Are there Deleterious Effects of Accuracy Motivation and Reward on Intuitive Performance?

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ABSTRACT

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Six studies examine the effect of accuracy motivation and reward on intuitive performance. In the first three studies, extrinsic motivation was found to undermine performance on an intuitive performance task. Intuitive accuracy was tested using the Artificial Grammar System. In Study One, participants who were induced into an extrinsic-self mindset performed marginally worse at discriminating letter strings compared to participants induced into an intrinsic-self mindset. In order to encourage extrinsic motivation for Studies Two and Three, participants were told that top performers on the intuition task would receive a $50 gift card. Extrinsically motivated participants discriminated strings significantly lower than control participants (Study 2) and classified strings at chance levels (Study 3). Study Four added a retrieval deadline to the task to minimize conscious control. Accuracy motivation did not improve with the response deadline, so I concluded that extrinsic motivation negatively impacted the implicit components of intuition. Further investigation revealed that fragmented attentional encoding accounted for diminished intuitive performance (Study 5). Last, intrinsic motivation improved intuitive performance (Study 6).

DEDICATION

This manuscript is dedicated to my mother, whose love and support has guided me through these years.

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I would have never been able to complete this dissertation without: the guidance of my advisor Dr. Markman; the support from my brother Brad and his wife Liz; the constant advice from Jen Bruce, Liz Tomsich, Lizz Dyczewski, Ellen Gordon, and Stephanie Smith; and of course, the love and support from my mom Mary Beth Skinner.

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CHAPTER 1: INTRODUCTION

Consider the following scenario: It is 1991, and while serving in Operation Desert Storm you are located in a 300-foot long, 30-foot wide, windowless submarine submerged in the Persian Gulf. You monitor a radar screen in a submarine stationed just outside Kuwait. Several hours into your shift a blip appears on the screen. The coastal location of the blip complicates interpretation, as it may plausibly represent friend or foe - a plane piloted by allies or a short-range missile. These 1:1 odds present a deadly puzzle. If the blip represents an ally then firing will kill two of your own. Conversely, standing down could result in the deaths of hundreds of fellow service members if the radar is indeed picking up a missile. Paralyzed, your autonomic nervous system triggers every physiological manifestation of fear, and droplets of sweat accumulate on the source of indecision: the button that would trigger a missile launch. Despite the ambiguity in the situation, your gut tells you that the blip is dangerous. After several seconds of indecision, you follow your intuition and purposefully press the button. As the unknown object slows and eventually disappears from radar, you enter an agonizing state of waiting to discover whether history will deem your intuition-based decision as heroic or tragic.

Gary Klein's (1999) book *Sources of Power: How People Make Decisions* details this account of Lieutenant Commander Michael Riley relying on his intuition and shooting down an unknown object after wrestling with several moments of uncertainty (Klein, 1999). For four hours, Riley anxiously waited to discover what turned out to be a seemingly miraculous outcome—the radar blip was indeed a missile and, thus, Riley was considered a hero. Even in hindsight, Riley could not explain the origin of his intuition, prompting the Marines to hire Gary Klein to investigate the cognitive processes that helped shape his judgment. Riley's case study demonstrates both the profound influence of intuition, as well as how intuition remains a mystery for many who experience it.

Researchers who study intuition have documented its role as a decision-making tool in contexts such as the military (Klein, 1999), nursing (Benner & Tanner, 2009), and art dealing (Gladwell, 2007). Although experts in these fields encourage the use of intuition (e.g. Benner et al., 2009; Conner, 2013; Joseph, 2012), rarely discussed are the implications of encouraging intuition use as a decision strategy for those who do not naturally rely upon their intuition. This reluctance may be due, in part, to the "black box" conundrum associated with not completely understanding the mechanics that underlie intuition (Cert & Wilcockson, 1996).

The limited knowledge gathered on intuitive processing suggests that individuals unconsciously select cues that trigger an emotional response, which leads to a particular judgment (Price & Norman, 2008). Although researchers describe intuition as a common decision-making tool (Kahneman, 2011), the factors that influence intuitive accuracy remain understudied. Task motivation, the presence of a reward or an incentive to perform well on a task, has been shown to influence decision-making in non-intuition based domains (Higgins, 2011), fin part because rewards tend to increase attention and effort directed toward a goal (Bonner & Sprinkle, 2002; Zedelius, Veling, Aarts, 2012). Critically, however, the present work hypothesized that the typically identified positive relationship between reward and performance diminishes or reverses in the domain of intuition-based performance. Intuitive decision-making entails recognizing and applying an affect when a decision cannot easily be determined by logic or retrieved from memory (Kahneman, 2011; Price & Norman, 2008).

The current research examined the influence of two types of accuracy motivation on intuition-based performance. Specifically, the central research question focused on whether intrinsic or extrinsic motivations accurately enhanced or undermined performance on tasks that rely upon, or benefit from, intuitive processing. Extrinsic motivation entails performing a behavior in order to achieve an external reward (Ryan & Deci, 2000). By contrast, intrinsic motivation entails a behavior being in itself a sufficient reward, regardless of external incentives (Ryan & Deci, 2000). The critical hypotheses stated: a) extrinsic motivation adversely impacts intuitive accuracy, b) an attentional mechanism underlies the relationship between extrinsic motivation and intuition-based performance, and c) intrinsic motivation improves intuitive performance. These novel effects within the reward and motivation literature will expand upon work in this area, which largely assumes that motivation and reward should improve performance (Bonner & Sprinkle, 2002; Brehm & Self, 1989). No research to date has directly examined how extrinsic and intrinsic motivations influence intuition-based performance, nor have they proposed that attentional mechanisms account for variance in performance accuracy. Thus, the current research contributes to the psychological literature by departing from the assumption that motivation improves performance, introducing a new descriptive model that specifies the relationship between intuition-based performance and accuracy motivation and identifies the underlying mechanisms.

The policy implications for improving our understanding of how accuracy motivation impacts intuition-based performance are significant, in that such an improved understanding may enable organizations to identify the conditions under which reliance on intuition should be encouraged, as well as when the use of extrinsic rewards such as monetary compensation should be discouraged. In turn, organizational contexts such /as the Military Sciences could develop evidence-based guidelines for decision-making by outlining the suboptimal consequences that can follow from offering extrinsic rewards for performance.

