The Influence Of The Physical Workspace On Creative Performance: Alternative Mediation Models

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THE INFLUENCE OF THE PHYSICAL WORKSPACE ON CREATIVE PERFORMANCE: ALTERNATIVE MEDIATION MODELS

by

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THESIS

Submitted to the Graduate School

of Wayne State University,

Detroit, Michigan

in partial fulfillment of

MASTER OF ARTS

2017

MAJOR: PSYCHOLOGY
(Industrial/Organizational)

Approved by:

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# TABLE OF CONTENTS

List of Tables...........................................................................................................iv

List of Figures.........................................................................................................v

Chapter 1: Introduction..........................................................................................1

Chapter 2: Literature Review..................................................................................4
  
  * Natural Settings.................................................................................................4
  * State Positive Affect as a Mediator ...................................................................7
  * Self-Regulation as a Mediator ..........................................................................9
  * State Openness as a Mediator ..........................................................................10
  * The Current Study ............................................................................................12

Chapter 3: Methods...............................................................................................16
  
  * Participants.......................................................................................................16
  * Procedure..........................................................................................................16
  * Materials..........................................................................................................17
  * Measures..........................................................................................................18
  * Control Variables..............................................................................................20
  * Manipulation Check..........................................................................................21
  * Analytic Procedure...........................................................................................22

Chapter 4: Results.................................................................................................24
  
  * Descriptive and Fit Statistics............................................................................24
  * Hypothesis Testing.............................................................................................25
  * Supplemental Analyses......................................................................................26

Chapter 5: Discussion............................................................................................28
Conclusion ................................................................................................................................. 28

Limitations ............................................................................................................................................ 30

Future Directions ............................................................................................................................ 31

Appendix A ............................................................................................................................................ 42

Appendix B ............................................................................................................................................ 43

Appendix C ............................................................................................................................................ 44

Appendix D ............................................................................................................................................ 45

Appendix E ............................................................................................................................................ 46

Appendix F ............................................................................................................................................ 47

Appendix G ............................................................................................................................................ 49

Appendix H ............................................................................................................................................ 50

Appendix I ............................................................................................................................................ 51

Appendix J ............................................................................................................................................ 52

Appendix K ............................................................................................................................................ 53

References ............................................................................................................................................. 54

Abstract ............................................................................................................................................... 73

Autobiographical Statement ............................................................................................................. 74
LIST OF TABLES

Table 1: Visual Depictions of Stimuli Per Condition.........................................................33
Table 2: Descriptive Statistics and Intercorrelations for Study Variables..............................34
Table 3: Fit Statistics for Measurement and Structural Models ........................................36
LIST OF FIGURES

Figure 1: Theoretical Model for Current Study .................................................................37
Figure 2: Full Structural Mode with Control Variables .....................................................38
Figure 3: Structural Model with AUT Outcome .............................................................39
Figure 4: Structural Model with RAT Outcome ............................................................40
Figure 5: Structural Model with Letter Task Outcome ..................................................41
CHAPTER 1: INTRODUCTION

Technological and economic pressures have compelled organizations to investigate alternative factors to achieving a competitive edge. In recent years, the key to organizational survival and prosperity is frequently identified as creativity and innovation (Hennessey & Amabile, 2010; Zhou & Shalley, 2008). Individual creativity has historically been conceptualized as a relatively stable trait with individual differences in consistency (Tierney & Farmer, 2002; Zhou & Shalley, 2003). A substantial amount of literature was derived from this understanding of creativity, and the research aimed to establish the attributes indicative of highly creative individuals. Theorized components of creativity include cognitive ability (Sternberg & O’Hara, 1999; Vincent, Decker, & Mumford, 2002), personality characteristics (Barron & Harrington, 1981; Chavez-Eakle, Eakle, & Cruz-Fuentes, 2012; Furnham & Bachtiar, 2008), methods of processing information (Mumford, Supinski, Baughman, Costanza, & Threlfall, 1997; Lubart, 2001), and expertise (Rich & Weisberg, 2004).

Other researchers have regarded creativity as a less stable phenomenon that manifests as a function of the person and the situation. More recently, organizational scholars have looked at a number of environmental factors that could serve to maximize individual creativity. Connection and interaction with others (Hirst, Van Knippenberg, Zhou, Quintane, & Zhu, 2014; Rickards, Chen, & Moger, 2001; West, 2002), leadership (Amabile, Schatzel, Moneta, & Kramer, 2004; Howell & Boies, 2004; Venkataramani, Richter, Clarke, 2014), culture and climate (Cerne, Nerstad, Dysvik, & Skerlavaj, 2013; Chua, 2013; Hunter, Bedell, & Mumford, 2007; Nouri et al., 2014), and organizational structure (Hirst, Van Knippenberg, Chen, & Sacramento, 2011) have all been demonstrated to have relationships with creativity in employees and could be variables contributing to the ideal work environment for innovation. The focus of this thesis is the
investigation of an additional environmental factor that has gained recent interest in the applied literature: the physical work environment.

It is not difficult to imagine the physical work environment as an important consideration for the creative individual. Envisioning the creative process of some of the iconic creators of our time naturally involves placing them within an environmental context that is often at odds with the traditional workspace. For example, the famous still images of Pablo Picasso in his spacious studio or Albert Einstein at his cluttered desk are strikingly different than the modern office that emphasizes organization, functionality, and ergonomics. Consequently, ideal creative environments often are associated with characteristics of the popularized right-brained persona: expressive, unpredictable, and unique. However, it is unclear if a creator’s self-imposed environment is simply a byproduct of their personality or if people actually draw from their environments in the creative process.

Environmental research has indicated that our behavior is partially influenced by our immediate surroundings. Within the work domain, scholars have studied the effects of natural and artificial lighting (Collins, 1975; Wineman; 1982), views of the outdoors (Heerwagen, 1990; Kaplan, Talbot, & Kaplan, 1988; Ulrich, 1984) and architectonic features (Becker & Steele, 1995; Mazumdar, 1992). While these variables have been shown to impact employee stress levels and job satisfaction, little of this research has produced significant relationships with job performance or other work-related behavior (citizenship behaviors, counter-productive behaviors, etc.; McCoy, 2002). However, recent research (Berman, Jonides, & Kaplan, 2008; Kaplan & Berman, 2010; Knight & Haslam, 2010; Nieuwenhuis, Knight, Postmes, & Haslam, 2014) has demonstrated that interacting with nature in the working environment (e.g., enriching the office with living plants) is associated with increased executive functioning, task performance, and objective workplace
productivity. These findings conflict with the widely accepted notion of the “lean” workspace (Markovitz, 2011): a simple, clean, and unobstructed working environment that should theoretically provide the greatest benefit to productivity, health, and functionality. Very little research had been conducted to evaluate the lean office hypothesis until Knight and Halsam (2010) found lean environments to be inferior to “green” ones across multiple dimensions.

In response to these findings, there has been a call in the field of industrial-organizational psychology for research investigating the effects of natural settings in the workplace (Colarelli, Minjock, An, O’Brien, & Boyajian, 2015). While the benefits of natural environments have been widely studied in the fields of environmental psychology and architecture, there is considerably less research on the topic in applied psychology journals. The proposed study is intended to address this call by examining the influence of natural settings on a work-relevant criterion (creative performance). In the following section, I will outline the existing theory that attempts to explain the mechanisms underlying the relationship between natural environments and work-related behavior.
CHAPTER 2: LITERATURE REVIEW

Natural Settings

Recent studies on the influence of nature in the workplace build upon an existing body of research that suggests exposure to living plants or natural settings provides a variety of psychosocial benefits, including emotional states (Adachi, Rohde, & Kendle, 2000; Chang & Chen, 2005; Larsen, Adams, Deal, Kweon, & Tyler, 1998), stress response (Kim & Matteson, 2002), attentiveness and productivity (Lohr, Pearson-Mims, & Goodwin, 1996; Shibata & Suzuki, 2001). The presence of plants has been shown to evoke positive mood and reduce negative mood (Hartig, Evans, Jamner, Davis, & Garling, 2003; Ulrich, 1979; Ulrich et al., 1991). In addition, studies have consistently demonstrated the relationship between exposure to nature and increases in one’s attentional capacity (Berman, Jonides, & Kaplan, 2008; Berto, 2005; Cimprich, 1993; Cimprich & Ronis, 2003; Hartig et al., 2003; Ottoson & Grahn, 2005; Tennessen & Cimprich, 1995). These psychological benefits may serve as mechanisms in the existing research on nature in the workplace, as they each share relationships with task performance and creative performance (e.g., Barsade & Gibson, 2007; De Dreu, Nijstad, Baas, Wolsink, & Roskes, 2012; Gilboa, Shirom, Fried, & Cooper, 2008; Mojzisch, Krumm, & Schultze, 2014; Seo, Barrett, & Bartunek, 2004; Sohn & Doane, 2003; Vredeveldt & Perfect, 2014).

