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A Mediational Model of the Creative Process

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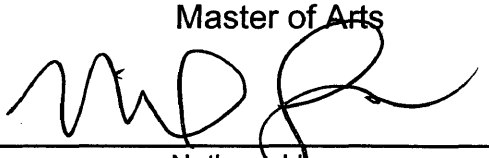

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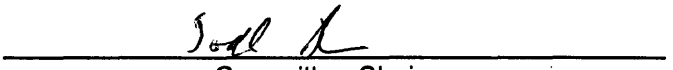

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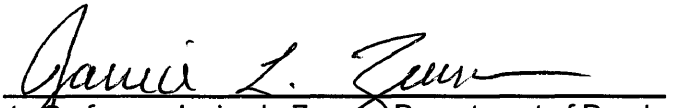

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ABSTRACT PAGE

Unconscious thought has long been theorized to play an important role in the creative process. Although this relationship has been extensively researched, the specific pathways leading from unconscious cognitive processes to useful creative output are still poorly understood. Thrash and Elliot (2003) have elaborated on inspiration as a psychological construct. The current study tests a mediational model in which inspiration mediates the relationship between unconscious thought and creative output using four conditions (control, conscious thought, 1-back, and 2-back). Preliminary analyses indicated a failure of the manipulation to influence unconscious thought, inspiration, or creativity. Further analyses supported the pattern of results predicted by the mediational model, such that attributions of an idea to unconscious thought predicted inspiration at the moment of getting an idea, which in turn predicted self-ratings of creativity of the completed story.

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A mediational model of the creative process

Historically, methodological constraints have limited research regarding the creative process to the description of cognitions present during menial creativity tasks. Although previous research has provided useful insight into cognitive processes involved in creativity, it has done little to characterize the specific pathways that lead from creative cognitions to tangible creative products. These pathways, largely unconscious and difficult to report, have guided researchers and theorists toward the goal of establishing a link between unconscious thought processes and creativity (Bowden & Jung Beeman, 1998; Dijksterhuis & Meurs, 2005; Dijksterhuis & Nordgren, 2006; Koestler, 1964; Schooler, Ohlsson, & Brooks, 1993).

Results from research by Dijksterhuis and colleagues (2006) supported this link. However, interpretations of these results are limited by the simplicity of the creativity tasks presented. These tasks, primarily focused on measures of divergent thinking or novel associations, are not of sufficient complexity to adequately describe the creative process. Although they do assess certain cognitions necessary for creativity, they do not assess or characterize the act of creation itself (i.e., writing a story, creating a work of art, developing a new scientific theory). As such, they assess only a very limited subset of the cognitive processes involved in creativity. Thus, these results paint an incomplete picture of the relationship between unconscious thought and the creative process and provide a limited description of the progression from cognition to actualized creative output. The present study seeks to establish a specific pathway between unconscious processes and creative output.

Creativity

Creativity is the act of bringing into being something original and meaningful. The hallmarks of creative output are that it be useful, original, meaningful, and appropriate to the context in which it will be applied. Creativity is characterized as the generation of original ideas that transcend standard rules, relationships, norms and patterns (*Oxford English Dictionary*; 1989). Researchers have searched for a way to define the creative personality for decades, from seeking to identify personality traits associated with creative behavior to establishing the cognitive processes mediating creativity (Baer & Oldman, 2006; Kelly, 2006; Simonton, 1999; Weisberg, 2006; Wolfradt & Pretz, 2001). Simonton (1999) performed a meta-analysis of the literature regarding creativity and personality and identified six clusters of findings. High levels of creativity are associated with intelligence, a cognitive style open to divergent ideas, openness to new experiences, a motivation to create, unusual behavior, lack of social interest, and schizophrenia-related symptomatology.

Similarly, Wycoff and Pryor (2003) showed that creative individuals exhibited a higher need for cognition and more use of humor, which they interpreted as the tendency for creative individuals to reframe threatening information and to seek out cognitively complex stimuli. Other studies have shown that creative behavior is unrelated to neuroticism (Martindale & Dailey, 1996), and that openness to experience and extraversion positively predict creative hobbies, creatively rated college majors, and peer- or expert-rated creative performance (Wolfradt & Pretz, 2001).

Indeed, after studying the relationship between personality traits and creative behavior, Wolfradt and Pretz (2001) identified openness as the only personality trait to predict creativity across fields of art, science, and a variety of hobbies. The researchers

suggested that this result may have indicated a high degree of domain specificity regarding creativity, with openness serving as a common underlying trait that acts as a catalyst for individuals to excel in their chosen domain because of their acceptance of new ideas. Kelly (2006) found that, in addition to openness, extraversion was also a significant predictor of creativity. This finding is consistent with some previous research (Wolfradt & Pretz, 2001), although not as common a finding as the relationship between openness and creativity. Kelly (2006) interpreted this relationship between extraversion and creativity as a by-product of the equally strong relationship between extraversion and tolerance, which she defined as a general attitudinal quality of openness to others' ideas and flexibility in thinking when comparing ideas. This interpretation is consistent with previous research showing that creativity was related to an increased ability to tolerate ambiguity (Sternberg, 1995). A heightened ability to tolerate ambiguity could help creative individuals evaluate new ideas, making them more likely to allow themselves to experience the uncertainty that occurs when challenging their own previously held ideas and adapting them to fit with new information.

Recent research has used new technology in neuroscience to identify specific structures and patterns of activation that underlie the creative process. Howard-Jones and colleagues (2005) used fMRI to identify activations of semantic divergence during a creative story generation task. During the creativity task, participants were required to incorporate three unrelated words into a story. In the uncreative condition, participants generated a story for three words that were obviously related to a single experience. When participants were engaged in creative, as opposed to uncreative, activities, they demonstrated increased bilateral activity in the medial frontal gyri and left anterior

cingulated cortex. The researchers suggested that this increased activation may be explained by the increased working load of creating novel associations, or by increased demands of episodic memory retrieval. In addition, creative tasks activated parts of the visual cortex, possibly indicating increased use of visual imagery when completing an explicitly creative task.

Battacharya and Petsche (2005) observed significantly different cortical functioning in artists versus non-artists during a sketching task. Specifically, frontal cortical regions showed dominant activity in the right hemisphere of artists, but not non-artists, possibly indicating extensive top-down processing and visual imagery during an artistic task. Grabner and colleagues (2007) showed similar right hemispheric activations for participant-generated ideas that were self-rated as "more original." These studies show reliable brain activations during the creative process, and are a useful complement to cognitive and personality research in establishing that process as a distinct phenomenon.

Creativity and Unconscious Thought

The hypothesized relationship between unconscious thought and creativity has been the subject of extensive speculation and, more recently, empirical study (Dijksterhuis & Meurs, 2005; Dijksterhuis & Nordgren, 2006; Kris, 1952; Lubart & Getz, 1997; Wallas, 1926). Ideas about the exact nature of the relationship have evolved from a focus on the psychodynamic unconscious to include the cognitive processes involved in unconscious thought.

One of the earliest to attempt a theory of creative thought was Wallas (1926), who proposed a four-stage process composed of preparation, incubation, illumination, and

verification. The preparation stage takes place consciously and refers to the process of taking in adequate information regarding the specific area of creativity targeted. The incubation stage is a period of time in which the individual disengages from the creative process or objective. The illumination stage follows, and is characterized by an idea bursting into consciousness, otherwise known as the "Aha!" moment. The verification stage takes place consciously as well, and is characterized by the actualization or application of the idea resulting from the thought process (Wallas, 1926). Of particular interest here is the incubation stage, which implies an active process that takes places while attention is directed away from the information taken in during preparation, and is directly followed by an illumination event consisting of a creative idea. Wallas's influential theory has directed creativity research for the past century, with particular attention paid to characterizing the processes that take place during the largely unconscious incubation stage.

Primary Process Thinking. Early references to the role of the unconscious in the creative process emerged from the psychodynamic theories of Freud and Kris. Freud (1958) outlined *primitive thinking*. Also termed primary process thinking (Russ, 2001), these thought processes occur early in the developmental process. Primary process thinking is primal, present at birth, and possesses strongly associated affective components (Freud, 1966; Russ, 2001). As such, it operates independently of logical, lexical thinking processes, which develop later and are rooted in language-based mechanisms. This primitive thinking is characterized by the use of non-verbal imagery and considerable flexibility. Primary process thinking can be likened to the type of thinking present in dreams, which is often illogical, free of time/space orientation, and

affect-laden (Russ, 2001). These definitions of primary process thinking imply two basic components: affective and cognitive (Russ, 2001). Holt (1977) proposed two types of properties that illustrate these components. Formal properties contain loose associations and condensed images, thus resembling the cognitive component proposed by Russ (2001). Content properties include affect-laden, aggressive, libidinal content that represents both the cognitive and affective components of primary process thinking.