Study One examined changes in intuitive accuracy after inducing intrinsic-self esteem and extrinsic-self esteem. Studies Two and Three demonstrated that extrinsically motivated participants performed worse at intuitively rating (Study 1) and classifying (Study 2) strings. Study Four tested the hypothesis that extrinsic motivation worsens performance accuracy on an intuitive task via implicit processing, a type of processing that entails minimal awareness of the decision-making process (Sloman, 1996). Subsequently, Study Five examined whether extrinsic motivation undermines intuitive performance accuracy because it directs attention toward central cues that may be less relevant, and away from subtle cues that may be more relevant (Whittlesea & Price, 2001). Finally, Study Six tested the novel proposition that intrinsic motivation may *enhance* intuitive performance accuracy.

CHAPTER TWO: INTUITION AND DECISION MAKING

Dual Processes

Systems of reasoning typically comprise two categories, although the names for each process may vary by researcher. *Experiential, System I* processing is less deliberative, employing labels such as reflexive (Lieberman, 2000), associative (Sloman, 1996), nonconscious (Dijksterhuis & Nordgren, 2006), impulsive (Strack & Deutsch, 2004), tacit, peripheral, slow learning, and quickly initiated (e.g. (Hogarth & others, 2005; Petty & Cacioppo, 1986; Rydell, McConnell, Mackie, & Strain, 2006; Stanovich & West, 2008). Experiential processing is thought to occur with minimal awareness of the decision-making process and characterized by a diminished ability to account for the reasoning that underlies judgments, preferences, and decisions. By contrast*, Rational, System II* processing is the more deliberative process, employing labels such as cognitive (Denes-Raj & Epstein, 1994), reflective (Lieberman, 2000; Strack & Deutsch, 2004), rule-based (Sloman, 1996), conscious (Dijksterhuis & Nordgren, 2006), deliberate, central, and fast learning (Hogarth & others, 2005; Petty & Cacioppo, 1986; Rydell et al., 2006; Stanovich & West, 2008) and is thought to require explicit awareness of the decision-making process (Smith & DeCoster, 2000). Generally speaking, processes that require conscious effort or awareness are labeled "explicit," whereas processing that occurs without awareness are labeled "implicit" (Dienes & Perner, 2001; Kihlstrom, Dorfman, & Park, 2007).

Emotions and Decision Making

Decades of empirical research have implicated the role of emotions in decision-making (Bechara, 2004; Damasio, 2008; Greene & Haidt, 2002; Kahneman, 2011). Even when individuals report having based their decisions on logic, research suggests affect directs cost-benefit analysis in favor of those options that initially rated the most positively (Kahneman, 2011; Lehrer, 2009). For instance, Haidt and colleagues found that although participants initially articulated rational justifications for characterizing incest as immoral, when confronted with evidence undermining their rationalizations, participants nonetheless maintained their initial judgments (Haidt, Bjorklund, & Murphy, 2000). Specifically, when participants criticized incest between siblings on the basis of their concern that the resultant children will be born with genetic abnormalities, but then learned that the siblings had used contraceptives, participants persisted in describing their behavior as immoral, even when they could generate no further "rational" justifications for the siblings' actions. Such judgments exemplify "gut-based" as opposed to "reasons-based" reasoning (Haidt et al., 2000). Indeed, such gut-based decision-making has been implicated for decisions involving less controversial or stigmatized topics as well. To illustrate, (Finucane, Alhakami, Slovic, & Johnson, 2000) asked participants to assess the risks and benefits of various technologies, such as nuclear power, preceded by their initial affective responses. Unsurprisingly, participants who reported disliking the technology listed more risks than benefits. Next, participants read about additional efficiency benefits of technologies like nuclear power, and again listed attitudes, advantages, and disadvantages of technology. On the second list, participants indicated more positive attitudes toward technology and listed more benefits *and* fewer risks of technology than they did on the first list. In sum, rather than allowing a rational cost-benefit analysis to be the basis for attitude formation, attitudes, *themselves*, were ultimately responsible for directing judgments (Finucane et al., 2000). Both studies (Finucane et al. 2000; Haidt et al., 2000), then, suggest that affect can bias judgments and decisions in a manner that aligns with pre-existing judgments.

By what mechanism do preexisting and implicit attitudes bias decision-making and the formation of new attitudes? Empirical work suggests that a decision may suffer when thinking mode (i.e., experiential vs. rational) and the object of evaluation are mismatched, such that an object that is typically evaluated experientially is instead evaluated using System II, rational processing. Rational processing in this case may foster an emphasis on irrelevant attributes that lead to reasons-based attitude change and, thus, suboptimal judgments (Kahneman, 2011). In a classic demonstration of reasons-based attitude change, Wilson and Schooler (1991) documented the tendency for one's *post-hoc constructions of* reasons, as opposed to one's *actual* reasons (to which we often lack introspective awareness; (Nisbett & Wilson, 1977) to influence attitude formation in a jam-tasting study. In one condition, participants completed questionnaires about their jam preferences and listed the reasons that they believed underlay their preferences (logical tasters). In a second condition, by contrast, participants simply tasted the jams and then rated their preferences (exempt tasters). The provocative finding was that whereas exempt tasters' jam preferences mirrored those of experts from Consumer Reports magazine, logical tasters gave the highest ratings to jams that were considered the worst by experts. Wilson and Schooler (1991) suggested that instructions to articulate reasons that justified their jam preferences prompted tasters to construct reasons (e.g., spreadability, color) that were incidental to the true source of their preferences. By listing reasons for their preferences that were unrelated to the true source of their preferences, tasters provided evaluations that differed vastly from those of both experts *and* exempt tasters, the latter of whom simply relied upon intuitive, System I processing to judge their preferences. More generally, the suggestion that decision-making may employ two systems of reasoning has spurred researchers to develop strategies for examining each system, as well as theories that address which system is most optimal to employ when rendering both simple and complex decisions.