The same mechanisms driving the relationship between natural settings and job performance likely occur in creative performance contexts as well. This connection was established through the work of Shibata and Suzuki (2002, 2004) who found that individuals exposed to plants generated more words in a word association task than those operating in a room absent of plant-life. While these studies focus on creative volume as opposed to creative breadth, they represent an important first step in establishing the link between natural environments and
creative output. However, it is still unclear which of the proposed benefits are the primary mechanisms spurring on the relationship.

Nieuwenhuis et al. (2014) provide three potential explanations for why plants and natural environments elicit these psychological benefits. The first class of explanations emphasizes the beneficial impact that living plants have on the air quality of the working environment. Not only do plants remove airborne pollutants (Orwell, Wood, Tarran, Torpy, & Burchett, 2004; Tarran, Orwell, Burchett, Wood, & Torpy, 2002; Wood, Orwell, Tarran, Torpy, & Burchett, 2002), but they also enrich the environment through the absorption of carbon dioxide and the release of oxygen. Increases in carbon dioxide levels have been shown to result in decreased academic performance (Shaughnessy, Haverinen-Shaughnessy, Nevalainen, & Moschandreas, 2006) as well as workplace productivity (Seppanen, Fisk, & Lei, 2006). Indoor plants have the capability to reduce carbon dioxide levels by 10 – 25% depending on the building’s ventilation system (Tarran, Torpy, & Burchett, 2007). In addition, the presence of plants appears to positively influence individual perceptions of air quality (Khan, Younis, Riaz, & Abbas, 2005). In sum, the benefits plants provide to individuals may be due to a biological reaction in the working environment.

Secondly, from an evolutionary perspective, the presence of plants is reflective of the natural environment within which human psychology and physiology evolved. Bowlby (1969) provided a commentary on the misfit between modern environments (e.g., the workplace) and human evolution:

We can therefore be fairly sure that none of the environments in which civilized, or even half-civilized, man lives today conforms to the environment in which man’s environmentally stable behavioral systems were evolved and to which they are intrinsically adapted (p. 86).
Bowlby attributes the human tendency to lose cognitive resources during work-related tasks to our evolutionary unfamiliarity with the environments we operate within and the tasks we are required to perform. While humans have adapted to modern settings over time, we have physiologically evolved to experience a particular range of variation in our environment. Conditions that exist beyond this adapted range could contribute to human malfunction (Roff, 1992). In the opposite way, returning to the environments from which we evolved (i.e., natural settings) may aid in the recovery of lost cognitive resources due to environmental discord (Crawford, 2002).

Consistent with this explanation is attention restoration theory (ART; Kaplan, 1995) which states that natural environments restore an individual’s capacity to direct attention and man-made environments deplete these capacities. When individuals maintain focus on an object or a task over time, they experience “directed attention fatigue” (DAF). ART suggests that natural settings demand less cognitive effort than man-made environments, thereby allowing recovery from DAF. Given the existing link between nature and attentional capacity, ART could serve as a viable explanation for the existing findings on nature in the workplace. Those with greater attentional capacities will perform better on tasks that require directed attention, thus leading to greater workplace productivity.

A third explanation for the psychological benefits provided by plants separates itself from biological and evolutionary theories and instead focuses on the individual’s perception of the indoor plant as a purposeful addition to a room by a manager or organization. Through the placement of plants within the workspace, individuals recognize that attempts are being made to increase worker comfort and happiness (Vischer, 2005). The increased levels of productivity and attentiveness brought about by plants may be tied to the perception that managers care about their
employees (Haslam, 2004). These “enriched” offices contribute to positive job attitudes (Dravigne, Waliczek, Lineberger, & Zajicek, 2008) and help foster a sense of community and belongingness among employees in the workspace (Elsbach, 2003; Vischer, 2005). In summary, employee perceptions may be driving the relationship between the presence of plants and work-related outcomes.

Although the presence of office plants may be a reflection of the overarching organizational culture, the consistency of findings in the environmental literature (for review, see Kaplan & Berman, 2010) suggests a resistance to such confounds and a contribution of unique variance on the part of natural settings. Of the psychological benefits yielded by plant life in the working environment, the present study attempts to expand upon the work of Nieuwenhuis et al. (2014) and Shibata and Suzuki (2002, 2004) by empirically testing three mediation models that serve to identify the mechanisms in the observed relationship. Specifically, I propose that the presence of living plants will positively impact performance on multiple measures of creativity through increases in a) state positive affect, b) self-regulation, and/or c) state openness to experience. Figure 1 presents the theoretical mediation model for the current study. The following paragraphs outline the influence of these mediating variables on creativity, as well as their roles as psychological byproducts of exposure to natural environments.

**State Positive Affect as a Mediator**

Scholars have indicated that the experience of positive emotion should increase creativity. Some have postulated that the release of dopamine in the brain as a result of an increase in positive affect is associated with improved information processing and increased access to materials stored in memory (Ashby, Isen & Turken, 1999). Positively-valenced memories in the brain may be more extensive and diverse than other brain materials (Isen, Johnson, Mertz, & Robinson, 1985) or
collected in a way that is less systematic (Baas, De Dreu, & Nijstad, 2008). This heightened level of information processing may prompt cognitive flexibility, divergent thinking, and ultimately creativity (Binnewies & Wornlein, 2011; To, Fisher, Ashkanasy, & Rowe, 2012). Others have argued that positive emotions promote looser cognitive processing by acting as a signal that the environment is safe or the situation is unproblematic (De Dreu, Baas, & Nijstad, 2008, George & Zhou, 2007; Schwarz & Clore, 2003). With this security need met, individuals have the capacity for additional divergent thinking and novelty seeking. Consistent with these notions, several studies have reported positive relationships between positive affect and creativity (e.g., Estrada, Isen & Young, 1997; Baas et al., 2008) or neutralized relationships between other variables and creativity after positive affect is controlled for (Eubanks, Murphy, & Mumford, 2010; Gilmore, Hu, Wei, Tetrick, & Zaccaro, 2013).

Increases in positive affect appear to be psychological consequences of exposure to natural settings. For example, Hartig et al. (2003) found that individuals who spent time walking through a nature reserve reported greater positive affect than those who walked through an urban environment. Similarly, Kaplan (1984) discovered that participation in a wilderness program resulted in a positive affect increase after comparing questionnaires before and after the program. The same effect appears to be present when exposed to images of natural environments as opposed to direct contact with nature; Ulrich (1979) found that positive mood was higher in individuals who were shown slides of natural environments contrasted with those shown images of urban environments. This finding existed independent of individual’s familiarity with the two environments, the visual complexity of the images, and the aesthetic quality of the environments. Lastly, viewing video footage of nature resulted in great positive affect than footage of urban
settings, and this affective increase was in turn associated with the relief of physiological stress symptoms (Ulrich et al., 1991).

The psychological benefits provided by natural settings are expected to carry a positive valence. Based on the research previously described, the affective benefit provided by plants in the working environment should mediate its relationship with creative performance.

_Hypothesis 1_: State positive affect will mediate the relationship between natural settings and creative performance.