Psychoanalytic theory has characterized primary process as possessing a property called mobility of cathexis, meaning that the energy surrounding and underpinning ideas and images is fluid and easily displaced. As such, this energy is not constricted to a specific idea or concept. Instead, it is freely circulating and promotes a wide scope of flexibly focused attention. This characteristic of primary process thinking facilitates a psychological state that allows interchangeable associations between all ideas, concepts, and images present in the mind. Indeed, Martindale (1989) posited that the freely associative nature of primary process thinking increases the likelihood of discovering novel combinations of concepts. This property of primary process thinking is a necessary component of creativity, where ideas and concepts are in part defined by the novelty of the associations underpinning them.

Kris (1952) relied heavily on primary process thinking in his theory of regression in the service of the ego. This theory of the origins of creativity elaborated on Freud's description of primary process thinking, focusing on the importance of controlling primary process thought and integrating it with conscious, secondary processes. Kris asserted that creative individuals possess strong egos that are not easily threatened by the affect-laden, primitive, often aggressive desires of the unconscious (Kris, 1952). Thus,

creative individuals are able to learn to harness and control their primary process thinking (Kris, 1952; Russ, 2001). These individuals can then regress to primary process modes of thought in a controlled fashion, returning to more rational thought processes as they desire. The ability to engage in controlled alternation between two modes of thought allows creative persons to evaluate the loose, primitive, affective associations formed during primary process thinking in a more logical context. The result of controlled regression is a pathway for the use of unconscious and unusual associations in logically evaluated creative outputs (Kris, 1952). Kris further postulated that control is the distinguishing factor between creative individuals and those individuals with disordered thought and psychopathology, who display similar patterns of regression in an uncontrolled manner.

Unconscious Thought. With the advent of the cognitive revolution, theories of unconscious influences on creativity moved from describing the psychodynamic unconscious to uncovering specific cognitive processes involved in creativity. Dijksterhuis and colleagues (2004) began researching unconscious processes in decision making and creativity tasks and showed that unconscious processes may be superior to conscious processes under certain conditions. Their Unconscious Thought Theory outlines two modes of thought: conscious and unconscious. Dijksterhuis and Nordgren (2006) have proposed that these modes of thought are qualitatively different. As such, they are applicable to different circumstances.

Conscious thought is defined as cognitive or affective thought processes that occur with conscious attention directed at a specific object or task (Dijksterhuis & Nordgren, 2006). Unconscious thought processes, while still object- and task-relevant,

take place while conscious attention is being focused in another direction. Both modes of thought contain cognitive and affective aspects, but the key difference between the two modes is attention. Although the two processes are relatively independent, they continually function together. Dijksterhuis and Nordgren (2006) outlined several key differences between conscious and unconscious thought that are relevant to the creative process.

Consciousness is generally constrained to completing one task at a time because of its relatively low processing capacity. Miller (1956) determined that the storage capacity of consciousness is about seven items. Conscious thought can process between 10 and 60 bits per second according to some researchers. This processing capacity represents only a small fraction of the total processing capacity that is possible with the entire human system. Wilson and Schooler (1991) showed that conscious thought, because of its highly limited capacity, led people to focus on a limited subset of attributes to the detriment of other relevant attributes. In their studies, participants evaluated and rated different categories of objects. Those participants instructed to carefully analyze the objects made less accurate evaluations than the participants who were merely instructed to casually evaluate the objects without directed thought or effort.

Dijksterhuis (2004) provided further evidence for the negative impact of limited processing capacity when he presented participants with a large amount information about four apartments and asked them to pick the best one. He divided participants into two groups: a conscious thought group and an unconscious thought group. In the conscious thought group, participants were instructed to carefully analyze the information presented. In the unconscious thought group, participants completed a distraction task

which prevented them from consciously focusing attention on the information presented. Dijksterhuis asserted that this distraction task paradigm forced participants to engage in unconscious thought for a period of time, during which unconscious cognitive processes continued to evaluate the information while attention was directed elsewhere. In line with the capacity principle, participants in the conscious thought group reported less holistic judgments than participants in the unconscious thought group. Additionally, unconscious thinkers chose the objectively superior apartment more often than both conscious thinkers and the immediate choice control condition. The capacity principle has implications for the creative process in addition to decision making processes. Specifically, low processing capacity could impede the formation of novel associations between tangentially related information that characterizes creative output.

Dijksterhuis and Nordgren (2006) posited that unconscious thought operates aschematically. As such, it is not constrained by an already existing, highly structured, deeply entrenched schema. Rather, it is better at discovering a structure from information that is already present. Consciousness is guided by schemas and expectancies. As such, it generally seeks to incorporate information into existing patterns and previously held expectancies. Sloman (1991) outlined two distinct reasoning processes that mirror the two modes of thought in Dijksterhuis' model. He stated that conscious, strategic thought processes possess an inherent hierarchical structure that automatic reasoning processes do not. Dijksterhius and colleagues suggested that the limited processing capacity of consciousness directly leads to more schema use. Indeed, using the same conscious versus unconscious thought paradigm, they showed that conscious thinkers more easily

resorted to the use of racial stereotypes than unconscious thinkers when evaluating a new person (Dijksterhuis, Bos, Nordgren, & van Baaren, 2006).

In contrast, unconscious thought is a slower process that integrates larger amounts of information into a more objective judgment without excessive limitation by existing organizational frameworks. Dijksterhuis (2004) further showed that, when provided with a consciously processed goal, unconscious thought can lead to enhanced memory with better organized categories. In fact, participants engaging in unconscious thought organized information about a potential roommate into logical clusters (i.e., intelligent behavior, extraverted behavior) without being informed of the clusters in advance. Dijksterhuis (2004) used these findings to determine that unconscious thought is an active, goal directed process that cannot be explained by mere set shifting or forgetting. Instead, it involves more consistent categorization of information into emergent categories that result in changes in the mental representations of objects (Dijksterhuis & Nordgren, 2006).

This difference also has implications for the creative process. To the degree that unconscious thought provides a clearer, more comprehensive mental representation of information and objects, it could result in ideas that are not only novel but creatively useful as well. Conversely, to the degree that conscious thought provides representations that only fit into existing, rigidly held schemas, it could significantly inhibit novel, creative ideas.

The weighting principle states that the unconscious naturally weights information about various attributes of an object based on their relative importance. Wilson and Schooler (1991) argued that conscious thought disrupts this naturally occurring process

and results in sub-optimal weighting. Wilson and colleagues showed that decisions made by conscious thinkers were often inconsistent and less satisfying over time, strongly adhered to, and wrong (Dijksterhuis & Van Olden, 2006; Wilson, Lisle, Schooler, Hodges, Klaaren, & LeFleur, 1993). Wilson et al. (1993) concluded that conscious thought forces people to place more weight on attributes that are easily accessible and verbalized while ignoring attributes that are more abstract. Dijksterhuis suggested that deliberation may actually be detrimental in the absence of a limited set of attributes that require a certain weighting. In terms of creativity, the weighting of a limited number of easily accessible, highly semantic attributes would inhibit the formation of novel associations using additional, more abstract and affective attributes.

Perhaps most relevant to the creative process, conscious thought processes are generally convergent whereas unconscious thought processes are divergent. As a result of the schema-focused, capacity constrained nature of consciousness, it is pressured to search for and categorize information in a way that will converge upon a single concept, idea, or category. Unconscious thought, as a result of its large processing capacity that remains unbound by existing rules or schemas, is more divergent. This principle speaks specifically to the role of incubation in creativity. The idea that the unconscious is active even without direct attention has been a proposed component of creativity since Wallas (1926) theorized about the creative process. Indeed, many creative individuals describe a process in which their most creative ideas or solutions to problems occur at times when they are not actively thinking about the task or problem. This certainly characterizes unconscious thought as an active process that, perhaps through incubation, is able to

process information in such a way that novel associations are formed using a larger pool of knowledge.

