & Lindenmeyer, J. (2013). Approach bias modification in alcohol dependence: Do clinical effects replicate and for whom does it work best?. Developmental Cognitive Neuroscience, 438-51.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*, 1149-1160.

Faunce, G. J. (2010). *Eating Disorders and Attentional Bias: A Review.* Eating Disorder: The Journel of Treatment and Prevention. 10(2), 125-139. DOI: 10.1080/10640260290081696

Gellis, L. A., Arigo, D., & Elliott, J. C. (2013). Cognitive refocusing treatment for insomnia: A randomized controlled trial in university students. Behavior Therapy, 44(1), 100-110. doi:10.1016/j.beth.2012.07.004

Gradinger, F. (2011). *The essence of functioning in sleep disorders: Development of a core set of categories of the international classification of functioning, disability and health (ICF)*. LMU München: Faculty of Medicine).

Johnson, E. O., Roth, T., Schltz, L., & Breslau, N. (2006). Epidemiology of DSM-IV Insomnia in Adolescence: Lifetime Prevalence, Chronicity, and an Emergent Gender Difference. *Pediatrics, 117*(2), 247-256.

Jones, B. T., Macphee, L. M., Broomfield, N. M., Jones, B. C., & Espie, C. A. (2005). Sleep-related attentional bias in good, moderate, and poor (primary insomnia) sleepers. *Journal of Abnormal Psychology, 114*(2), 249-258. doi:10.1037/0021-843X.114.2.249

MacMahon, K. M. A., Broomfield, N. M., & Espie, C. A. (2006). Attention bias for sleep-related stimuli in primary insomnia and delayed sleep phase syndrome using the dot-probe task. *Sleep: Journal of Sleep and Sleep Disorders Research, 29*(11), 1420-1427.

March, J. S. (2010). Attention bias modification training and the new interventions research. Biological Psychiatry, 68(11), 978-979. doi:10.1016/j.biopsych.2010.10.007

Marchetti, L. M., Biello, S. M., Broomfield, N. M., MacMahon, K. M. A., & Espie, C. A. (2006). Who is pre-occupied with sleep? A comparison of attention bias in people with psychophysiological insomnia, delayed sleep phase syndrome and good sleepers using the induced change blindness paradigm. *Journal of Sleep Research, 15*(2), 212-221. doi:10.1111/j.1365-2869.2006.00510.x

McCabe, S. B., & Gotlib, I. H. (1995). Selective attention and clinical depression: Performance on a deployment-of-attention task. *Journal of Abnormal Psychology, 104*(1), 241-245. doi:10.1037/0021-843X.104.1.241

McCabe, S. B., Gotlib, I. H., & Martin, R. A. (2000). Cognitive vulnerability for depression: Deployment of attention as a function of history of depression and current mood state. *Cognitive Therapy and Research, 24*(4), 427-444. doi:10.1023/A:1005579719849

Moul, D., Hall, M., Pilkonis, P., & Buysee, D. (2004). Self-report measures of insomnia in adults: Rationales, choices, and needs. *Sneep Medicine Reviews, 8*, 177-198.

Moul,D.E., Pilkonis,P.A., Miewald,J.M., Carey,T.J., & Buysse,D.J. (2002). Preliminary study of the test-retest reliability and concurrent validities of the Pittsburgh Insomnia Rating Scale (PIRS). Sleep 25 Abstract Supplement, A246-A247.

Neubauer, A. C., Riemann, R., Mayer, R., & Angleitner, A. (1997). Intelligence and reaction times in the hick, sternberg and posner paradigms. *Personality and Individual Differences, 22*(6), 885-894. doi:10.1016/S0191-8869(97)00003-2

O'Regan, J. K., Rensink, R. A., & Clark, J. J. (1999). Change-blindness as a result of 'mudsplashes.'. *Nature, 398*(6722) doi:10.1038/17953

Ohayon, M. M. (2002). Epidemiology of insomnia: What we know and what we still need to learn. *Sleep Medicine Reviews, 6*(2), 97-111.

Pigeon, W. R. (2010). Treatment of adult insomnia with cognitive-behavioral therapy. *Journal of Clinical Psychology, 66*(11), 1148-1160. doi:10.1002/jclp.20737

Posner, M. I. (1980). Orienting of attention. The Quarterly Journal Of Experimental Psychology, 32(1), 3-25. doi:10.1080/00335558008248231

Radloff, Lenore Sawer. (1977). The CES-D Scale : A Self-Report Depression Scale for Research in the General Population. *Applied Psychological Measurement.* 1: 385 DOI: 10.1177/014662167700100306.