**Self-Regulation as a Mediator**

Another mechanism through which natural settings may impact creative performance is through increased self-regulatory capacity. Self-regulation behaviors (e.g., self-monitoring and self-evaluation; Kanfer, 1990) allocate attentional or cognitive resources to the maintenance of task-relevant attention. Because these resources are of limited supply, prolonged attempts to self-regulate can be detrimental to task performance (Muraven & Baumeister, 2000). However, the increased mental focus afforded by self-regulation behaviors should lead to greater performance in the short-term (Kanfer & Ackerman, 1989; Zimmerman & Kitsantas, 2007). Self-regulation theory draws heavily from executive control theory (i.e., the idea that maintaining attentional control in the face of distraction will lead to improved performance) and resource theory (i.e., maintaining attentional control requires cognitive resources). In support of these concepts, a meta-analysis conducted by Randall, Oswald, and Beier (2014) found that increased cognitive resources resulted in greater attentional regulation, which then lead to increased task performance. These findings highlight the importance of identifying individual and situational factors that influence a person’s ability to maintain cognitive resources or regulate attention, as there are implications for performance.
If creativity is defined as the generation of new ideas and solutions, a person who acts creatively must override habitual or instinctual thought in order to diverge from existing ideas. As executive control over attentional resources is necessary for such adjustment, self-regulation is likely the process by which an individual deviates from traditional modes of thought (Tice, Baumeister, Shmueli, & Muraven, 2007). In addition, attention restoration theory (ART; Kaplan 1995) suggests that exposure to natural settings will facilitate the regulation of attentional resources. For example, Berman et al. (2008) found that merely going for a walk in a park restored the individual resources needed to perform on a working memory task. Views of nature have also been shown to improve sustained attention in comparison to urban environments (Berto, 2005). Support for the role of nature in ART has been demonstrated repeatedly across different contexts (e.g., Cimprich & Ronin, 2003; Hartig et al., 2003; Ottosson & Grahn, 2005). Therefore, it is possible that the influence of natural settings on creativity may occur via an improved capacity to self-regulate resources.

Hypothesis 2: Self-regulation will mediate the relationship between natural settings and creative performance.

State Openness as a Mediator

In addition to an increased ability to self-regulate, nature in the workplace may influence creative performance through other mechanisms. Recent conceptualizations of personality as a dynamic construct suggest that behavioral tendencies (i.e., trait personality) represent the average frequency of momentary behavioral states (Fleeson, 2001). These states fluctuate enough to exhibit intra-individual variability yet still suggest a stable underlying personality trait (Fleeson, 2007; Huang & Ryan, 2011; Minbashian, Wood, & Beckmann, 2010). Individuals appear to express this within-person variability in behavior as a response to situational characteristics (e.g., task
demands; Minbashian et al., 2010) or work experiences (e.g., citizenship behavior; Judge, Simon, Hurst, & Kelley, 2014).

As state-level personality change has been tied to behavioral outcomes (e.g., Minbashian et al., 2010), creative performance could be a function of momentary increases in openness to experience. Costa and McCrae (1992) define openness to experience as the extent to which individuals are imaginative, curious, and receptive to novel ideas, experiences, and points of view. Openness is not a measure of creativity per se, but instead reflects a tendency to engage in behaviors likely to lead to divergent thinking and creative performance. Consistent with this rationale, researchers have routinely found relationships between openness and creative performance above and beyond other personality variables (Batey, Chamorro-Premuzic, & Furnham, 2010; Dollinger, Urban, & James, 2004; Feist, 1998; Harris, 2004; McCrae, 1987; Prabhu, Sutton, & Sauser, 2008; Scratchley & Haskitan, 2001). In addition, openness has demonstrated predictive and convergent validity across multiple measures of creativity and creative personality scales (Dollinger, Urban, & James, 2004) including creative self-efficacy (Jaussi, Randel, & Dionne, 2007; Karwowski, Lebuda, Wisniewska, & Gralewski, 2013; Pretz & McCollum, 2014). Other individual differences predictive of creativity (e.g., intelligence) tend to exhibit weaker or insignificant correlations after controlling for openness (e.g., Silvia, 2008).

The creative performance benefits afforded by state openness to experience may be stimulated by the unexpectedness of natural elements in the working environment. Material that is not often found in the traditional lean workspace (such as plant life) could trigger divergent thinking or act as a separate source of content to draw creatively from. This is consistent with chance-configuration theory (Simonton, 1988). Simonton (1988) suggested that creativity manifests as the manipulation of mental elements (e.g., memories, knowledge, thought, stimuli,
etc.) and this manipulation often occurs through chance permutation (i.e., perceiving the elements differently through chance occurrence). One way of sparking such a chance permutation is to encounter unexpected stimuli. Because openness to experience facilitates the incorporation of the new material into one’s mental schema, unforeseen plant life in the working environment could spur on state-level increases in openness to experience, supporting the chance-configuration model of creativity.

**Hypothesis 3**: State openness to experience will mediate the relationship between natural settings and creative performance.

**The Current Study**

Each of the proposed mediations were tested simultaneously in the present study. It is important to note that these mediators are not mutually exclusive and can coexist as distinct mechanisms in the relationship. Support for all three of the hypotheses would indicate that the effect of the stimulus on creative performance is a function of an individual’s perception of affective disposition, personality, and attentional capability. Given the theoretical rationale behind each hypothesis, it is fully expected that each mediator contributes to the model despite any relative differences. Because the laboratory environment is not conducive to testing the composition of elements in the air, the possibility that the hypothesized relationship is a function of improved air quality could not be tested in the current study.

Due to the lack of consensus among researchers on how creative performance ought to be measured (Parkhurst, 1999), multiple methods were utilized. While the remote association test (RAT; Mednick, 1962) has been widely used as a measure of creativity (e.g., Bowden & Beeman, 1998; Bowers, Regehr, Balthazard, & Parker, 1990; Schooler & Melcher, 1995; Zhong, Dijksterhuis, & Galinsky, 2008), some researchers argue that tests of convergent thinking such as
the RAT do not align with most definitions of creativity because of their single-solution items (e.g., Byron & Khazanchi, 2012). In an attempt to maximize the probability of selecting a valid measure of creativity, the RAT will be completed in conjunction with a popular divergent thinking task, the alternate uses test (AUT; Guilford, 1967; Guilford, Christensen, Merrifield, & Wilson, 1978). In addition, to test the idea that the experimental condition is contributing uniquely to creative performance above and beyond task performance, a separate task performance measure was added to the procedure.

In addition, given that the presence of natural material in the laboratory environment would appear out of the ordinary to participants, it becomes necessary to rule out the possibility that findings are only due to an unexpected element in the experiment. Thus, a separate comparison condition was added to the design that places a similarly unexpected object in the working environment. As the experimental condition included a photograph of a natural setting, the comparison condition featured a photograph of an urban setting (e.g., Berto, 2005). This photograph should not exhibit the restorative benefits of natural settings (e.g., Kaplan, 1995; Ulrich, 1984; Ulrich et al., 1991), yet will operate as an additional stimulus. Significant differences between this condition and the experimental condition would indicate an effect of natural settings above and beyond the unexpected element in the environment.