Dijksterhuis and Meurs (2006) showed that unconscious thinkers produced more creative and divergent uses of a brick, and more divergent responses to a listing task. Although these studies address one facet of creativity, they provide evidence for the superiority of unconscious thought in creativity. Dijksterhuis' and Nordgren's (2006) theory of unconscious thought provides a useful framework from which to study the effects of different modes of thought on creativity. Although it outlines many reasons for the superiority of unconscious thought in creative tasks, results of research thus far have established the link using tasks that assess only a very limited number of simple creativity tasks. As such, these results do little to elucidate what takes place during unconscious thought that specifically facilitates more creative output. It is possible that other cognitive processes linked to creativity could help to provide a more detailed explanation qualifying the relationship between unconscious thought and creativity.

Insight

Insight is defined as an unexpected solution to a problem that appears after an impasse, and has long been described as possessing qualities that are distinct from language and based in unconscious processes (Bowden & Jung Beeman, 1998; Koestler, 1964; Schooler, Ohlsson, & Brooks, 1993; Wallas, 1926). Evidence for these processes comes from a variety of sources, most notably from anecdotal reports by creative individuals and laboratory scientists, who recall solutions appearing suddenly after periods of distraction or wordless thought. Further information comes from experimental studies by Kaplan and Simon (1990), who reported that individuals successfully solving

insight problems were unable to report critical steps in the problem solving process, primarily the sudden reorganizations of information that seem to precede the appearance of a solution.

Insight problems have been extensively used in the study of both creativity and inspiration. An insight problem contains three necessary properties: it is within the competence of an average subject, it has a high probability of leading to an impasse, and has a high probability of leading to a sudden appearance of a solution after periods of sustained effort or distraction (Bowden, Jung Beeman, & Fleck, 2005; Schooler, Ohlsson, & Brooks, 1993). Although these problems have been useful in establishing a cursory account of processes involved in insight, the results of studies comparing insight and non-insight problems should be interpreted with caution. Insight problems can be solved using processes unrelated to insight. The insights experienced during insight problem solving are not inherent components of the problem itself, but rather result from specific types of thought patterns that may or may not be applied to the problem.

Early research into the cognitive mechanisms active during insight problems solving suggested the importance of unconscious thought in arriving at solutions. More recent research has characterized these unconscious processes as the result of spreading activation (Ohlsson, 1992; Schooler et al., 1993). Ohlsson (1992) proposed a model suggesting that information not directly related to an insight problem is activated in subawareness. This activation accumulates until it reaches a threshold of consciousness. During the accumulation phase, which takes place unconsciously or below the threshold of awareness, mental representations of a problem or object change. With each change in the representation comes a corresponding spreading activation down a new pathway

away from the activation of the original information (Schooler et al., 1993). In this way, more remote information is activated to form a larger base of information in the unconscious. This process may directly facilitate the reorganizations and novel associations responsible for both insight and creativity. As such, it is qualitatively different from the analytical processes that are used during the conscious contemplation of a problem.

Indeed, Kounios and colleagues (2006) have used imaging techniques to show qualitative differences in brain activation during self-reported insight experiences when solving insight problems. Specifically, activity preceding the introduction of the problem predicted whether or not participants would solve the problem correctly. Further, both EEG and fMRI data showed increased activity in medial frontal and temporal areas before exposure to correctly solved problems (Kounios, et al., 2006). The authors suggested that this pattern of activation indicated preparation to strongly activate prepotent candidate solutions, and to prepare attention to switch to non-prepotent solutions if necessary. In this way, insight preparation is able to prepare individuals to not unduly discount weak or distant solutions characterized by remote associations, a process that is essential in creativity tasks.

Seger, Glover, and Gabrieli (2000) used fMRI to study differential activation in cortical structures during a novel word generation task. Participants completed tasks requiring the generation of verbs that were either closely or distantly related to a given noun. Closely associated semantic items showed activation in the left inferior frontal lobe and right cerebellum. Distant associations between nouns and verbs produced identical activation in the left inferior frontal lobe and additional activations in the right prefrontal

cortex, left middle frontal gyrus, and bilateral activation in the cerebellum. The left inferior prefrontal cortex has been implicated in selection of items based on semantic properties. Interestingly, this activation remained unchanged during the generation of distant associations, with new areas being recruited to complete the task. The pattern observed in the generation of distant associations suggests that perhaps the function of the inferior prefrontal cortex is more important for identifying close semantic relationships, with additional areas needed to form more distant associations (Seger, Glover, & Gabrieli, 2000). The frontal gyrus and cerebellum have both been implicated in searching for correct responses. To the degree that searching for novel associations is more effortful, researchers asserted that activations in these areas during generation of distant associations is not surprising.

The right prefrontal cortex has been similarly implicated in insight processes central to the concept of inspiration. Goel and Vartanian (2005) identified differential activation between lateral and vertical set shifts in an insight task. Specifically, increased right prefrontal cortex activation was observed in lateral, but not vertical, set shifts. Further, a hypothesis generation task for solutions to the match problem showed significant activation in the left dorsolateral and right ventrolateral prefrontal cortices, indicating that both lateral and vertical set shifts are involved in the generation process. Additionally, comparisons of successfully versus unsuccessfully completed insight problems showed right ventrolateral prefrontal cortex and left middle frontal gyrus activation. This pattern of activation indicates processes beyond that of mere insight, which is associated with the right hippocampus (Goel & Vartanian, 2005, Luo & Niki, 2003). Thus, activations observed during lateral set shifts in insight problem solving

suggest additional processes that remain unexplained by activities observed in previous research on insight (Luo & Niki, 2003). It is possible that these additional activations could correspond with certain processes involved in inspiration, a link that has yet to be studied.

Interestingly, the patterns of right hemispheric activation seen in insight problem solving are similar to those found in the previously discussed study of neural processes in professional artists. These activations, corresponding largely with hard-to-verbalize, unconscious thought processes, suggest a similar mechanism underlying insight and creativity.

Inspiration

Thrash and Elliot (2003) have characterized inspiration as composed of three core characteristics: transcendence, evocation, and approach motivation. Transcendence is one's awareness that a higher level of output can be achieved, and is characterized as integral in the processes of illumination and insight (Thrash & Elliot, 2003). Evocation refers to the tendency of inspiration to be experienced as an unwilled and evoked event. Inspiration is an experience attributed to a source other than the self, for which the self cannot take responsibility. Finally, inspiration is partially composed of an approach motivation, which is the force that compels individuals to transmit their inspired idea outward to others. Interestingly, inspiration is distinguishable from the approach-motivated positive affective state, which exhibits similar levels of approach motivation, but lower levels of transcendence and evocation.

Researchers have suggested that inspiration serves the important function of transmitting or actualizing ideas or visions (Thrash & Elliot, 2003). The proposed

relationships between transcendence, illumination, and insight are of particular relevance here. After insight forces an idea into consciousness, the resulting illumination triggers inspiration which provides a pressure to transmit that idea outward and to actualize the idea into a transmittable form. Thus, it seems that inspiration could play an important role in the creative process by pressing individuals to transform a novel, original, creative idea into a product that can be shared and useful. Inspiration has been largely ignored both in general psychological research and in the creativity literature.

These links within the construct of inspiration suggest a direct role for inspiration in the unconscious processes leading to creative output. More specifically, the necessity of the transcendence component of inspiration in insight suggests that inspiration could play a similar role in creativity. Taken together, it is reasonable to propose a link between unconscious processes, inspiration, and the creative process. More specifically, inspiration could help describe the established, yet poorly understood, relationship between unconscious thought and creativity.

Thrash and Elliot (2003) established a link between inventors' self-rated inspiration and their number of registered patents. Additionally, the number of patents was significantly related to the self-reported frequency of inspiration in patent holders. Furthermore, the study showed that patent holders reported experiencing inspiration more frequently and more intensely than a control group (Thrash & Elliot, 2003). Further support for the link between inspiration and creativity comes from several studies by Thrash and colleagues (manuscript in progress). Inspiration predicted peer-rated creativity in both scientific- and poetry-writing tasks when controlling for self-rated effort. A third study related self-reports of inspiration, effort, and positive affect (PA)

while writing to the creativity of completed stories as rated by English majors and American Studies graduate students. Creativity ratings were significantly positively correlated with both inspiration and PA, but not effort. A regression analysis revealed that only inspiration uniquely predicted ratings of creativity, $\beta = 0.26$, $p<0.01$.

This study also revealed interesting patterns in self-attributions of thought processes involved in the generation of ideas for the story writing process. In a regression analysis, effort and PA positively predicted the attribution of one's ideas to conscious thought, whereas inspiration negatively predicted conscious thought attributions. Another regression showed that self-rated inspiration and PA positively predicted unconscious thought, whereas effort negatively predicted unconscious thought. These findings provide evidence of an extra step in the causal chain of the creative process. Namely, unconscious thought could make an individual more likely to experience inspiration and to produce output that is rated as more creative by themselves and others.