Unconscious Thought Theory (UTT)

Dijksterhuis and colleagues (Dijksterhuis, 2004; Dijksterhuis, Bos, Nordgren, & Van Baaren, 2006; Dijksterhuis & Nordgren, 2006) have conducted a research program that examines how deliberative thinking can yield suboptimal decisions. This work focused primarily on decisions involving choice options that feature a large number of complex attributes. When it comes to picking out a new car, an apartment, or a couch, it is argued that decisions will be improved if individuals allow their unconscious to consolidate the relevant information instead of consciously weighing all the options (Dijksterhuis, 2004). UTT delineates several principles (5 of which are described here) that purport to explain why unconscious processing may be beneficial for certain kinds of decisions. To begin, UTT's *capacity principle* refers to the relative abilities of the conscious and the unconscious to process information. Only about 7 chunks of information (+ or – 2) can be processed by conscious, working memory at any one time (Miller, 1956), a shortcoming that educes suboptimal decisions in cases when the number of relevant attributes are greater than 7 (+ or – 2). Conversely, the capacity of the unconscious is less bounded and thus can process a larger amount of information, thereby enhancing the likelihood that the most relevant cues are considered (Dijksterhuis, 2004).

UTT also specifies a *bottom-up-versus-top-down principle*. According to this principle, consciousness greatly relies on schemas and expectancies when encoding information, whereas during unconscious processing information is encoded in a piecemeal manner without forcing it to fit into an existing framework. Encoding information schematically can produce errors if the schema in question highlights nonexistent associations, similar to jamming a puzzle piece into the wrong space until it fits. During unconscious processing, by contrast, information is encoded without reliance on potentially biasing schemas. Next, UTT's *weighting principle* describes how conscious processing can overweight the importance of an attribute to the extent that they provide irrelevant and/or post-hoc justifications for why a given attribute is important (see also Wilson & Schooler, 1991). According to UTT, unconscious processing allows for the simultaneous weighing of multiple attributes.

The *rule principle* specified by UTT (Dijksterhuis & Nordgren, 2006) posits that although complex arithmetic calculations can be performed consciously, unconscious processing can yield rough estimates. This difference can be advantageous in decision-making when one attribute shared by two choice options. For example, if one apartment costs an additional $20 per month, individuals will consciously note this difference and thus be more likely to include it as decision factor, whereas during unconscious processing the rental price difference will be perceived as roughly the same and thus will not carry as much weight in the ultimate decision.

Finally, UTT's *convergence-versus-divergence principle* describes the advantages of relying on unconscious processing while engaging in creative problem solving. For problems that benefit from intuitive processing, an incubation period encourages decision-making. According to UTT, such an incubation period provides individuals with time to engage in unconscious processing that allows for information integration and organization. By contrast, if individuals consciously scrutinize one problem aspect to the exclusion of all other problem aspects, they may fall prey to functional fixedness, a state that hinders creative problem-solving (Dijksterhuis, 2004; Hélie & Sun, 2010). If unconscious processing does in fact lead to more optimal attribute weighing, then intuition should be a powerful tool in the domain of decision making.

Intuition

Often described as a "gut feeling" (Helman & Berry, 2003; Knowlton, Ramus, & Squire, 1992; Plessner & Czenna, 2008; Topolinski & Strack, 2009c), researchers tend to construe intuitive decision making as a process by which one chooses among options on the basis of a positive or negative feeling about the target object (Epstein, 2008). Intuitive processing is most closely associated with System I, and as such is characterized by slow learning but quick and effortless initiation (Price & Norman, 2008). Importantly, however, the output of intuitive processing is interpreted through the deliberative, rational system (i.e., System II; Price & Norman, 2008). Thus, when individuals have an intuitive experience they must make a conscious decision about whether to apply it to the choice or problem at hand. In addition, they must consciously infer what the emotion signifies. As such, intuition decision-making employs both the rational and experiential systems.

Price and Norman (2008) have described intuition as a "graded dimension of consciousness" (p.34) that originates in response to unconsciously activated feelings. Individuals become aware of such feelings and apply them toward the targets of judgments (Price & Norman, 2008). In turn, the term "cognitive feelings" describes conscious awareness of such feelings (Norman & Price, 2012; Price & Norman, 2008) that, "…can be used to guide behaviour and judgements [sic], including confidence ratings, in the absence of full conscious awareness of the information-processing antecedents of those feelings" (Norman & Price, 2012, p.127). In other words, intuition is neither completely conscious nor unconscious but rather is dependent upon both System I and System II processing in order to work efficiently.

Artificial Grammar System

A methodological tool that has been employed to measure intuition (including the implicit learning that precedes intuitive judgments) is the artificial grammar task (AGT), which employs an artificial grammar system (AGS; Reber, 1989). The methodology entails two components: an implicit learning phase, and an intuitive judgment phase. For the implicit learning phase, participants are told to retype seemingly random letter strings from memory after a brief exposure. In actuality, these letter strings conform to an AGS containing a pattern that is too complicated to recognize explicitly, but is processed unconsciously (Dienes & Perner, 2001; Pothos, 2007). Before participants complete the intuitive judgment task, they are informed about the letter patterns and how their unconscious integrates the information about the patterns. Participants then see new letter strings that follow the same rules as the old strings, and they are told to use their gut feelings to classify the new letter strings as grammatically correct or incorrect based on the pattern to which they had been previously exposed. Typically, participants perform better than chance at correctly classifying the new strings as grammatically correct or incorrect, even after stating that they did not learn any information about the pattern from the initially presented letter strings (Lieberman, Chang, Chiao, Bookheimer, & Knowlton, 2004; Martin Allwood, Par Anders Granhag, 2000). In a variation of the AGT, participants rate their liking toward the strings or confidence that the strings are grammatically correct. Past research has demonstrated that liking ratings minimize the conscious input directed toward intuitive decision-making because: 1) participants are not told about the pattern, and 2) participants report their feelings without believing that there is a right or wrong answer (Gordon & Holyoak, 1983; Helman & Berry, 2003). On the other hand, researchers have argued that confidence ratings involve more explicit processing (Dienes & Perner, 2001; Gordon & Holyoak, 1983).

Multiple Mechanisms By Which Individuals Render Intuitive Judgments

Figure 1 depicts a descriptive model of how multiple mechanisms influence intuitive judgments. Study Four imposes a response deadline for the purposes of delineating the process (i.e., conscious or unconscious) by which accuracy motivation may diminish intuitive performance.