Due to the uncertainty that the experimental condition will have an immediate effect on participants’ momentary states, a “filler task” was included to account for a possible lagged effect. The filler task consisted of several exploratory variables of interest: core self-evaluations, need for cognition, self-monitoring, goal-orientation, and insufficient effort responding. The 15-minute duration of the filler task would allow for additional time for the experimental stimulus to influence state measures.
Certain individual factors that correlate highly with the outcome were controlled for in the analyses. For example, a criticism of the influence of positive emotion on creative behavior is that emotional arousal, regardless of valence, appears to impact creativity (Seo, Barrett, & Bartunek, 2004; Seo, Bartunek, & Barrett, 2010). Indeed, negative affect has also been shown to relate positively to creativity, occasionally outperforming positive affect (Baas et al., 2008; Kaufmann & Vosburg, 1997; To et al., 2012). Researchers have attempted to reconcile the conflicting findings, proposing that positive and negative affect influence creativity independently and through different means. De Dreu et al. (2008) proposed a dual pathway model between affect and creativity: positive emotion influences creativity through increased cognitive flexibility and information processing (e.g., Amabile, Barsade, Mueller, & Staw, 2005; Isen, 1999) while negative emotion promotes creative thinking by informing the individual that the situation is problematic and requires a solution (De Dreu et al., 2008; George & Zhou, 2002). In concordance with this idea, To et al. (2012) found that both positive and negative affect predicted creative performance engagement, with positive emotion having a greater coefficient than negative emotion ($\beta$s = .32 and .15, respectively). Because theory suggests that natural settings only evoke positive or neutral emotional arousal, positive affect is considered in the theoretical model while any predisposition to negative affectivity was controlled for.

Additionally, cognitive ability was considered as a control variable in the analysis. Cognitive ability tends to be highly correlated with creative performance (e.g., Batey & Furnham, 2006; Benedek, Jauk, Sommer, Arendasy, & Neubauer, 2014; Jauk, Benedek, & Neubauer, 2014; Kim, Cramond, & VanTassel-Baska, 2010) and may be used as a control variable in the analysis. As individuals with high cognitive ability tend to have higher levels of total creative output and lower rates of creative growth over the time allocated for divergent thinking (Beaty & Silvia,
2012), less intelligent individuals are more likely to begin with common and less creative responses. This could indicate that intelligence allows for the suppression of cognitive interference from salient, obvious ideas (Benedek et al., 2014).

Lastly, Big Five personality traits and demographics were measured and used in an exploratory fashion. Big Five personality traits sometimes exhibit small to moderate relationships with creativity (e.g., King, Walker, & Broyles, 1996; McCrae, 1987). In addition, ethnic subgroup differences in cognitive ability tests present the need to use race as a control variable in the analyses (Gottfredson, 1988; Jensen, 1980, 1998; Sackett & Wilk, 1994). However, personality and demographics were not controlled for unless participants in a particular condition were found to have significantly greater levels (e.g., more conscientious) due to chance.
CHAPTER 3: METHODS

Participants

The participants for the proposed study were recruited through the SONA research participation program in the Department of Psychology at Wayne State University. Undergraduate psychology students were granted extra credit towards a psychology course for participating in the study. A power analysis using the effect sizes reported in Study 3 of Nieuwenhuis et al. (2014) for productivity on a vigilance task controlling for the number of errors made ($\eta^2_p = .26, d = 1.19$) as well as completion time ($\eta^2_p = .21, d = 1.03$) suggested that at least 100 – 140 participants should be collected for the current study to achieve a desired power level of .90. With the expectation that certain cases may be unusable for various reasons (e.g., failing to complete certain measures or follow instruction), the current study will aim for an $N$ of 250. A total of 235 completed survey responses were collected in the current study; the final sample ($N = 206$) excluded participants with univariate and multivariate outliers, as well as individuals who responded in the affirmative to multiple items indicative of insufficient effort responding.

Procedure

Individuals who registered for the study online were randomly assigned into three conditions that vary on the presence of stimuli in the laboratory environment (natural stimuli vs. unexpected stimuli vs. no stimuli). Upon online registration, participants were asked to follow a link containing pre-experiment survey items. This survey was used to assess trait affectivity, Big Five personality, and cognitive ability. Items from the affectivity and personality scales were mixed randomly into one survey, while the cognitive ability measure was completed separately following the completion of the survey. To link the two surveys together, a PIN number was assigned to each participant that allows them access to cognitive ability measure (i.e., Wonderlic).
Following completion of the pre-experiment survey, participants scheduled an appointment to complete the laboratory portion of the study.

Upon arrival, participants were read a standardized instruction. To prevent the influence of experimenter effects, all experimenters remained blind to seat assignments until after the standardized instruction had been read to participants. The seat assignment was generated by a computerized random number generator following instruction. In addition, to account for order effects, the two creative performance measures appeared to participants in a randomly generated order.

Participants were then informed that they would be completing a number of performance-related tasks and questionnaires. They began the study by completing two identical measures intended to capture momentary phenomena at multiple time points during the study (state affect and state personality). These two measures were separated by the “filler task.” Following the second measure of state variables, participants proceeded to the performance assessments. These measures consisted of two creative performance tests (RAT and AUT) and a letter-circling task, with the latter positioned as the last performance measure of the survey. The final procedural steps were to administer a third identical measure of state variables and evaluate participants’ perceived effort regulation during the task.

Materials

Visual depictions of all study materials are presented in Table 1.

Natural material. Participants in the presence of nature condition were exposed to natural material through two manipulations of the laboratory environment: 1) a small indoor plant placed in the participant work station, and 2) a photograph of a natural environment transposed onto a mouse pad. As window views and photographs appear to provide similar psychological benefits
to plants in the immediate environment (e.g., Berman et al., 2008; Berto, 2005; Cackowski & Nasar, 2003; Kaplan, 1993), both representations of nature were included in the present study. Plants will be chosen based on their ability to live for long periods of time with minimal exposure to light. Natural material was placed at two (out of five) computer stations and remained in place for the duration of the study. The plant had a diameter of 4.25 inches and a height of 7.75 inches.

**Unexpected stimulus.** Participants in the unexpected stimulus condition were using a mouse pad similar to that of the natural setting condition. However, this mouse pad displayed a picture of an urban environment.

**Measures**

**Creative performance.** Two creative performance measures were used in the current study. RAT items consist of three word combinations that are connected by a fourth word that the participant must generate (e.g., *blank*, *list*, and *mate* each can be paired with the word *check*, as in *blank check*, *check list*, and *check mate*). The AUT involves the generation of as many possible uses of common items (e.g., *newspaper*, *shoe*, *brick*, etc.).

The RAT consists of 30 items. Participants were given 30 minutes to complete the 30-item test. Individuals were assessed based on the number of correct responses provided. The AUT consists of 3 items, each of which is limited to a 3-minute response time. Participants were judged on the fluency of their responses (i.e., the total number of uses produced for each item). While creativity can be assessed in multiple ways with such divergent thinking tests (e.g., how original are the responses given), nearly all the variance on these tests can be attributed to fluency (Plucker & Renzulli, 1999).

**Task performance.** A similar measure of task performance utilized by Gellatly and Meyer (1992) was employed in the present study. The task consisted of reading through strings of letters
and circling the vowels in each row, with 48 rows and 7 randomly-positioned vowels in each row. Participants were given 6 minutes to correctly circle as many vowels as possible. First trial participants typically average 28.4 completed rows with 43% surpassing 30 rows (Gellatly & Meyer, 1992).

**Affect.** Both trait affectivity and state-level affect were assessed with the 20-item PANAS measure (Watson, Clark, & Tellegen, 1988). Instructions for trait affect asked participants to indicate to what extent they feel certain emotions *in general* (e.g., excited, upset, alert, ashamed, etc.). In contrast, state affect asked to what extent these emotions are being felt *in the present moment*. Each emotion was rated on a 5-point Likert scale (*1 = Very slightly or not at all, 5 = Extremely*). Of the 20 items, 10 of them represent a positive emotion which were aggregated into a positive affect score. The other 10 will produce a negative affect score.

**Trait Big Five personality.** Trait Big Five personality variables (i.e., *openness, conscientiousness, extraversion, agreeableness, and emotional stability*) were captured using the 50-item Mini IPIP (Goldberg, 1999; Goldberg et al., 2006). An example of an item for *openness* would be to rate to what extent on a 7-point Likert scale (*1 = Very inaccurate, 7 = Very accurate*) a person feels that they “Enjoy hearing new ideas” or “Have a vivid imagination.” Distinctions between trait and state personality levels will be similar to that of positive and negative affect measures. 4 of the Big Five measures were considered for use as control variables.