Based on the research outlined above, I hypothesized a mediational model of creativity. Specifically, I hypothesize that unconscious thought, when compared to conscious thought, would produce higher self-rated and peer-rated creativity of a completed story writing task. I further posited that this process would be mediated by inspiration while generating an idea and completing the story-writing task. I tested this hypothesis by applying Dijksterhuis and colleagues' (2006) distraction task paradigm to a story writing task in which participants complete a previously viewed story immediately or after engaging in either conscious or unconscious thought.

Method

Participants

One hundred and twenty-two undergraduates (64 females; mean age = 18.78, *SD* = 0.95) from the College of William and Mary participated in the experiment. They were randomly assigned to one of four conditions: a control condition ($n = 31$), a conscious thought condition ($n = 32$), a 1-back unconscious thought condition ($n = 27$), and a 2-back unconscious thought condition ($n = 31$). All participants provided informed consent prior to completion of the experiment and were granted course credit in exchange for participation. One participant in the 2-back unconscious condition was dropped due to a programming malfunction that interrupted the distraction task.

Procedure

Participants completed one hour-long experimental session. All instructions and stimuli were administered using a Dell computer and MediaLab ® software.

Participants completed a battery of initial measures assessing self-reports of writing experience and ability, personality traits, trait-level affect, and thinking style. After the initial questionnaires, participants completed practice 1-back and 2-back tasks. Following Dijksterhuis and Meurs' (2006) paradigm, n-back tasks were used to manipulate conscious versus unconscious modes of thought. An n-back task is a memory task in which participants are presented with a series of one-digit numbers one at a time. They are then asked if the presented digit is a "match" or "no match" to the digit that appears *n* digits before it (Dijksterhuis & Meurs, 2006; Jonides, Schumacher, Smith, Lauber, Awh, et al., 1997). For the 1-back task, participants were asked whether or not the presented digit matched the one that came before it (i.e., one digit back). For the 2-

back task, participants were asked whether or not the presented digit matched the one that came two before it (i.e., two digits back; see Appendix 1 for the full description of n-back tasks as viewed by participants).

Dijksterhuis and Meurs (2006) suggested that the cognitive resources needed to complete these tasks fully occupy conscious attention, thereby preventing conscious, focused thought. They further argued that this prevention of conscious thought actually promotes unconscious thought processes, a theory that has been supported by their findings in several studies of decision making and simple creative processes. Practice n-back sessions of both 1- and 2-back tasks were included in all conditions to reduce the likelihood that unfamiliarity with the task during the actual unconscious thought period could cause frustration in the unconscious thought conditions. These practice sessions provided participants with feedback after every response and all participants were given the option to repeat each practice session until they understood the task.

Participants were introduced to the story writing task after completion of the practice 1- and 2-back tasks. They first viewed instructions which informed them that they would have 30 seconds to read the first few sentences of a story (see Appendix 2), after which they would have seven minutes to complete the story. Participants were provided with the beginning sentences of the story in an effort to standardize the content of the completed stories, thus making it easier to compare the creativity of the stories. In the control condition, participants were given seven minutes to complete the story immediately following their initial viewing of the first sentences of the story. In the conscious thought condition, participants were informed that they should take three minutes to think about and plan their story before writing. They were then shown a blank

white screen for three minutes, after which they were given seven minutes to complete the story.

In the 1-back unconscious thought condition, participants completed a three-minute version of the 1-back task that they practiced earlier in the study, while participants in the 2-back unconscious thought condition completed a three-minute version of the 2-back task they had practiced earlier in the study.The n-back tasks were created to contain evenly distributed ratios of one match for every five non-matches throughout the entire task. This ratio corresponded with approximately one match for every five stimuli in the 1- and 2-back tasks. Within each subset of five stimuli, the location of the match was allowed to vary randomly. Each digit in the n-back tasks was presented in the center of the computer screen for two seconds. Participants were then presented with a screen containing the options "Match" or "No Match," and were asked to respond within five seconds of viewing the digit. Previous studies have used various n-back distraction tasks when manipulating conscious and unconscious thought in both decision making and creativity tasks (Dijksterhuis & Meurs, 2006; Jonides, Schumacher, Smith, Lauber, Awh, et al., 1997).

The decision to include both a 1- and 2-back task condition was made for multiple reasons. First, although the 2-back task has been used as a distraction task in previous research, the difficulty of the task is likely to cause frustration in some participants. The 1-back task was significantly less taxing during pilot sessions and was included to investigate potentially differential effects of the distraction tasks on participants' self-rated affect. Second, the 1-back task may not completely prevent conscious thought during the distraction period because it requires less cognitive resources, and may instead

promote only a partial blockage of conscious thought. The inclusion of this task allows a comparison of partially obscured conscious thought with a task that completely obscures conscious thought (the 2-back task). After these respective distraction tasks, participants in both the 1-back and 2-back conditions were given seven minutes to complete their stories.

After the story writing task, participants completed questionnaires assessing affect at various points during the story writing task, reports of idea modality, attribution, and self-ratings of inspiration, creativity, and effort in generating a story idea and writing the story, and self-appraisal of the idea and of the finished story.

Measures

Writing Experience. Participants first completed a 6-item self-report assessment of experience and perceived competence. Three items pertained to writing in general and three items addressed the writing of fictional stories specifically. Participants responded to all six items using a Likert scale ranging from one (*Not at all experienced*) to seven (*Extremely experienced*). Sample items include "How experienced are you with writing?"

NEO-FFI. The NEO-Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992) is a 60-item personality assessment providing measures of five established domains: extroversion (E), neuroticism (N), agreeableness (A), openness to experience (O), and conscientiousness (C). Six additional items from the NEO-Personality Inventory Revised Openness-Aesthetic sub-factor (NEO-PI-R; Costa & McCrae, 1992) were included in this study as they were particularly relevant to the study of creativity. Participants responded to the degree to which the items accurately described them using a five-point Likert scale (1=*Strongly disagree*, 5=*Strongly agree*).

Affect. The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) was developed to assess two dominant and relatively independent dimensions of affect. We used to the PANAS to assess trait level positive affect (PA; 10 items) and negative affect (NA; 10 items) at the beginning of the experimental session. Additionally, the PANAS was completed three times after the story writing task in order to assess state-level positive and negative affect at the time of getting an idea for a story, while writing the story, and at the end of the experimental session. Participants responded to the degree to which the items described what they were feeling at the specified time using a five-point Likert scale (1=*Very slightly*, 5=*Extremely*).

Idea modality. All participants completed an 18-item measure of modality twice after the story writing task: once regarding the modality in which the central idea appeared (visual, auditory, specific words, scents, phrases to be used, etc.) and again regarding the degree to which each item played a role in the story writing process. Participants responded to the degree to which they agreed or disagreed with each modality using a seven-point Likert scale (1=*Strongly disagree*, 7=*Strongly agree*).

Idea and story appraisal. Participants completed a 27-item measure twice after the story completion task: once as an appraisal of their idea and again as an appraisal of their completed story. Both measures used a scale of 1 (*strongly disagree*) to 7 (*strongly agree*). Six items from this scale were used to compute a measure of creativity of the story idea or of the completed story. This measure consisted of a summation of ratings of the idea (or completed story) as original, creative, novel, clever, ingenious, and insightful. Additionally, a variable assessing the degree to which participants felt their idea (or the

completed story) was organic was computed using the summation of three self-rated items describing the degree to which the idea was organic, natural, and authentic.

Inspiration. A three-item measure of inspiration was completed twice after the story writing task: once to assess inspiration at the moment of getting an idea and again to assess inspiration while writing the story. Participants responded using a seven-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*).

Effort. A three-item measure of effort was completed twice after the story writing task: once to assess effort in getting an idea for the story and again to assess effort while writing the story. Participants responded using a seven-point Likert scale (1 = strongly disagree, 7 = *strongly agree*).

Attributions of idea and story origins. A six-item scale was completed twice after the story completion task: once to assess the role of three possible origins of the idea, and again to assess the role of those three origins in the writing process. Each origin was composed of two items: conscious sources (conscious mind, unconscious thought), unconscious sources (unconscious or subconscious mind, nonconscious source deep within), or spiritual sources (supernatural or spiritual force, spiritual or transcendent influence). Participants responded using an identical seven-point Likert scale previously described.