Rensink, R. A. (2002). Change detection. *Annual Review of Psychology, 53*(1), 245-277. doi:10.1146/annurev.psych.53.100901.135125

Rensink, R. A., O'Regan, J. K., & Clark, J. J. (1997). To see or not to see: The need for attention to perceive changes in scenes. *Psychological Science, 8*(5), 368-373. doi:10.1111/j.1467-9280.1997.tb00427.x

Sagaspe, P., Sanchez-Ortuno, M., Charles, A., Taillard, J., Valtat, C., Bioulac, B., & Philip, P. (2006). Effects of sleep deprivation on Color-Word, Emotional, and Specific Stroop interference and on self-reported anxiety. Brain And Cognition, 60(1), 76-87. doi:10.1016/j.bandc.2005.10.001

Sharma, D., Albery, I. P. and Cook, C. (2001), Selective attentional bias to alcohol related stimuli in problem drinkers and non-problem drinkers. Addiction, 96: 285–295. doi: 10.1046/j.1360-0443.2001.96228512.x

Simons, D. J., & Chabris, C. F. (1999). Gorillas in our midst: Sustained inattentional blindness for dynamic events. *Perception, 28*(9), 1059-1074. doi:10.1068/p2952

Simons, D. J., & Rensink, R. A. (2005). Change blindness: Past, present, and future. *Trends in Cognitive Sciences, 9*(1), 16-20. doi:10.1016/j.tics.2004.11.006

Smith, N. K., Larsen, J. T., Chartrand, T. L., Cacioppo, J. T., Katafiasz, H. A., & Moran, K. E. (2006). Being bad isn't always good: Affective context moderates the attention bias toward negative information. *Journal of Personality and Social Psychology, 90*(2), 210-220. doi:10.1037/0022-3514.90.2.210

Spiegelhalder, K., Espie, C., & Riemann, D. (2009). Is sleep-related attentional bias due to sleepiness or sleeplessness? *Cognition and Emotion, 23*(3), 541-550. doi:10.1080/02699930802022129

Spiegelhalder, K., Espie, C., Nissen, C., & Riemann, D. (2008). Sleep-related attentional bias in patients with primary insomnia compared with sleep experts and healthy controls. *Journal of Sleep Research, 17*(2), 191-196. doi:10.1111/j.1365-2869.2008.00641.x

Spiegelhalder, K., Kyle, S. D., Feige, B., Prem, M., Nissen, C., Espie, C. A., & Riemann, D. (2010). The impact of sleep-related attentional bias on polysomnographically measured sleep in primary insomnia. *Sleep: Journal of Sleep and Sleep Disorders Research, 33*(1), 107-112.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. Journal Of Experimental Psychology, 18(6), 643-662. doi:10.1037/h0054651

Taylor, D. J., Gardner, C. E., Bramoweth, A. D., Williams, J. M., Roane, B. M., Grieser, E. A., & Tatum, J. I. (2011). Insomnia and mental health in college students. *Behavioral Sleep Medicine, 9*(2), 107-116. doi:10.1080/15402002.2011.557992

Taylor, L. M., Espie, C. A., & White, C. A. (2003). Attentional Bias in People With Acute Versus Persistent Insomnia Secondary to Cancer. Behavioral Sleep Medicine, 1(4), 200-212. doi:10.1207/S15402010BSM0104_3

Uchiyama, M., Inoue, Y., Uchimura, N., Kawamori, R., Kurabayashi, M., Kario, K., & Watada, H. (2011). Clinical significance and management of insomnia. *Sleep and Biological Rhythms, 9*(2), 63-72. doi:10.1111/j.1479-8425.2011.00496.x

Wang, M., Wang, S., & Tsai, P. (2005). Cognitive behavioural therapy for primary insomnia: A systematic review. Journal Of Advanced Nursing, 50(5), 553-564. doi:10.1111/j.1365-2648.2005.03433.

Woods, H., Marchetti, L. M., Biello, S. M., & Espie, C. A. (2009). The clock as a focus of selective attention in those with primary insomnia: An experimental study using a modified posner paradigm. Behaviour Research and Therapy, 47(3), 231-236. doi:10.1016/j.brat.2