**State Big Five personality.** State levels of the Big Five was assessed using a brief version of Goldberg’s (1992) adjective markers for the Big Five personality traits (Mini-Marker subset; Saucier, 1994). Participants rated the extent to which they think an adjective describes how they are feeling at the moment on a 9-point Likert scale.
(1 = Extremely inaccurate, 7 = Extremely accurate). For example, “imaginative,” “philosophical,” and “intellectual” are adjectives that align with the openness to experience factor. The Mini-Marker subset consists of 40 adjectives.

**Self-regulation (or effort regulation).** An individual’s ability to self-regulate during the task was evaluated using a 4-item measure based on the subscale from the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1991) which is intended to capture one’s persistence at a task. For example, participants rated on a 5-point Likert scale (1 = Very inaccurate, 5 = Very accurate) to what extent they endorse the statements “I worked hard to do well on the task, even if I didn’t like what I was doing” or “I felt so lazy or bored during the task that I quit before I finished the task.” Individuals who have the ability to self-regulate should report greater mental focus and effort regulation than those whose self-regulatory ability is diminished.

**Control Variables**

**Cognitive ability.** The Wonderlic Personnel Test – Quicktest (WPT-Q; Wonderlic Inc., 2002) served as the cognitive ability measure for the present study. Participants were given 8 minutes to complete as many items on the test as possible.

**Demographics.** Participants were asked to provide their age, gender, and ethnicity, with an option to decline disclosure if preferred.

**Filler Task Variables**

**Core self-evaluations.** The measure developed by Judge, Erez, Bono, and Thoresen (2003) captures four separate traits: 1) self-esteem, 2) generalized self-efficacy, 3) neuroticism, and 4) locus of control. These four subscales are combined into an aggregate score across 12 items. An
example item on a 7-point Likert scale (1 = *Strongly disagree*, 7 = *Strongly agree*) is “I am confident I get the success I deserve in life.”

**Goal-orientation.** The goal orientation scale (Vandewalle, 1997) captures a disposition towards aligning oneself with a particular means of achievement. The scale consists of 13 items. An example item on a 7-point Likert scale (1 = *Strongly disagree*, 7 = *Strongly agree*) is “The development of my ability is important enough to take risks.”

**Insufficient effort responding.** Three items from a scale developed by Huang, Bowling, and Liu (2014) assess the extent to which participants were attentive in their responses to items. The endorsement of these items would be considered an incorrect response from any respondent; thus, attentive respondents will not endorse the items. An example item on a 7-point Likert scale (1 = *Strongly disagree*, 7 = *Strongly agree*) is “I can teleport across time and space.”

**Need for cognition.** An individual’s tendency to engage in or enjoy thought was measured with an 18-item scale developed by Cacioppo and Petty (1982). An example item on a 7-point Likert scale (1 = *Strongly disagree*, 7 = *Strongly agree*) is “The notion of thinking abstractly is appealing to me.”

**Self-monitoring.** An individual’s tendency to regulate their self-presentation in response to environmental cues was captured using a 13-item revised scale of Snyder’s (1974) original scale (Lennox & Wolfe, 1984). An example item on a 7-point Likert scale (1 = *Strongly disagree*, 7 = *Strongly agree*) is “Even if I am not enjoying myself, I often pretend to be having a good time.”

**Manipulation Check**

To assess whether or not participants are aware of the experimental condition, two free response items appeared at the end of the survey. The items are “Did you notice anything strange while completing this study?” and “What do you think the purpose of the study is?” In addition,
the manipulation check included 12 subscale items from a scale intended to capture one’s affinity with nature (Emotional Affinity Towards Nature by Adults; Kals, Schumacher, & Montada, 1999). An example item on a 7-point Likert scale (1 = *Strongly disagree*, 7 = *Strongly agree*) would be “Getting in contact with nature makes me feel happy and satisfied.”

**Analytic Procedure**

Structural equation modeling (SEM) was utilized for the proposed analyses. Hypotheses were tested using multi-mediator mediation analyses (Preacher, Zyphur, & Zhang, 2010) via Mplus version 7.1 (Muthen & Muthen, 1998). State positive affect, state openness, and self-regulation will be positioned as mediating variables. The direct relationship between the mediators and the predictor (presence of natural setting) and outcome variables (creative & task performance) were specified, as well as the indirect effect of the experimental condition on the performance outcomes through each of the proposed mediators (Preacher & Hayes, 2004).

After assessing the number of fully completed surveys for analysis (N = 235), individual respondents were selected out of the analysis if either of the following criteria were met: a) response indicated a univariate and multivariate outlier on one or more study variables, or b) response indicated insufficient effort responding on two or more items from either the pre-lab survey or the in-lab survey. After these individuals were selected out, a final sample of 206 respondents was retained.

Preliminary mean comparisons of conditions indicated that mean levels on the proposed mediating variables and performance outcomes generally did not significantly differ between experimental and non-experimental conditions. The unexpected stimulus condition, which had the least amount of group participants (N_{unexpected} = 47) had significantly lower RAT scores than the other groups (F(2, 203) = 3.61, p = .029); however, the experimental condition did not differ
significantly from the control condition. Consequently, in order to maximize the sample size for SEM analysis, a dichotomous variable comparing the experimental condition to all other comparison conditions was used in the path model.

Given that it is difficult to achieve adequate model fit with the number of observed variables, item parceling (Little, Cunningham, Shahar, & Widaman, 2002) was used to improve CFA model fit when necessary. Item parceling is a widely used practice in SEM (Bandalos & Finney, 2001) and leads to more accurate estimates than looking at many indicators disaggregated (Williams & O’Boyle, 2008). Because the state variables (i.e., openness and positive affect) continued to contribute to inadequate model fit after item parceling, state variables were assessed as single indicator latent variables (James, Mulaik, & Brett, 1982; Kenny, 1979), with the factor loading of the scale average set to the square root of the scale reliability and the observed variance multiplied by 1 minus the scale reliability. The single indicator approach is sometimes used when sample sizes are relatively small and the emphasis is on structural model path estimates, as in the current study (e.g., Anderson & Williams, 1992; Law & Wong, 1999; Williams & Hazer, 1986).

Control variables were arranged in the structural model according to the guidelines of Williams, Vandenberg, and Edwards (2009), which suggest that control variables should be allowed to correlate with exogenous predictors and include regression paths to the outcome variable(s). In the case of the current study, because the control variables were expected to be somewhat interrelated, the controls were allowed to intercorrelate in the model. Race was included as a control variable due to a significant bivariate relationship with WPT-Q scores ($r = -.30, p < .001$). Additionally, because trait personality did not appear to differ by condition, only openness to experience was included as a control variable in the analysis. To view the full structural model with control variables, see Figure 2.
CHAPTER 4: RESULTS

Descriptive and Fit Statistics

Descriptive statistics and bivariate correlations for the study variables can be found in Table 2. Results were broadly speaking in the expected directions and magnitudes, with creative performance measures producing associations with both trait openness (rs = .26 to .31) and state openness (rs = .02 to .23). State openness measures yielded much stronger correlations with the convergent thinking test (RAT) as opposed to the divergent thinking test (AUT). Effort regulation was significantly related to both creative performance (rs = .21 to .31) and task performance (r = .16).

Fit statistics for measurement and structural models are presented in Table 3. Model fit indices are often evaluated in tandem, with good model fit established by the fulfillment of multiple fit criteria (Hu & Bentler, 1999). While a CFI of .95, an SRMR of .08, and a RMSEA of .06 are considered conservative fit criteria, models above a CFI of .90 and below a SRMR of .10 and RMSEA of .08 are generally considered to have adequate model fit (Williams et al., 2009). The initial confirmatory factor analyses indicated adequate factor loadings (> .40) and model fit for the AUT model (CFI = .938, SRMR = .057, RMSEA = .051), the RAT model (CFI = .915, SRMR = .066, RMSEA = .062) and the letter task model (CFI = .927, SRMR = .060, RMSEA = .056).