Demographic Information. Standard demographic information was collected including sex, age, and ethnicity. Self-reports of verbal and math scores for the Standardized Aptitude Test (SAT) were collected as an assessment verbal ability. Participants also indicated whether or not English was their first language learned and

primary language of use, and rated the perceived difficulty of the writing task and whether or not they produced a complete story.

Results

Preliminary Analyses

Preliminary analysis revealed no significant main effects of sex or significant interactions between sex and condition (see Table 1).

Manipulation check. No significant effects were found using a regression to test whether or not condition predicted either attributions of story ideas to unconscious sources (see Table 2). This preliminary result suggests that the manipulation may have been unsuccessful. Thus, the following analyses involving the manipulation must be interpreted with caution given the failed manipulation check.

Condition effects

Three condition contrasts were used to perform regression analyses to assess the effect of the manipulation on the creativity task: control condition versus all other conditions, unconscious thought conditions (1- and 2-back) versus conscious thought condition, and 2-back condition versus 1-back condition. Regression analyses revealed no significant relationship between condition and a self-rating of creativity of the completed story (see Table 3). Additionally, there was no significant relationship between condition and a self-rating of the creativity of the story idea (see Table 4). No significant relationship was found between condition and inspiration either when getting an idea for the story (see Table 5) or writing the story (see Table 6). Thus, the hypothesis that unconscious thought conditions would produce more feelings of inspiration and higher

self-ratings of creativity was not supported. This finding led to more in-depth exploratory probing to investigate the reasons for the failure of the experimental manipulation.

Exploratory analyses

Affect and Idea Appraisal. Three identical condition contrasts were used to perform regression analyses to investigate the lack of effect of manipulation on the creativity task. Regression results revealed two significant effects of condition. First, the contrast of experimental conditions versus control condition significantly predicted lower ratings of positive affect at the moment of getting an idea, $\beta = -.22, p < 0.05$. This finding indicates that the control condition had higher ratings of positive affect ($M = 29.42$) relative to the conscious thought condition ($M = 26.69$), the 1-back condition (M=24.45), and the 2-back condition ($M = 24.35$; see Figure 1). Second, an identical contrast showed a significant difference in appraisal of the idea as organic as a result of manipulation conditions versus controls, $\beta = -.21, p < 0.05$. Again, this indicates that the control condition had a higher mean self-rating of the idea as organic ($M = 13.06$) versus the conscious thought condition ($M = 11.66$), the 2-back condition ($M = 11.55$), and the 1-back condition ($M = 10.78$; see Figure 2).

Personality Traits. Regression analyses using identical contrasts described above were performed to test moderating effects of NEO-FFI personality traits on the relationship between creativity and unconscious thought and inspiration and unconscious thought, respectively. The contrast of all experimental conditions versus the control condition revealed a significant interaction effect with NEO-FFI Neuroticism, such that those high on neuroticism were especially responsive to the conscious thought, 1-back,

and 2-back conditions when rating inspiration at the moment of getting the idea for their story, $\beta = -.19, p < 0.05$.

Using the regression formula, predicted values based on high and low self-rated NEO-FFI neuroticism were calculated for self-rated inspiration at the moment of getting an idea for each experimental condition. Individuals high in neuroticism tended to report lower mean ratings of inspiration in the 1-back ($M = 10.21$), the conscious thought ($M = 8.95$), and the 2-back ($M = 8.38$) conditions than in the control condition ($M = 12.12$). Individuals low in neuroticism report similar ratings of inspiration across the conscious thought ($M = 11.75$), 2-back ($M = 11.44$), 1-back ($M = 9.28$), and in the control condition ($M = 10.04$; see Figure 3).

Perceived Competence. Regression analyses were performed to determine whether perceived competence and experience in writing in general and fictional writing moderated self-ratings of creativity and inspiration. Although neither self-ratings of competence or experience in writing significantly predicted self-ratings of creativity or inspiration, a pattern approaching significance was found for the influence of an interaction of an unconscious versus conscious condition contrast and perceived competence at writing on a self-rating of creativity of the completed story, $\beta = 0.16, p = 0.08$.

Using the regression formula, predicted values for high and low perceived writing competence were calculated for each experimental condition. The control condition produced the highest self-ratings of creativity in high and low competence individuals. In those participants with high self-rated competence, creativity ratings for the 1-back (21.25) and 2-back (22.76) conditions were higher than that of the conscious thought

condition (19.76) (see Figure 4). A different pattern was observed for participants with low self-rated writing competence, such that creativity ratings were highest in the conscious thought condition (19.92) relative to the 1-back (17.76) and 2-back (15.65) conditions (see Figure 4).

Expert Ratings of Creativity

Past research has shown that self-ratings of creativity are more highly correlated with ratings of inspiration and unconscious attributions than are peer-ratings (Thrash & Cassidy, in preparation). Additionally, self-reports consistently predict peer reports of creativity. Because preliminary analyses showed no effect of manipulation on self-ratings of creativity and inspiration, I determined that peer ratings of creativity were even less likely to support the hypotheses than self-ratings. Additionally, accurate coding of completed stories would necessitate the employment of English majors as qualified coders. Given the limited budgeting resources for this study, expert ratings of creativity were not collected.

Attributions of Idea to Unconscious Thought

Although the experimental conditions used in this study were not effective in manipulating conscious and unconscious thought, the mediational model could still be tested using the measured attribution of the source of the main story idea in place of condition. Following Baron and Kenny's (1986) three steps for establishing a mediational model, a series of two regressions was performed to assess whether inspiration mediated the relationship between attributions of idea to unconscious sources and appraisal of the idea as creative. Each analysis includes all three condition contrast codes in order to

control for the effects of experimental condition, which are not relevant for this particular analysis.

In the first step, I entered the three contrast codes (any experimental condition vs. control, unconscious thought conditions vs. conscious thought condition, and 1-back condition vs. 2-back condition) and attribution of story idea to an unconscious source as predictors of the self-appraisal of creativity. Attribution of idea to an unconscious source was the only significant predictor of self-rated creativity of the completed story, $\beta = 0.29$, $p < 0.001$. Next, inspiration at the moment of getting a story idea was used as an outcome variable, with the three contrast codes and attribution of idea to unconscious sources again used as predictors. Attribution of story idea to unconscious sources was the only significant predictor of inspiration at the moment of getting a story idea, $\beta = 0.30$, $p < 0.001$. In the second step, inspiration at the moment of getting an idea was included in addition to all variables from step one as predictors of the self-appraisal of creativity. Inspiration at the moment of getting an idea was the only significant predictor of self-rated creativity of the completed story, $\beta = 0.57$, $p < 0.001$. Additionally, when inspiration was added as a predictor of self-rated creativity, the relationship between attributions of idea to unconscious sources and self-rated creativity was no longer significant, $\beta = 0.12$, *n.s* (see Figure 5). These findings lend compelling support to the mediational model of creativity proposed in the current study.

Discussion

The hypothesis that unconscious thought would produce increased self-ratings of creativity and inspiration was not supported by the results of analyses based on experimental condition. A contrast comparing all manipulation conditions (1-back, 2-

back, and conscious thought) to the control condition (immediate completion) revealed significantly lower positive affect and ratings of the idea as organic in all manipulation conditions relative to the control condition. More specifically, participants in the control condition reported the highest positive affect and participants in the unconscious thought conditions reported the lowest positive affect. Additionally, NEO-FFI Neuroticism scores interacted with condition such that higher neuroticism lowered inspiration at the time of generating a story idea for those in the 2-back and conscious thought conditions. Neither self-rated competence nor experience in writing predicted self-rated creativity, inspiration, or decreased effort. A pattern approaching significance was observed for the influence of the interaction of perceived competence in writing and an unconscious vs. conscious thought contrast on self-ratings of creativity of stories. In contrast, exploratory analyses provided support for the meditational model when controlling for the effects of condition, such that attributions of the idea to unconscious sources significantly predicted inspiration, which significantly predicted self-rated creativity.

Significant changes in positive affect as a result of condition

Positive affect correlates highly with both self-ratings of creativity and inspiration. Frederickson and Branigan (2005) compared primed positive and negative emotion states to neutral emotion states. They found that positive emotions broadened the scope of attention to encompass a global focus whereas negative emotion states narrowed the focus of attention. Further, they found that negative emotion states narrow attention toward specific action tendencies (i.e. run away in fear, attack in anger) and the mobilization of the appropriate physical response. Conversely, positive emotional states broaden activation of action tendencies, producing significantly more action tendencies

than either negative or neutral emotion states, suggesting a corresponding broadening of cognitive processes, most specifically associations between thought and action.