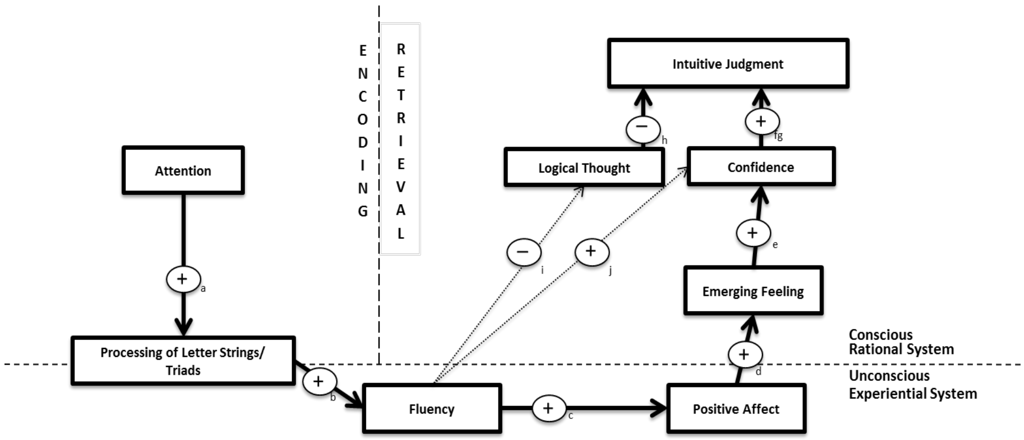

Figure 1. Descriptive model of factors that contribute to intuitive performance [ij](Alter, Oppenheimer, Epley, & Eyre, 2007); [h](Dijksterhuis et al., 2006); [eg] (Gordon & Holyoak, 1983); [a](Helman & Berry, 2003); [f](Kahneman & Klein, 2009); [bcd](Topolinski & Strack, 2009c); [h](Wilson & Schooler, 1991)

Affect. Affect can be elicited by the stimulus itself or be evoked more generally by contextual factors (Price & Norman, 2008; Fig. 2, path d & e). Positive mood inductions have been shown to improve intuitive performance (Bolte & Goschke, 2010; Bolte, Goschke, & Kuhl, 2003), whereas negative mood inductions have been shown to worsen intuitive performance (Topolinski & Strack, 2009a). Furthermore, mood inductions have been shown to overwhelm the affect that derives from the stimulus itself (e.g., correct grammar string in the AGT) and serve as a source of misattribution. To illustrate the latter, (Topolinski & Strack, 2009a) had participants listen to music and told some that the music would exaggerate their emotional responses. Participants who were informed about exaggerated emotional responses were subsequently unable to perform as well on an intuitive judgment task compared to participants who were told nothing. Apparently, "informed" participants misattributed positive affect as deriving from the music instead of the correct grammar strings.

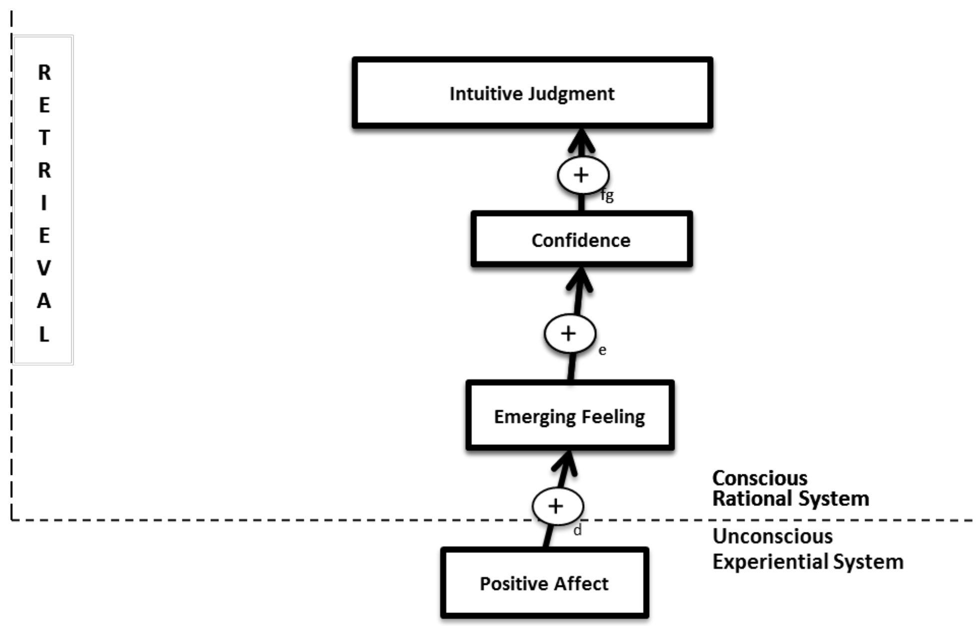

Figure 2. Descriptive model of factors in the rational system

Fluency. Fluency describes the ease with which information is processed(Alter et al., 2007). Thus, when information becomes more difficult to process, fluency decreases, whereas when information becomes easier to process, fluency increases (Alter et al., 2007). A variety of factors can influence fluency. For instance, fluency decreases when the contrast between the background and foreground of a stimulus decreases **(as demonstrated here)** (Topolinski & Strack, 2009c).

Fluency is integral to the intuition process (Topolinski, 2009; Topolinski & Strack, 2009b, 2009c). For instance, Alter and colleagues (2007) established that individuals tend to distrust the experiential system and prefer rational thinking when stimulus presentation becomes less fluent. Conversely, when a stimulus is high in fluency, individuals are more likely to rely upon the experiential system. Research by Topolinski and Strack has helped identify fluency as an unconscious process (Topolinski & Strack, 2009c; Figure 1, path c). For instance when Topolinski & Strack (2009a) informed participants that the music to which they were listening augmented their fluency (i.e., the ease with which they could process grammar strings) participants' intuitive judgment performance was unaffected (i.e., their performance did not differ from "uninformed" participants). Conversely, when participants were informed that the music could exaggerate their emotions, intuitive performance suffered. These results were interpreted as evidence that fluency is experienced unconsciously, whereas affect is consciously recognized. In all, studies have demonstrated that fluency is a mechanism that can improve (obstruct) intuition via increasing (decreasing) intuition-based affect (Topolinski, 2009; Topolinski, Likowski, Weyers, & Strack, 2009; Topolinski & Strack, 2009a, 2009b, 2009c). However, research has yet to address the effect of motivation on fluency (Oppenheimer, 2008) or how the motivation-fluency relationship may impact intuitive performance.