The next step in the analysis is to evaluate the fit of the structural models. Adequate model fit was established for the AUT model (CFI = .915, SRMR = .100, RMSEA = .054), the RAT model (CFI = .913, SRMR = .102, RMSEA = .056) and the letter task model (CFI = .910, SRMR = .101, RMSEA = .056). As a result, path estimates of the direct and indirect effects in the structural models were evaluated. For a graphical representation of each structural model, see Figure 3 (AUT), Figure 4 (RAT) and Figure 5 (letter task).
Hypothesis Testing

Hypothesis 1 posited that state positive affect would mediate the relationship between the experimental condition and creative performance outcomes. Results indicate that state positive affect did not significantly relate to condition assignment ($\beta = .05, p = .53$). Additionally, state positive affect did not significantly relate to AUT performance ($\beta = -.12, p = .76$), RAT performance ($\beta = .18, p = .62$), nor letter task performance ($\beta = .08, p = .83$). Lastly, indirect effects of the experimental condition through state positive affect on AUT ($\beta = -.04, p = .79$), RAT ($\beta = .01, p = .70$), and letter task performance ($\beta = .00, p = .84$) were all non-significant. Therefore, Hypothesis 1 was not supported.

Hypothesis 2 stated that self-regulation would mediate the relationship between the experimental condition and creative performance outcomes. Results suggest that condition assignment was not associated with self-regulation ($\beta = .11, p = .14$). Moreover, self-regulation did not predict AUT performance ($\beta = .19, p = .12$) or letter task performance ($\beta = .16, p = .19$). However, self-regulation was significantly related to RAT performance ($\beta = .24, p = .03$). There were no significant indirect effects of experimental condition through self-regulation onto AUT ($\beta = .02, p = .29$), RAT ($\beta = .03, p = .22$), or letter task performance ($\beta = .02, p = .32$). Therefore, Hypothesis 2 was not supported.

Hypothesis 3 posited that state openness to experience would mediate the relationship between the experimental condition and creative performance outcomes. Results indicate that condition assignment was not associated with state openness to experience ($\beta = .00, p = .98$). In addition, state openness did not predict AUT performance ($\beta = .10, p = .78$) RAT performance ($\beta = -.07, p = .85$) or letter task performance ($\beta = -.03, p = .94$). There also were no significant indirect effects of experimental condition through state openness onto AUT ($\beta = .00, p = .98$),
RAT ($\beta = .00, p = .98$), or letter task performance ($\beta = .00, p = .97$). Therefore, Hypothesis 3 was not supported.

**Supplemental Analyses**

Additional analyses were conducted to further investigate the influence of the experimental manipulation. First, utilizing the measure by Kals, Schumacher, and Montada (1999), I assessed the potential interactive effects of one’s emotional affinity with nature on the mediating variables. It is possible that certain individuals may be more receptive than others to the experimental manipulation, such that those with a stronger affinity towards nature would be more readily influenced by the natural stimuli. A moderation analysis was assessed using the XWITH function in Mplus, regressing the three mediating variables onto the interactive effect of affinity with nature and experimental condition. The interaction was non-significant for effort regulation ($b = .08, p = .77$), state openness to experience ($b = -.27, p = .09$) and state positive affect ($b = -.05, p = .78$).

Second, given that natural stimuli are associated with gains in attentional resources (ART; Kaplan, 1995), it is possible that the experimental manipulation could influence an individual’s tendency to engage in insufficient effort responding (IER). Thus, IER respondents were included in the supplemental analysis, and IER was assessed as an additional mediating variable. The experimental condition was not predictive of IER ($\beta = .04, p = .60$). Additionally, IER was not uniquely predictive of RAT performance ($\beta = -.10, p = .15$), AUT performance ($\beta = .02, p = .77$) or letter task performance ($\beta = .06, p = .44$) after the consideration of control variables.

Lastly, I decided to run the analyses with both a high-performing and a low-performing group, using at or above the 50th percentile of performance variables as the cutoff score. There is a possibility that the experimental manipulation may be able to distinguish between individuals at similar performance levels, but not collectively. When considering the high performers on the
AUT, the effect size of the experimental manipulation on mediating variables increased for effort regulation ($\beta = .29, p < .001$) and state positive affect ($\beta = .11, p = .35$), with the effort regulation relationship reaching significance. A similar pattern was demonstrated with RAT high performers, although the effect sizes were still non-significant for effort regulation ($\beta = .19, p = .08$) and state positive affect ($\beta = .10, p = .37$). However, the pattern did not hold for high performers on the letter task for effort regulation ($\beta = .09, p = .41$) or state positive affect ($\beta = .08, p = .48$). Additionally, the previously moderate effect sizes between effort regulation and performance almost dropped out completely in the high-performing samples for AUT ($\beta = .03, p = .83$) and RAT ($\beta = -.03, p = .83$).
CHAPTER 5: DISCUSSION

Conclusion

The primary goal of the current study was to use an experimental manipulation to replicate prior studies that found natural settings to positively relate to work-relevant outcomes. In addition, I sought to assess the mediating mechanisms responsible for these positive effects. Results of the experiment did not resemble previous findings, such that differences in creative performance between the experimental condition and the other conditions were null. In addition, none of the proposed mediators shared a significant relationship with assignment to the natural setting, and condition did not indirectly affect the performance outcomes through the proposed mediators. Therefore, the study results failed to support its hypotheses, and did not contribute to the support of existing theory or previous findings.

One conclusion that can be drawn from the results is that natural settings do not influence work-relevant outcomes through the mechanisms proposed. Null results may point to alternative explanations of prior findings that were not tested in the current study as more tenable (i.e., natural settings are indicators of good air quality or managerial support). However, given the robustness of findings supporting attention restoration theory (e.g., Kaplan, 1995), researchers should not readily dismiss the possibility that ART contributes to the effect of natural settings. Another explanation for the current findings is that the experimental manipulation (i.e., a small plant and mouse pad on a computer desk) may have not been salient enough to influence behavior. Additionally, the lab context (i.e., computer-based tasks completed over the course of an hour) may also have limited the effect of the experimental condition.

Despite the lack of hypothesis support, one contribution of the study is the disparate findings between the RAT and the AUT as measures of creative performance. For example, effort
regulation and cognitive ability were significantly related to RAT performance, but not AUT performance, suggesting that the RAT was more cognitively demanding. In addition, both trait and state openness to experience were stronger bivariate correlates with RAT than AUT performance. While these results may indicate that RAT may be a better indicator of creative performance, it is important to note that AUT performance was measured in fluency (i.e., the number of ideas generated) as opposed to the originality (i.e., uniqueness of ideas generated). It is possible that originality ratings of AUT responses may yield different relationships with study variables.

In a supplemental analysis, it was found that individuals in the natural setting condition experienced increased levels of effort regulation and state positive affect when only high performing individuals were analyzed. Moreover, in a sample of high AUT performers, assignment to the experimental condition was positively and significantly associated with effort regulation. This finding may indicate that certain high-performing individuals are more receptive to their surrounding environment or respond to natural stimuli more strongly. In spite of this finding, effort regulation was found to be unrelated to performance outcomes when only high performers were assessed. This contrasts with the significant relationship between effort regulation and RAT performance in the overall sample. The benefits of natural settings (such as increased self-regulation) may only lead to performance increases in low performers. In turn, low performers are more reliant on effort allocation to perform well than high performers.

Additionally, a preliminary mean comparison between the conditions revealed a significantly lower mean RAT score for the unexpected stimulus condition in comparison to the other two conditions. One explanation for this result is that participants assigned to this condition were always in the presence of other research participants; the unexpected stimulus condition was only assigned if there were three or more individuals present in the lab. Research on personal space
and density of employees in a work environment (e.g., Fried, 1990; Hayduk, 1978) suggests that people may react differently to their work depending on the amount of people in their immediate environment. To test this idea in the context of the current study, a t-test was conducted using a dichotomous grouping variable for group size (Group 1 = < 2 participants in lab, Group 2 = > 2 participants in lab) and RAT as the dependent variable. Results indicated that there was a significant difference between groups, $t(204) = -2.36, p = .02$, where labs with greater attendance produced significantly lower scores. This result indicates that group size may have impacted the level of performance on this performance outcome. An alternative explanation is that the more sparsely attended sessions tended to occur at the beginning of the semester. Thus, students with lower class grades towards the end of the semester may have had a greater incentive to earn extra course credit, and this group may have been more likely to produce lower performance scores on the laboratory measures.