The pattern of results observed in analysis of positive affect and condition supports Frederickson's (2001) *broaden and build* theory, which states that the differing effects of emotional states on attention is an evolved complementary function. Negative emotions narrow attentional focus to specific action tendencies because they more closely correspond with active threats in the environment whereas positive emotions broaden thought-action repertoires, inspiring individuals to pursue a broader range of thoughts, actions, and associations than they would in either neutral or negative states (Frederickson, 2001). Positive emotions may further serve to build up personal resources over time, in effect creating positive psychological conditions that outlast the emotional states in which they were developed. More specifically, it may increase resources such as physical health, social resources, intellectual resources, and may foster certain psychological processes, most notably creativity (Frederickson, 2001).

Thus, significantly lower ratings of positive affect in unconscious thought conditions and conscious thought conditions relative to the control condition is a likely explanation of the failure of the manipulation conditions. These results suggest that any condition in which participants were asked to wait a period of time before expressing their ideas had a negative effect on the subsequent writing task and self-ratings of positive affect. There are multiple explanations for this effect. First, perhaps requiring participants to wait to express their idea, either by conscious planning or by distracting them from thought, frustrated them enough to negatively influence positive affect. Indeed, the corresponding low self-attributions of the idea as organic in manipulation

conditions could be the result of a similar process. Restricting the flow of the creative process in a contrived laboratory setting may have decreased the feeling that ideas originated from a natural source. The disruption caused by the forced delay of idea expression could account for both findings.

Second, the distraction task used in the unconscious thought conditions could have been the source of additional differences in positive affect between unconscious and conscious thought conditions. We included both the 1-back and 2-back tasks in an effort to assess different levels of potential cognitive stress and frustration due to the challenging nature of the tasks. Indeed, results support the idea of differing effects of the two n-back tasks. Although not significant, self-ratings of positive affect were slightly lower in the 2-back task compared to the 1-back task. Interestingly, the decrease in positive affect in the conscious thought condition was less than the decrease in positive affect seen in the unconscious thought conditions, relative to controls. These results could indicate increasing decrements in positive affect, and increasing levels of frustration, as a result of increasingly difficult and cognitively taxing tasks.

Significant interaction of NEO-FFI Neuroticism and condition moderates self-rated inspiration

The significant interaction of neuroticism and manipulation conditions on self-ratings of inspiration has interesting implications for the effects of personality traits on state-level inspiration. Participants with high neuroticism reported less inspiration in both the conscious thought and 2-back conditions, suggesting that both highly focused thought and highly taxing tasks will negatively impact the ability of highly neurotic individuals to become inspired. In contrast, those participants reporting low neuroticism displayed

equally high ratings of inspiration at the moment of getting an idea in both the conscious thought and 2-back conditions, suggesting some benefit for both focused thought and unconscious thought during distraction. Additionally, the magnitude of difference between high and low neuroticism participants was greatest in the 2-back condition (see Figure 5). Neuroticism has been linked to simplistic thinking styles, high adherence to norms, and low self-awareness (Zhang & Huang, 2001). To the extent that inspiration necessitates an awareness of one's own internal states, and to the extent that creativity requires departure from norms and complex cognitions, neuroticism could be a negative influence on both. Future research should continue to investigate the effects of personality traits on state-level inspiration, affect, and creativity.

Interaction of self-rated competence and condition moderates self-rated creativity.

Self-ratings of writing competence interacted with condition to moderate the relationship between unconscious thought and self-ratings of inspiration, a result that was marginally significant. In the control condition, those participants rating themselves as highly competent at writing also produced higher predicted self-ratings of creativity of their completed stories. Participants in the conscious thought condition produced virtually identical self-ratings of creativity regardless of self-rated writing competence. Highly competent writers again produced higher self-ratings of creativity in both the 1- and 2-back tasks, an effect that increased in magnitude from 1- to 2-back condition. This pattern of results shows that, for those individuals who have self-perceived competence in writing, the pattern predicted both by Dijksterhuis and colleagues' (2006) previous research and by the mediational model of creativity proposed does occur. Conversely, unconscious thought exerted progressively negative effects on the self-rated creativity of

individuals with low writing competence. These results suggest an important role for perceived competence in moderating the benefits of unconscious thought on creativity.

Indeed, extensive research has shown that individuals with high perceived competence are more likely to accept the challenges of tasks and exhibit persistent effort to complete tasks, generally leading to increased performance relative to low perceived competence individuals (Elliot & Dweck, 1988; Leondari & Gialamas, 2002). On the other hand, those with low perceived competence generally perform worse on tasks relative to high competence individuals, and additionally show higher levels of negative affect and lower levels of persistence during task completion (Elliot & Dweck, 1988). It is possible that individuals with high self-perceived writing competence have more experience with writing. More specifically, they may have higher competence as a direct result of more experience which may have allowed them to engage in more frequent incubation. Thus, they may be more used to engaging in unconscious thought during the writing process. As a consequence, these individuals may benefit more from unconscious thought as a function of being better at unconscious thought because of increased levels of practice.

Although results indicate that the manipulation used here was not effective, there was strong support for the proposed mediational model independent of conditions. Attributions of the idea to unconscious sources strongly predicted self-ratings of the creativity of the main story idea. When self-rated inspiration was taken into consideration, it was strongly predicted by attributions of idea to unconscious sources and in turn strongly predicted creativity of the story idea, after which the relationship between attributions of the idea to unconscious sources and creativity was no longer significant

(see Figure 5). This pattern of results strongly suggests that the processes posited by the current model did indeed occur within individuals, and provides more evidence that the primary problem with the current study was a failure of the experimental manipulation and not an absence of the effect itself.

Although many explanations exist regarding the failure of the unconscious and conscious thought manipulations in the current study, the existence of the phenomenon characterized by Dijksterhuis and colleagues (2006) and proposed here in the mediational model was supported by subsequent analyses. Interestingly, the pattern of expected results predicted by the proposed model was found when the experimental manipulation was controlled for. This pattern provides a strong foundation for future study of the relationship between unconscious thought processes, inspiration, and creativity. It is possible that using a different distraction task, thereby minimizing decreases in positive affect, may be sufficient to show the desired effect. Future research should labor to identify more suitable ways to effectively manipulate conscious and unconscious thought. The mediated model proposed here, if validated in the future, would be an important and meaningful progression in our understanding of the processes driving human innovation.

Appendix A: Full description of n-back tasks as viewed by participants

In the 1-back task, you will be presented with a series of one-digit numbers, one at a time. After seeing each number, you will be asked whether it matches the number that came before it. For example, imagine that you are shown the following sequence of numbers, one at a time: 4, 4, 6, 5, 3, 3, 7, 9, 7. After being shown the second number (4), you would be asked whether it matches the number that preceded it (4). The correct answer would be "Match," because 4 matches 4. Then, after being shown the third number (6), the correct answer would be "No Match," because the 6 doesn't match the 4 that preceded it. In this example, the correct answer for all remaining numbers would be "No Match," except for the sixth number (3), which matches the 3 that preceded it. Please press "Continue" to try a practice 1-back task.

The 2-back task works exactly like the 1-back task with one key difference: for each number, you will indicate whether it matches the number that came TWO before it. For example, imagine that you are shown the following sequence of numbers, one at a time: 4, 6, 4, 5, 3, 8, 7, 9, 7. After being shown the third number (4), you would be asked whether it matches the number that came two before it (4). The correct answer would be "Match," because 4 matches 4. Then, after being shown the next number (5), the correct answer would be "No Match," because the 5 doesn't match the 6 that came two before it. In this example, the correct answer for all remaining numbers would be "No Match," except for the final number (7), which matches the 7 that came two before it. Please press "Continue" to try a practice 2-back task.

Appendix 2: Beginning of story task as viewed by participants

John and Maria walked through town on a summer evening, hand in hand. It was their third date. As they were passing a house next to the lake, they stopped, alarmed by a sound coming from inside the house. Immediately they knew that the evening had taken a turn in a direction that they could not have anticipated.

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Table 1

Moderation of self ratings of inspiration and creativity by sex and interaction of sex and condition.