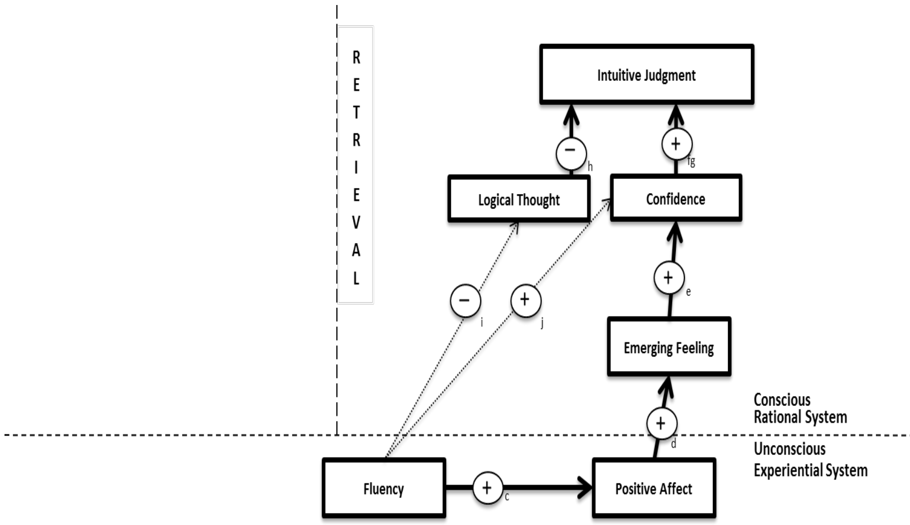

Figure 3. Descriptive model of factors in the experiential system

Fluency and confidence. Research by Alter and colleagues (2007) demonstrated a relationship between fluency and confidence (Figure 3, path j). Using a paradigm adapted from Stepper and Strack (1993), the authors had participants either furrow their brow or puff out their cheeks. Results indicated that participants who furrowed their brows showed less confidence toward the tasks they were completing. The authors concluded, "people are less confident in their judgments when they adopt facial expressions commonly associated with cognitive effort" (Alter et al, 2007, p.573). Alter and colleagues (2007) further tested this relationship by manipulating representative heuristics and base rates. Participants who furrowed their brows were more likely to use base-rates and less likely to rely on representative heuristics. In other words, furrowing one's brow (low fluency) increased reliance upon the rational thought process and lowered reliance on the experiential thought process. Furthermore, participants were also less confident in their decisions, which the authors posit increased their use of careful analysis, i.e. conscious thinking.

Research has found that fluency is not a necessary mechanism in the relationship between confidence and intuition. For instance, (Allwood & Granhag, 1999) examined the correlation between confidence ratings and the classification accuracy of the artificial grammar system [AGS]. Participants had more confidence toward correct strings that they classified correctly than incorrect strings. Similarly, (Gordon & Holyoak, 1983) found higher confidence ratings for correct compared to incorrect strings. These studies demonstrate a relationship between confidence and intuition. If extrinsic motivation hinders confidence (resulting in lower intuitive accuracy) then minimizing explicit processes may prevent this hindrance.

Intention. Unlike confidence, fluency, and affect, scarce research has examined how accuracy motivation influences intuition. (Topolinski & Strack, 2008) theorized that intentions might worsen intuitive performance. Using an altered version of the Semantic Coherence Task to measure intuition, Topolinski and Strack (2008) demonstrated that intending to find a coherent triad actually impedes its semantic activation. Logically, one could assume that someone who is intentionally trying to solve the triad is focusing more on this triad and therefore this person can better process the word, which should improve the activation of similar words. However, the authors argue that intentionality leads to the activation of specific concepts that then prevent the spread to neighboring concepts because these words become inhibited. Their research supported this hypothesis, where participants who were told to search for the fourth word of the triad were worse at classifying coherent from incoherent triads.

Seemingly, the article does support the hypothesis that intentionality can worsen intuition. However, the intentionality manipulation of searching for the fourth word of the triad may not trigger accuracy motivation nor may motivation explain the results. In fact, searching for the fourth word may have increased deliberate thinking, which also worsens intuition (Figure 3, path h; Halberstadt & Levine, 1999; Wilson & Schooler, 1991) or created an information shift, where "...thinking about reasons is believed to lead to a change in the information on which people base their attitudes" (J. B. Halberstadt & Wilson, 2008, p.550). Increasing intention via finding the fourth word of the triad does not equate to motivation. In other words, participants may have searched for the fourth word but still remained unmotivated to perform well on the task. The current research directly manipulated motivation to examine whether accuracy motivation influences intuition and, if so, whether motivation impacted explicit or implicit processing. To examine these questions, the current studies manipulated intrinsic and extrinsic value motivations via reward along varying dimensions of autonomy and control.

CHAPTER 3: MOTIVATION AND REWARD

Basic Types of Self-Related Motivations

Higgins (2011, p.27) defines motivation as "preferences directing choices," meaning that individuals are motivated to be effective at attaining goals. In turn, Higgins delineates three types of effectiveness that motivate individuals: value, truth, and control effectiveness. *Value effectiveness* refers to the desire to attain pleasure and avoid pain, exemplified by classic operant conditioning studies pioneered by Skinner and his colleagues demonstrating that rats will be more likely to press a lever if doing so elicits a reward (e.g., (Skinner, 1956), as well as more recent work examining how corporations can be deterred from law-breaking (e.g., Fisse, 1982). Whereas value effectiveness describes how rewards and punishments motivate specific actions, *truth effectiveness* derives from individuals' need to establish objective reality. To illustrate truth effectiveness, Higgins provides the example of the film "The Truman Show." The main character, Truman, is unknowingly the center of a television show. When he begins to sense something awry, he overcomes a world of resistance in order to discern the truth. His desire drives him to ignore the warnings of his friends and family, face his greatest fears, and risk his life at sea during a thunderstorm in order to learn the truth. Lastly, *control effectiveness* reflects the desire to exert control over one's actions. Psychological reactance, for instance, appears to stem from an aversion to having one's freedom restricted (Brehm, 1966).