**Limitations**

There are several limitations to the current study that may temper the conclusions that can be drawn. First, it is possible that I was unable to reproduce the findings of Nieuwenhuis et al. (2014) because of an uncertainty surrounding how long the effects of natural settings would last. For example, it is possible that natural settings have little immediate effect on creative performance, but have the potential to exhibit greater benefits long-term (i.e., increased cognitive endurance over time due to reduced directed attention fatigue). Unfortunately, I was unable to capture this phenomenon given the constraints of the current study.

Second, it is uncertain which work contexts would reap the greatest benefits from a natural work environment. Perhaps the laboratory setting, in which participants could claim no ownership over their work space, was not the ideal environment for the natural material to have an effect.
Given the size of the laboratories, large-scale changes to the environment could not be made. In addition, the laboratories are void of natural light. Consequently, while the experimental condition includes living plants, such plant life would not be able to survive in the laboratory environment long-term. This noticeable inconsistency may have impacted the way individuals perceived the living plants, thereby inhibiting the expected psychological benefits.

Lastly, using a student sample to capture a performance criterion was likely problematic, as variance in these populations tends to be derived from individual differences in motivation. Additionally, the correlation between performance and effort regulation suggests that motivational differences were likely the primary drivers of performance. While controlling for some of these differences (e.g., conscientiousness, cognitive ability, etc.) was intended to amplify the effect of the experimental condition and its proposed mediators, this amplification was not demonstrated. Conducting this study in which there is a greater incentive to perform well (without creating a strong situation; e.g., Meyer, Dalal, & Bonaccio, 2009) may result in more generalizable performance relationships.

**Future Directions**

This study is one of the first to analyze the possible mechanisms that facilitate the influence of natural settings on work-related outcomes. While the lack of substantive findings in the current study limits its contribution, it suggests that future work on the influence of natural settings should look outside of the laboratory context or induce the effect with a stronger manipulation. If the current study had found significant results, it would have further legitimized Colarelli et al.’s (2015) assertion that physical characteristics of the working environment deserve a larger role in the organizational literature. This assertion is still valid despite the study’s non-significant
findings, and subsequent research should continue to investigate how employees interact with their working environments.

Moreover, there are a number of future studies that could be produced from the thesis dataset. For example, there are several variables (such as those included in the filler task measure) that were assessed without hypothesizing any associations with state or outcome variables. In particular, given the recent work on insufficient effort responding in the organizational literature (e.g., Bowling et al., 2016; Huang, Liu, & Bowling, 2015), it may be fruitful to test for relationships between IER and the mediating variables to capture the momentary characteristics linked to insufficient effort. In addition, I could extend one of my previous co-authored publications (i.e., Huang & Bramble, 2016) by analyzing state personality variables as responses to situational cues; in this case, state openness to experience may contribute to unique variance in creative performance above and beyond trait personality.

There are likely additional mechanisms and moderating variables that are at play in the proposed relationship between natural settings and work outcomes. Future research should investigate alternative potential mediators such as job attitudes and motivation. The context under which the effect occurs is a probable moderator; for example, the strength of the effect may vary in high vs. low stakes environments, as well as industries with different creative content. Creative individuals likely draw from their environments in the creative process, and organizational research should identify the environmental conditions under which these individuals can thrive.
Table 1: Visual Depictions of Stimuli Per Condition

<table>
<thead>
<tr>
<th>Stimulus 1: Experimental Condition</th>
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<tr>
<td>Stimulus 2: Experimental Condition</td>
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<td>Stimulus: Unexpected Stimulus Condition</td>
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Table 2: Descriptive Statistics and Intercorrelations for Study Variables

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Note. N = 206. Bolded and italicized values are significant at p < .05. Reliabilities on the diagonal. Condition (1 = experimental condition, 0 = non-experimental conditions); RAT = Remote Associates Test; AUT = Alternate Uses Test; SPA = state positive affect; SO = state openness.
Table 2 (cont.): Descriptive Statistics and Intercorrelations for Study Variables

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Note. N = 206. Bolded and italicized values are significant at $p < .05$. Reliabilities on the diagonal. Race (1 = African-American, 0 = Other); TO = trait openness; TPA = trait positive affect; WPTQ = Wonderlic Personnel Test – Quick Form; IER = Insufficient Effort Responding; EATN = emotional affinity towards nature.
Table 3: Fit Statistics for Measurement and Structural Models

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*Note. N = 206. df = degrees of freedom; CFI = comparative fit index; SRMR = standardized root-mean-square residual; RMSEA = root-mean-square error of approximation; AUT = Alternate Uses Test; RAT = Remote Associates Test.*
Figure 1: Theoretical Model for Current Study
Figure 2: Full Structural Model with Control Variables

Note. Solid paths indicate the regression of an exogenous variable on an endogenous variable. Dotted/curved lines represent intercorrelations. The following variables are included as control variables in the model: trait openness to experience, trait positive affect, cognitive ability, and race.
Figure 3: Structural Model with AUT Outcome

Note. All path estimates are non-significant at $p < .05$. Control variables were included in this analysis, but not shown here.
Figure 4: Structural Model with RAT Outcome

Note. * = significance at $p < .05$. Control variables were included in this analysis, but not shown here.
Figure 5: Structural Model with Letter Task Outcome

Note. All path estimates are non-significant at $p < .05$. Control variables were included in this analysis, but not shown here.
APPENDIX A

Core Self-Evaluation

1. I am confident I get the success I deserve in life.
2. Sometimes I feel depressed.
3. When I try, I generally succeed.
4. Sometimes when I fail I feel worthless.
5. I complete tasks successfully.
6. Sometimes, I do not feel in control of my work.
7. Overall, I am satisfied with myself.
8. I am filled with doubts about my competence.
9. I determine what will happen in my life.
10. I do not feel in control of my success in my career.
11. I am capable of coping with most of my problems.
12. There are times when things look pretty bleak and hopeless to me.
APPENDIX B

Goal Orientation with 3 IER-S items*

1. I am willing to select a challenging assignment that I can learn a lot from.
2. I look for opportunities to develop new skills and knowledge.
3. I enjoy challenging and difficult tasks where I'll learn new skills.
4. The development of my ability is important enough to take risks.
5. I prefer situations that require a high level of ability and talent.
6. I can teleport across time and space.*
7. I am concerned with showing that I can perform better than others.
8. I try to figure out what it takes to prove my ability to others.
9. I enjoy it when others are aware of how well I am doing.
10. I prefer to work on projects where I can prove my ability to others.
11. I have never used a computer.*
12. I would avoid taking on a new task if there was a chance that I would appear rather incompetent to others.
13. Avoiding a show of low ability is more important to me than learning a new skill.
14. I’m concerned about taking on a task at work if my performance would reveal that I had low ability.
15. I prefer to avoid situations where I might perform poorly.
16. I eat cement occasionally.*
APPENDIX C

Social Skill

1. I find it easy to put myself in the position of others.
2. I am keenly aware of how I am perceived by others.
3. In social situations, it is always clear to me exactly what to say and do.
4. I am particularly good at sensing the motivations and hidden agendas of others.
5. I am good at making myself visible with influential people.
6. I am good at reading others’ body language.
7. I am able to adjust my behavior and become the type of person dictated by any situation.
APPENDIX D