	β	*t*	*p*
Inspiration while writing			
sex	-0.10	-1.07	0.29
sex X contrast 1	-0.20	-0.70	0.49
sex X contrast 2	0.41	1.40	0.16
sex X contrast 3	-0.50	-1.64	0.10
Inspiration at the moment of getting an idea			
sex	-0.08	-0.90	0.37
sex X contrast 1	-0.18	-0.62	0.54
sex X contrast 2	0.33	1.10	0.27
sex X contrast 3	-0.29	-0.95	0.35
Six-item rating of creativity of completed story			
sex	-0.15	-1.64	0.10
sex X contrast 1	0.01	0.04	0.97
sex X contrast 2	0.21	0.71	0.48
sex X contrast 3	-0.31	-1.02	0.31

Note: sex = main effect of sex; contrast 1 = interaction of sex and condition contrast of any experimental condition vs. control condition; contrast 2 = interaction of sex and condition contrast of unconscious thought conditions (1- and 2-back) vs. conscious thought condition; contrast 3 = interaction of sex and condition contrast of 2-back condition vs. 1-back condition.

Table 2

Condition contrasts predicting attributions of story idea to unconscious sources

	β	*t*	*p*
Contrast 1	-0.00	-0.04	0.97
Contrast 2	-0.04	-0.40	0.69
Contrast 3	-0.05	-0.51	0.61

Note: contrast 1 = any experimental condition vs. control condition; contrast 2 = unconscious thought conditions (1-back and 2-back) vs. conscious thought condition; contrast 3 = 2-back condition vs. 1-back condition.

Table 3

Condition contrasts predicting a six-item self-rating of creativity of completed story

	β	*t*	*p*
Contrast 1	-0.10	-1.09	0.28
Contrast 2	-0.03	-0.32	0.75
Contrast 3	-0.02	-0.20	0.84

Note: contrast 1 = any experimental condition vs. control condition; contrast 2 = unconscious thought conditions (1-back and 2-back) vs. conscious thought condition; contrast 3 = 2-back condition vs. 1-back condition.

Table 4

Conditional contrasts predicting a six-item self-rating of creativity of story idea

	β	*t*	*p*
Contrast 1	-0.08	-0.92	0.33
Contrast 2	-0.06	-0.66	0.51
Contrast 3	-0.01	-0.11	0.91

Note: contrast 1 = any experimental condition vs. control condition; contrast 2 = unconscious thought conditions (1-back and 2-back) vs. conscious thought condition; contrast 3 = 2-back condition vs. 1-back condition.

Table 5

Condition contrasts predicting inspiration at the moment of getting story idea

	β	*t*	*p*
Contrast 1	-0.10	-1.10	0.27
Contrast 2	-0.08	-0.91	0.37
Contrast 3	-0.02	-0.21	0.84

Note: contrast 1 = any experimental condition vs. control condition; contrast 2 = unconscious thought conditions (1-back and 2-back) vs. conscious thought condition; contrast 3 = 2-back condition vs. 1-back condition.

Table 6

Condition contrasts predicting self-ratings of inspiration while writing

	β	*t*	*p*
Contrast 1	-0.12	-1.32	0.19
Contrast 2	-0.08	-0.91	0.37
Contrast 3	0.02	0.21	0.83

Note: contrast 1 = any experimental condition vs. control condition; contrast 2 = unconscious thought conditions (1-back and 2-back) vs. conscious thought condition; contrast 3 = 2-back condition vs. 1-back condition.

Figure captions

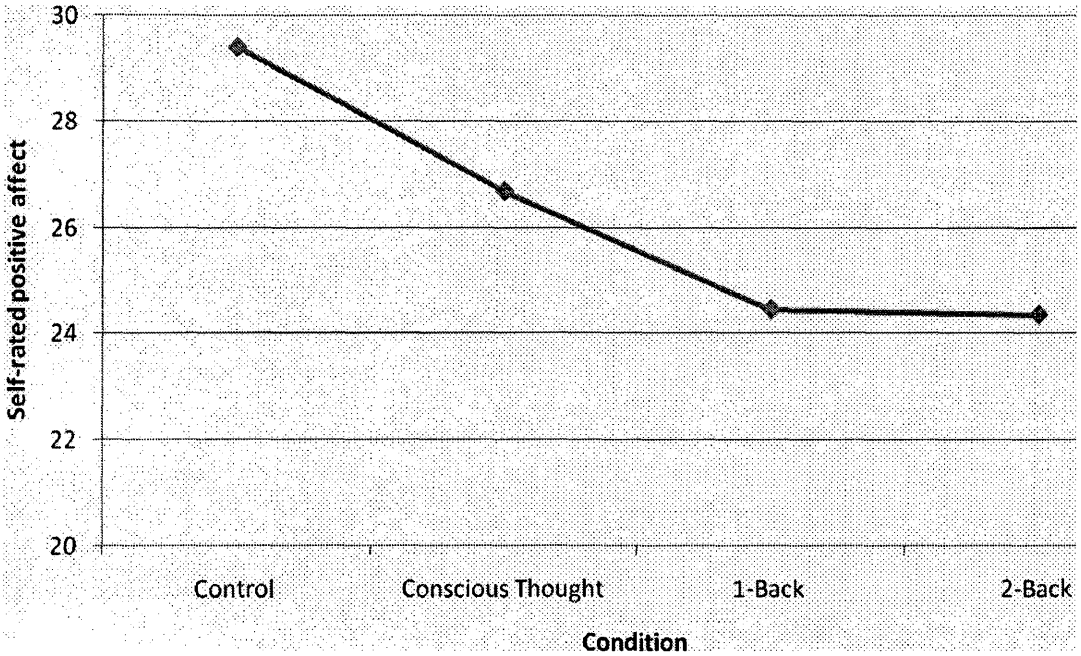
Figure 1. Graph of self-rated positive affect at the moment of getting an idea for the story as a function of condition.

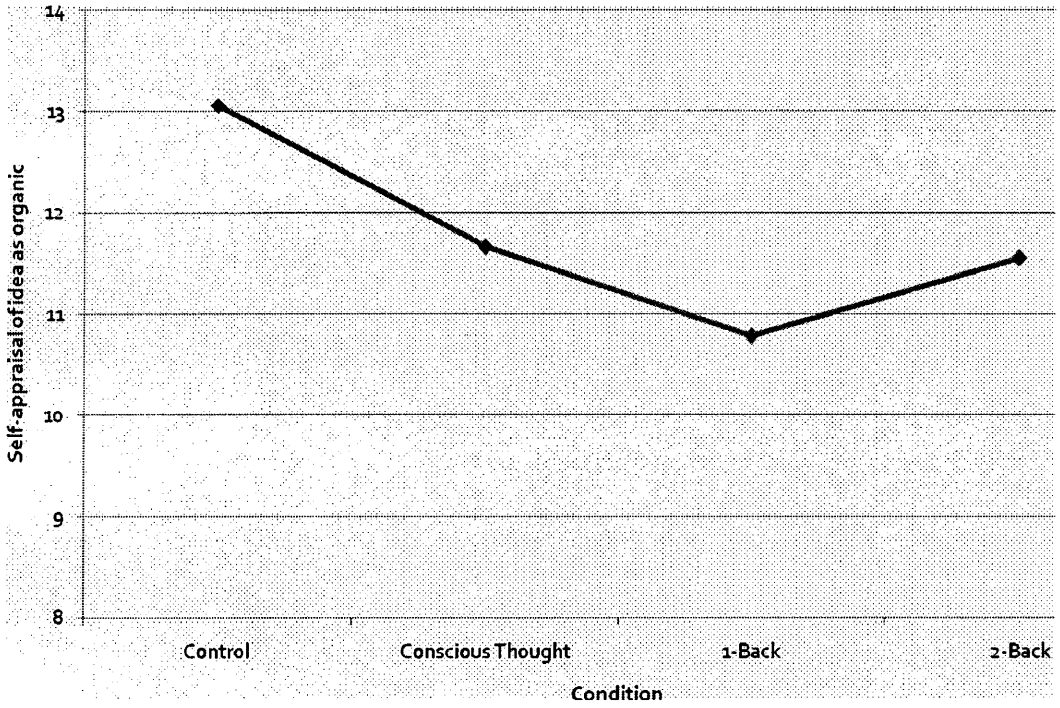
Figure 2. Graph of self-rated appraisal of the story idea as organic as a function of condition.