Intrinsic and Extrinsic Value Motivations as Conceptualized by Self-Determination Theory

Self-determination theory (SDT; e.g. Deci & Ryan, 2000) focuses on value and control effectiveness in the sense that "value" is conceptualized as rewards and punishments and "control" is conceptualized as perceived autonomy. More generally, SDT identifies two basic types of motivation: extrinsic and intrinsic (Covington & Müeller, 2001; Ryan & Deci, 2000). Extrinsic motivation transpires when a person is motivated to perform the behavior in order to achieve a reward that is not inherent to the behavior (Covington & Mueller, 2001; Ryan & Deci, 2000). Intrinsic motivation transpires when a person is satisfied to perform the behavior without the need for external rewards. SDT explains extrinsic and intrinsic motivation through three basic psychological needs: competence, relatedness, and autonomy (Ryan & Deci, 2000). Within SDT, Ryan and Deci discuss two sub theories; cognitive evaluation theory (CET) examines intrinsic motivation whereas organismic integration theory (OIT) examines extrinsic motivation (Ryan & Connell, 1989; Ryan & Deci, 2000). OIT encompasses four forms of extrinsic motivation that vary along two dimensions: regulation and autonomy. *Externally regulated motivation*, the least autonomous and self-regulated, refers to motivation driven by a need to fulfill a demand or receive a reward (Ryan & Connell, 1989; Ryan & Deci, 2000). For example, student A may be extrinsically motivated to perform well in school, not because he receives satisfaction from learning the material, but because his parents give him $50 for every A he gets on his report card. *Introjected motivation*, which increases in autonomy and self-regulation, motivates a person in order to protect or enhance ego-based needs, such as protecting self-esteem or improving one's pride (Ryan & Connell, 1989; Ryan & Deci, 2000). People desire internal rewards (e.g. believing they teach well) or to protect themselves from internal punishment (e.g. believing they teach badly). Next, *identified regulated motivation* involves an internal goal that is personally valued and accepted (Ryan & Connell, 1989; Ryan & Deci, 2000). For example, a person who tells people she is good at math will be motivated to study the quantitative section on the GREs because a low GRE score would damage her ego. Last, the most autonomous and self-regulated extrinsic motivation is *integrated regulated motivation*, where the goal assimilates with other personally relevant goals and becomes part of the self-concept (Ryan & Deci, 2000). This motivation remains extrinsic because this motivation still lacks the inherent enjoyment of the task.

CET predicts that high feelings of competence and high feelings of autonomy predicate intrinsic motivation (Ryan & Deci, 2000). In order to be intrinsically motivated, the task must carry intrinsic value for the person and be self-determined as opposed to being determined by an outside force. In other words, the behavior, by definition, has to be self-determined (Hayamizu, 1997). Compared to student A, student B may be intrinsically motivated to perform well in school because she derives satisfaction from the learning experience, not because her parents give her a reward for her performance (Lawler & Hall, 1970). More specifically, one's motivation is extrinsic when an external or internal reward relates to one's performance; one's motivation is intrinsic when the performance is itself the reward.

The classic study by (Lepper, Greene, & Nisbett, 1973) found that extrinsically manipulating motivation through rewards lowers intrinsic motivation. When children received a reward for drawing, the children were less likely to draw in the future than children who did not receive a reward to draw. This effect, known as the overjustification effect, results from a person's self-perception that the motivation to perform the task originated from the desire to receive the reward, not for the task's intrinsic value (Lepper, Greene, & Nisbett, 1973). Other studies have since examined the relationship between intrinsic and extrinsic motivation and overwhelmingly supported the hypothesis that extrinsic motivation can lower intrinsic motivation (Notz, 1975).

In contrast, research has also discussed occasions where extrinsic motivation can improve performance in the long term by becoming a tool that increases intrinsic performance (as seen in Covington & Mueller, 2001). For example, if student C was intrinsically motivated to perform well on a task before she received the gift card for her top performance then the gift card becomes a symbol for her great performance and thus increases her intrinsic motivation. In fact, extrinsic rewards may fulfill many different types of motivation. Srivastava, Locke, and Bartol (2001) found that money, a common extrinsic motivation, can fulfill many different motives, such as self-esteem motives and achievement motives. However, the high importance instilled in money still negatively influenced subjective well-being, which includes one's perception of control, self-autonomy, and general well-being. Negative motives, such as seeking power, social comparison, and overcoming self-doubt, accounted for a large chunk of this relationship (Srivastava et al., 2001). Overall, these studies support the notion that extrinsic motivation lowers intrinsic motivation. In Studies 1-4, and Study 6, value effectiveness is manipulated by providing the externally regulated motivator of the gift card or inducing an introjected motivation through an ego-threat. Study 5 manipulates control effectiveness by providing the participants with an opportunity to lessen their workload through their performance. The next section will discuss past studies that examine how these motivations have influenced dual processes that, like intuition, rely on conscious and unconscious knowledge.

Motivation and Dual Processes

A number of studies have examined the relationship between motivation and other constructs that straddle experiential and rational processes. Research by (Mackinnon, Geiselman, & Woodward, 1985) manipulated motivation to examine its influence on the Stroop interference effect, where words that spell a color (e.g. 'Red') are shown in a different color. Reaction time is slower when one tries to state the color blue because they unconsciously process the word "red" faster. Motivation can either improve or worsen performance (Mackinnon, Geiselman, and Woodward; 1985). In this study, the authors tested whether motivation improved performance by narrowing ones focus onto the color of the word and subsequently discounting the meaning of the word (which inhibits semantic processing) or inhibited performance by distracting from the color in which the word is depicted. Participants in a high-incentive condition expected to compete against another person on the Stroop in order to receive extra credit. Results indicated that participants in a high incentive condition reported greater effort and had lower Stroop interference. Mackinnon, Geiselman, and Woodward (1985) further examined whether motivation improved performance via the encoding or retrieval of the words. The authors argue that if motivation influenced encoding then results would indicate changes in long-term memory, where participants would remember less words because their attention would focus more on the color of the word than what the word stated. However, if motivation improves the retrieval stage (i.e. after meaning extraction) then participants would recall the same number of words as the non-motivated group. In fact, the low-incentive group recalled more Stroop words from memory, suggesting that motivation improved the encoding of information. This varies from the current research in that incentives take place after the encoding stage, which negates the opportunity for motivation to influence meaning extraction during the learning stage. In addition, the Stroop task entails overcoming unconscious processing (i.e. experiential system) by narrowing conscious effort. Concerning the current research, if extrinsic motivation minimizes conscious control then one would expect an increase in performance (cf. Bolte & Goschke, 2005). However, if extrinsic motivation is narrowing attention and influencing the processing of the test strings (which measures intuition), then attention deficiencies could account for the hindered performance. Study 5 explores this hypothesis.