Need for Cognition

1. I would prefer complex to simple problems.
2. I like to have the responsibility of handling a situation that requires a lot of thinking.
3. Thinking is not my idea of fun.*
4. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.*
5. I try to anticipate and avoid situations where there is likely a chance I will have to think in depth about something.*
6. I find satisfaction in deliberating hard and for long hours.
7. I only think as hard as I have to.*
8. I prefer to think about small, daily projects to long-term ones.*
9. I like tasks that require little thought once I’ve learned them.*
10. The idea of relying on thought to make my way to the top appeals to me.
11. I really enjoy a task that involves coming up with new solutions to problems.
12. Learning new ways to think doesn’t excite me very much.*
13. I prefer my life to be filled with puzzles that I must solve.
14. The notion of thinking abstractly is appealing to me.
15. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.
16. I feel relief rather than satisfaction after completing a task that required a lot of mental effort.*
17. It’s enough for me that something gets the job done; I don’t care how or why it works.*
18. I usually end up deliberating about issues even when they do not affect me personally.
APPENDIX E

Self-Monitoring

1. In social situations, I have the ability to alter my behavior if I feel that something else is called for.
2. I am often able to read people's true emotions correctly through their eyes.
3. I have the ability to control the way I come across to people, depending on the impression I wish to give them.
4. In conversations, I am sensitive to even the slightest change in the facial expression of the person I'm conversing with.
5. My powers of intuition are quite good when it comes to understanding others' emotions and motives.
6. I can usually tell when others consider a joke to be in bad taste, even though they may laugh convincingly.
7. When I feel that the image I am portraying isn't working, I can readily change it to something that does.
8. I can usually tell when I've said something inappropriate by reading it in the listener's eyes.
9. I have trouble changing my behavior to suit different people and different situations.
10. I have found that I can adjust my behavior to meet the requirements of any situation I find myself in.
11. If someone is lying to me, I usually know it at once from that person's manner of expression.
12. Even when it might be to my advantage, I have difficulty putting up a good front.
13. Once I know what the situation calls for, it's easy for me to regulate my actions accordingly.
APPENDIX F

Mini-IPIP

1. Talk to a lot of different people at parties.
2. Have little to say.
3. Am always prepared.
4. Am quiet around strangers.
5. Have a rich vocabulary.
6. Have a vivid imagination.
7. Often feel blue.
8. Am full of ideas.
10. Have frequent mood swings.
11. Pay attention to details.
12. Feel comfortable around people.
13. Am not interested in other people's problems.
15. Keep in the background.
16. Make people feel at ease.
17. Make a mess of things.

18. Worry about things.
19. Follow a schedule.
20. Am the life of the party.
21. Do not have a good imagination.
22. Sympathize with others' feelings.
23. Seldom feel blue.
25. Am not really interested in others.
26. Leave my belongings around.
27. Have difficulty understanding abstract ideas.
28. Use difficult words.
30. Spend time reflecting on things.
31. Take time out for others.
32. Insult people.
33. Have a soft heart.

34. Get chores done right away.
35. Get stressed out easily.
36. Feel little concern for others.
37. Am quick to understand things.
38. Feel others' emotions.
39. Like order.
40. Am not interested in abstract ideas.
41. Don't like to draw attention to myself.
42. Often forget to put things back in their proper place.
43. Get irritated easily.
44. Am relaxed most of the time.
45. Am exacting in my work.
46. Shirk my duties.
47. Don't mind being the center of attention.
48. Change my mood a lot.
49. Have excellent ideas.
50. Don't talk a lot.
APPENDIX G

Big Five Mini-Markers

1. Bashful
2. Bold
3. Careless
4. Cold
5. Complex
6. Cooperative
7. Creative
8. Deep
9. Disorganized
10. Efficient
11. Energetic
12. Envious
13. Extraverted
14. Fretful
15. Harsh
16. Imaginative
17. Inefficient
18. Intellectual
19. Jealous
20. Kind
21. Moody
22. Organized
23. Philosophical
24. Practical
25. Quiet
26. Relaxed
27. Rude
28. Shy
29. Sloppy
30. Sympathetic
31. Systematic
32. Talkative
33. Temperamental
34. Touchy
35. Uncreative
36. Unenvious
37. Unintellectual
38. Unsympathetic
39. Warm
40. Withdrawn
APPENDIX H

Positive and Negative Affect Scale

1. Interested
2. Distressed
3. Excited
4. Upset
5. Strong
6. Guilty
7. Scared
8. Hostile
9. Enthusiastic
10. Proud
11. Irritable
12. Alert
13. Ashamed
14. Inspired
15. Nervous
16. Determined
17. Attentive
18. Jittery
19. Active
20. Afraid
APPENDIX I

Remote Associates Test

Instructions: Look at the three words and find a fourth word that is related to all three.

Example: What word is related to these three words?

 paint doll cat
The answer is "house": house paint, dollhouse, and house cat.

Here is another example:

 stool powder ball
The answer is "foot": footstool, foot powder, and football.

You have 30 minutes to complete the following items:

1. cottage / swiss / cake = __________________
2. loser / throat / spot = __________________
3. night / wrist / stop = __________________
4. rocking / wheel / high = __________________
5. dew / comb / bee = __________________
6. widow / bite / monkey = __________________
7. coin / quick / spoon = __________________
8. aid / rubber / wagon = __________________
9. dream / break / light = __________________
10. fish / mine / rush = __________________
11. print / berry / bird = __________________
12. worm / shelf / end = __________________
13. manners / round / tennis = __________________
14. playing / credit / report = __________________
15. room / blood / salts = __________________
16. ache / hunter / cabbage = __________________
17. high / book / sour = __________________
18. horse / human / drag = __________________
19. age / mile / sand = __________________
20. catcher / food / hot = __________________
21. health / taker / less = __________________
22. lift / card / mask = __________________
23. pine / crab / sauce = __________________
24. house / thumb / pepper = __________________
25. trip / house / goal = __________________
26. fence / card / master = __________________
27. mail / board / lung = __________________
28. wise / work / tower = __________________
29. cry / front / ship = __________________
30. line / fruit / drunk = __________________
APPENDIX J

Alternate Uses Test

Name as many uses for the following object as possible (3 minutes each):

1. Brick

   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

2. Paperclip

   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

3. Newspaper

   ______________________________________________________
   ______________________________________________________
   ______________________________________________________
APPENDIX K

Effort Regulation

1. I often felt so lazy or bored that I gave up on the task.
2. I worked hard on the task, whether I enjoyed it or not.
3. When the task was difficult, I gave up.
4. Regardless of whether I thought the task was interesting, I kept working.
REFERENCES


Colarelli, Minjock, An, O'Brien, & Boyajian, 2015, April). Why we need more nature at work.

In L. R. Nieminen (Chair), *Where does workplace design fit into the I-O tool box?*

Symposium presented at the annual conference of Society for Industrial and Organizational Psychology, Philadelphia, PA.


Goldberg, L. R. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. Deary, F. De Fruyt, & F. Ostendorf (Eds.), *Personality Psychology in Europe*, Vol. 7 (pp. 7-28) Tilburg, NL: Tilburg University Press.


ABSTRACT

THE INFLUENCE OF THE PHYSICAL WORKSPACE ON CREATIVE PERFORMANCE: ALTERNATIVE MEDIATION MODELS

by

REED BRAMBLE

January 2017

Advisor: Boris B. Baltes, Ph.D.

Major: Psychology (Industrial/Organizational)

Degree: Master of Arts

The present study assessed how individuals respond to stimuli in their immediate work environment. Specifically, I conducted a laboratory experiment with a student sample to test the influence of natural stimuli in the workspace on individuals’ creative performance. Additionally, I tested a series of potential mediating variables that could have driven the effect: state positive affect, state openness to experience, and self-regulation of effort. While the results indicated that the hypotheses were broadly unsupported, supplemental analyses revealed that the intervention significantly predicted effort regulation in a high-performing subgroup. Study limitations and recommendations for future directions are discussed.
AUTOBIOGRAPHICAL STATEMENT

Reed Bramble was raised in Grand Rapids, MI, and received his B.S. in Psychology from Grand Valley State University in 2013. Reed has published in peer-reviewed journals such as Personality and Individual Differences and Journal of Organizational and Occupational Psychology. Reed hopes to pursue an academic career studying personality assessment in the work context.