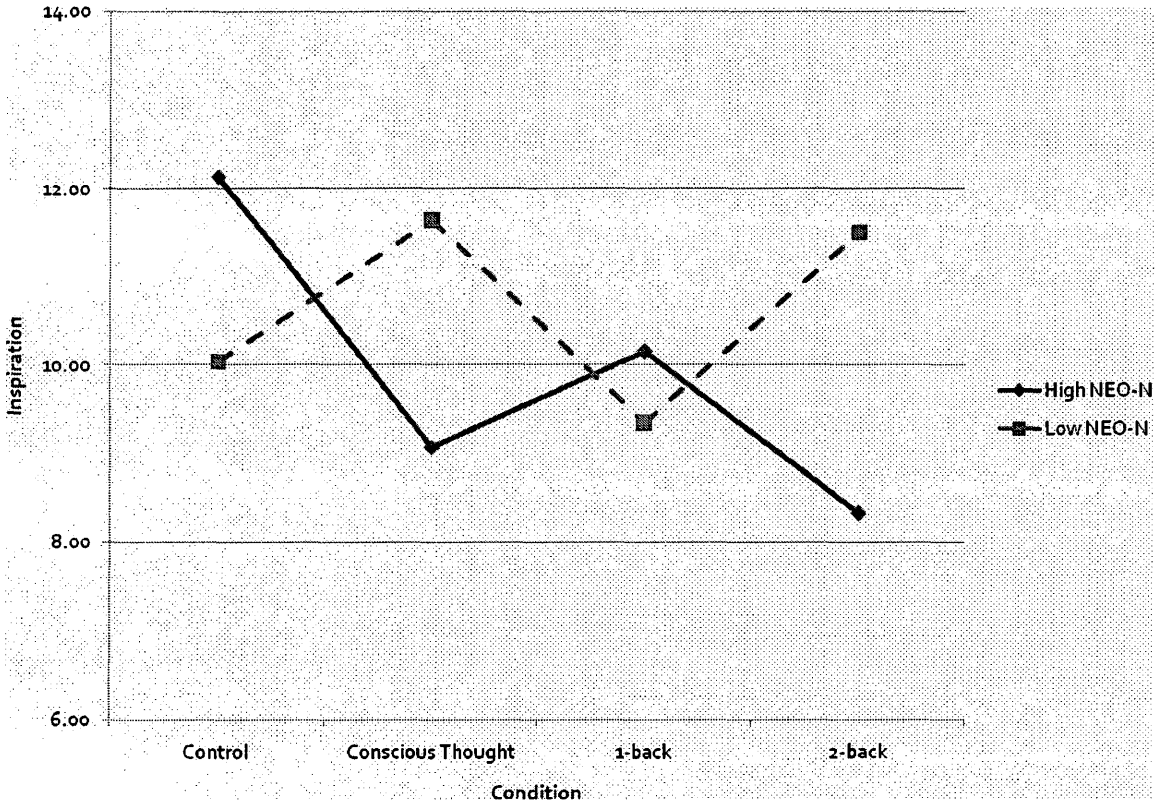
Figure 3. Graph of predicted values for self-appraisal of story idea as creative as a function of the interaction between NEO-FFI neuroticism and condition.

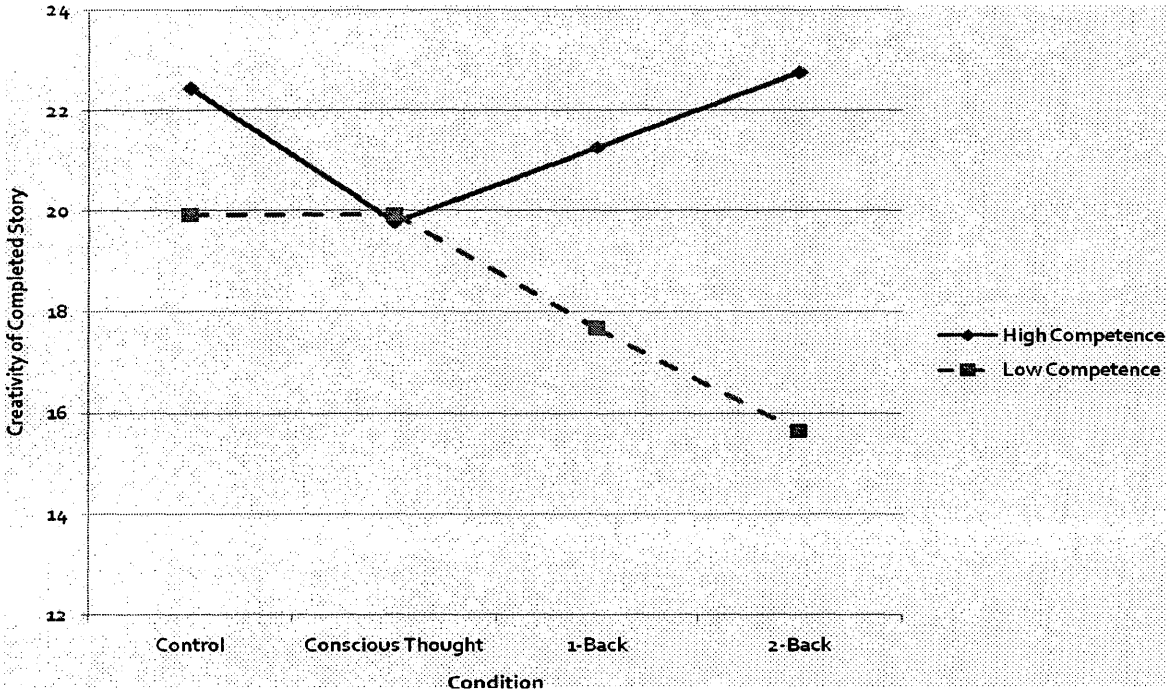
Figure 4. Graph of predicted values for self-rated inspiration at the moment of getting an idea for the story as a function of the interaction between self-rated competence and condition.

Figure 5. Steps 1 and 2 for establishing the mediation of the relationship between attributions of story idea to unconscious sources and creativity by inspiration.

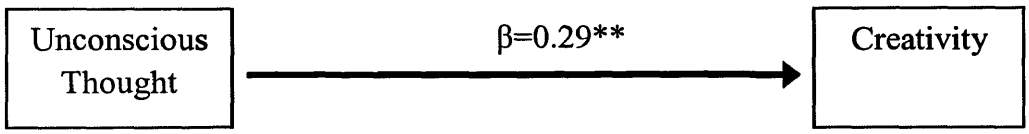

30
28
26
24
22
20
Self-rated positive affect
Control
Conscious Thought
1-Back
2-Back
Condition


14
13
12
11
10
9
8
Self-appraisal of idea as organic
Control
Conscious Thought
1-Back
2-Back
Condition

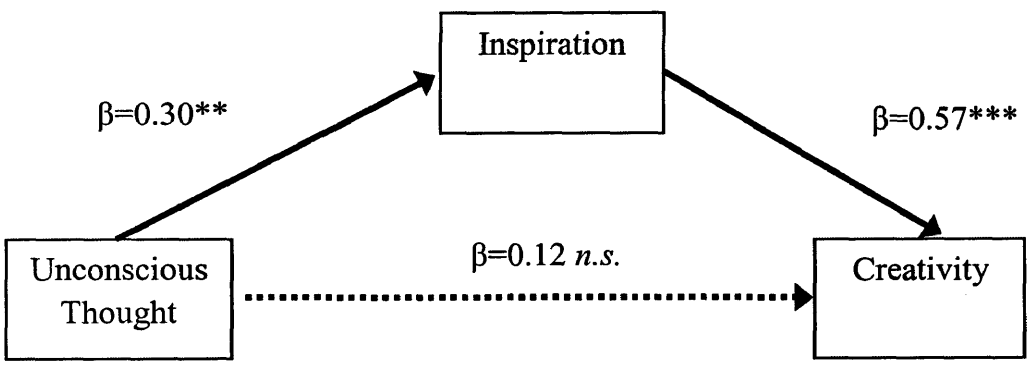

14.00
12.00
10.00
8.00
6.00
Inspiration
Control
Conscious Thought
1-back
2-back
Condition
High NEO-N
Low NEO-N


24
22
20
18
16
14
12
Creativity of Completed Story
Control
Conscious Thought
1-Back
2-Back
Condition
High Competence
Low Competence

Step 1



Step 2



Note: ** = significant at the 0.001 level; *** = significant at the 0.0001 level

Vita

Nathaniel Lucena

Nathaniel Lucena was born in Kealakekua, HI, July 28th, 1981. He graduated *cum laude* from Centenary College of Louisiana in Shreveport, LA in May, 2004 with degrees in Sociology and Psychology and Departmental Honors in Psychology. In August, 2005, he entered the College of William and Mary to pursue a Master of Arts Degree in Experimental Psychology. He defended his thesis in June of 2007. Nathaniel is currently employed at the Neurocognition and Imaging Research Lab of the University of North Carolina-Chapel Hill.