Other studies examined how the attentional blinking task activates unconscious and conscious motivations whilst detecting two stimuli in succession (Bijleveld, Custers, & Aarts, 2011). The attentional blinking task requires participants to detect two stimuli serially, where one stimulus is located peripherally and a second stimulus is located centrally. The authors specify a dysfunctional strategy where participants focus on details because it lowers the likelihood that participants will detect both stimuli. Overall, results indicated that activating conscious motivation (via supraliminal priming of a coin) enhanced concentration on task information, which then interfered with effective processing of peripheral information. In other words, participants could not allocate attention to both stimuli. Interestingly, unconscious motivation (via subliminal priming of a coin) improved performance on the task. Studies 5 and 6 revealed similar results, where extrinsic motivation lowered intuitive performance because attention narrows (Study 5). The study on intrinsic motivation echoed the pattern of traditional motivation studies where motivation has been shown to improve performance (Study 6) (Covington & Mueller, 2001; Ryan & Connell, 1989; Ryan & Deci, 2000).

In other research, Visser and Merikle (1999) used the Process Dissociation Procedure to examine the effects of extrinsic motivation on conscious and unconscious processing and retrieval. In various experiments, Visser and Merikle (1999) tested memory and perception using stem completion tasks. In the perception experiments, participants saw a word (e.g. table) and then completed a stem (e.g. tab__). In the inclusion condition, they tried to complete the stem using the word that had just been flashed. In the exclusion condition, they tried to complete the stem without using the word that preceded this stem. Words were either presented subliminally or supraliminally. In addition, participants in the motivation condition believed they would receive a monetary reward for correct answers. The authors employed reaction time measures in order to examine conscious and unconscious influences on performance. The results indicated that participants in the motivated condition committed fewer errors when the words were presented subliminally, and were better able to encode the words that were presented supraliminally.

Overall, these studies demonstrated that motivation could influence information processing at both conscious and unconscious levels, with differing consequences for performance. Similarly, different types of accuracy motivation could improve or worsen intuitive-based performance. Studies 4 through 6 demonstrated that: 1) extrinsic motivation diminishes performance on intuitive tasks, 2) diminished performance occurs because motivation impacts unconscious processes and attention to the stimuli, and 3) intrinsic motivation improves intuitive performance.

CHAPTER 4: STUDIES 1-3

Studies 1-3 examined whether accuracy motivation improves or worsens intuitive performance. More specifically, Study 1 examined the relationship between intuition and introjected motivation by threatening the participant's external self, whereas Study 2 and Study 3 manipulated externally regulated motivation in order to examine subsequent effects on intuitive performance confidence (Study 2) and intuitive performance accuracy (Study 3).

Study One

The first study examined how priming extrinsic self-worth influences intuition-based performance in comparison to priming the intrinsic self. Heightened extrinsic self-worth was predicted to enhance motivation to perform well because it links task achievement to one's sense of self-worth (Arndt, Schimel, Greenberg, & Pyszczynski, 2002). Conversely, heightened intrinsic self-worth was not predicted to enhance motivation to perform well because it serves as a reminder that one's self-worth is stable and unrelated to their task performance. Thus, it was predicted that participants in the extrinsic self-worth condition would perform worse on the intuition-based task than would participants in the intrinsic self-worth condition because the enhanced motivation to perform well negatively relates to intuitive performance.

Participants

Ninety-one undergraduates at Ohio University completed the experiment in exchange for course credit. Twenty-two participants were removed for failing to follow instructions or by exceeding 2SD beyond the mean number of times that participants, overall, provided the same response (i.e., pressing the same response for at least 18 out of the 20 questions). The final sample comprised 69 participants.

Procedure

Implicit learning phase. Up to five participants came into the lab at a time, each seated at a computer. Participants were told that they would be completing a memory task. The computer presented the participants with 24 grammar strings that the participants retyped (e.g. VMRTMXR). These grammar strings followed a specific pattern (Meulemans & Van der Linden, 1997; see Figure 4). Nine letters covered the number pad on the computer, and participants could use the number keypad or the mouse to retype each grammar string.

Extrinsic self-worth manipulation. In order to create a threat to self-worth, some participants read,

> Think of a person who tends to be very evaluative of you, and seems to accept you only to the extent that you live up to certain standards of performance. Try to think of a person who best fits this description (whether from your current life or sometime in the past), and write this person's name or initials below (Arndt et al, 2002).

Afterward, participants described the realism, clarity, and ease with which they were able to imagine the target person.

Intrinsic self-worth manipulation. Participants in the intrinsic self-worth condition read,

> Think of a person who tends to be very accepting and non-evaluative of you, who simply accepts you for who you are. Try to think of a person who best fits this description (whether from your current life or sometime in the past), and write this person's name or initials below (Arndt et al, 2002).

Afterward, these participants also described the realism, clarity, and ease with which they were able to imagine the target person.

Intuition phase. In this phase, participants were exposed to 20 new grammar strings. For each string, participants rated their confidence that the string was grammatically correct on a 1 (“not at all confident”) to 6 (“very confident”) scale.

Process questionnaire. This questionnaire asked participants to select the type of process that most closely described how they decided to rate the grammar strings. The options they were provided included: “I didn’t pay attention”; “I randomly clicked anything”; “I only clicked odd numbers”; “I only clicked even numbers”; “I remembered a pattern that I used”; “I felt like I was following a pattern that I can’t remember”; “I tried to use my gut feeling”; and “I guessed.” Subsequent analyses did not include participants who selected the first four options and/or who selected the fifth option and could describe a specific pattern.

PANAS. Participants completed the Positive and Negative Affect Schedule (PANAS; (Watson, Clark, & Tellegen, 1988) in order to examine whether affect differed as a function of the self-worth manipulation. Participants rated their current emotions (e.g., jittery, hostile, nervous, attentive, determined, alert) on a 1 (“not at all”) to 9 (“very much”) scale.

Results

Intuition Task Confidence Ratings

Differences between the extrinsic self-worth and intrinsic self-worth conditions were examined with regard to mean confidence expressed for correct strings and mean confidence expressed for incorrect strings. Discrimination ratings were created by subtracting each participant's confidence ratings for correct strings from their confidence ratings for incorrect strings, and mean between-group differences for these ratings were examined as well. There were no significant differences between the extrinsic self-worth condition (M = 3.19, SD = 0.91; M = 3.16, SD = 0.90) and the intrinsic self-worth condition (M = 3.48, SD = 0.87; M = 3.11, SD = 0.83) regarding confidence expressed for correct string ratings and incorrect string ratings, respectively, $t(67) = 1.80$, $p = .19$. However, there was a marginally significant difference between the extrinsic self-worth condition (M= 0.36, SD = 0.73) and the intrinsic self-worth condition (M=0.03, SD=0.78) for confidence discrimination ratings, $t(67) = 3.36$, $p = .071$.

A one-sample t-test was then employed to examine the confidence discrimination ratings against zero within both the extrinsic self-worth and intrinsic self-worth conditions. Discrimination ratings significantly higher than zero indicated a statistically reliable ability to provide confidence ratings that discriminate between correct and incorrect grammar strings. As predicted, participants in the intrinsic self-worth condition (M=0.36, SD=0.73) provided confidence ratings that indicated a reliable ability to discriminate between correct and incorrect grammar strings, $t(30) = 2.76$, $p = .01$, whereas participants in the extrinsic self-worth condition (M=0.03, SD=0.78) did not demonstrate a reliable ability to do so, $t < 1$.

PANAS

An arousal index was created after conducting a factor analysis on responses to the PANAS (α= .86). No significant difference in arousal was found between the two conditions, $t < 1$.

Discussion

The results of Study 1 indicated that participants in the intrinsic self-worth condition were able to provide confidence ratings that significantly distinguished between correct and incorrect grammar strings, whereas participants in the extrinsic self-worth condition were unable to provide confidence ratings that significantly distinguish between the two. Because it was predicted that participants who experienced an ego threat would be more motivated to perform well than participants who were not threatened, the results provide support for the hypothesis that extrinsic motivation can worsen performance on tasks that benefit from intuitive processing.

Limitations

In Study 1, participants imagined a person that either threatened their self-worth or reassured them of their self-worth. The manipulation of self-worth type through instructions to imagine may have been somewhat subtle, given the marginally significant difference that was found between the two conditions with regard to confidence discrimination. In order to strengthen the manipulation, Study 2 employed actual extrinsic rewards in the form of $50 gift cards.

Study Two

Study 2 examined whether extrinsic motivation provided in the form of monetary reward lowers intuition-based performance. Previously, (Bonner & Sprinkle, 2002) have found that the use of incentives improves performance on immediate tasks by increasing task effort. In Study 2, participants who believe that top performers on the intuition task will receive a $50 gift card should be more motivated and, thus, should put forth greater effort toward performing well on the task. For reasons described before, however, increased effort should have the ironic effect of leading participants to perform worse on the intuition task.

Participants

Sixty-six undergraduates at Ohio University completed the experiment in exchange for course credit. Twenty participants were removed for failing to follow instructions, previously completing the study, exceeding 2 SDs in providing the same response, or doubting the validity of the $50 gift card. This resulted in a final sample of 46 participants.

Procedure

Implicit learning task. This was the AGT employed in Study 1.

Extrinsic motivation manipulation. Experimenters randomly placed participants to the gift card or control condition. Participants in the gift card condition believed that top performers on the intuition task would receive a $50 gift card. Participants in the control condition had no information about a gift card. Both conditions were also told to use their hunches or gut feeling for the intuition task and do not try to think about the answers.

Intuition task. This task replicates the intuition task employed in Study 1, where participants rated their confidence that the strings were grammatically correct on a 1-6 scale.

Process questionnaire. This questionnaire was employed in Study 1.

Manipulation check. Participants in the gift card condition assessed how excited they were about the gift cards in order to make sure there was motivation to perform well. Further analyses excluded participants from the gift card condition who stated that they had no excitement about the gift card.

PANAS. This questionnaire was employed in Study 1.

Results

Intuition Task Confidence Ratings

No significant differences were revealed between the motivation condition (M=3.29, SD=0.77; M=3.29, SD=0.71) and control condition (M=3.58, SD=0.79; M=3.11, SD=0.84) for the correct string and incorrect string confidence ratings, $t(43) = 1.53$, $p = .22$, $t < 1$, respectively. Importantly, however, there was a significant difference between the motivation condition (M=0.00, SD=0.79) and control condition (M=0.47, SD=0.76) for the confidence discrimination ratings, $t(43) = 4.37$, $p = .042$, where participants in the motivation condition performed worse than participants in the control condition.

A one-sample t-test tested the confidence discrimination ratings against zero for the motivation condition and the control condition. The control condition (*M*=0.47, *SD*=0.76) performed significantly better than zero, $t(22) = 3.03$, $p = .006$, whereas the motivation condition (*M*=0.00, *SD*=0.79) did not perform significantly better than zero, $t < 1$.

PANAS

An arousal index was created after running a factor analysis on items in the PANAS scale ($\alpha = .811$). There was no difference in arousal levels between conditions, $t(45) = 1.23$, $p = .27$.

Discussion

These results indicated that the control (i.e. unmotivated) condition could discriminate the correct from the incorrect strings significantly better than the motivation condition. In addition, only the control condition could significantly discriminate strings better than chance levels; the motivation condition could not discriminate better than chance. Once again, extrinsic motivation appears to lower performance on intuition-based tasks. In addition, a significant difference in response reaction times is often endemic of changes in cognitive fluency. However, reaction times may also result from the meta-cognitive awareness that the intuitive process is struggling. Given that the PANAS scale indicated no significant differences in emotion, emotion may be excluded as a mechanism, leaving confidence and deliberate thinking as other possible mechanisms for the hindrance in performance, in addition to cognitive fluency.

Limitations

Results of this study support the theory that extrinsic motivation worsens intuitive-based performance, but it was still unclear what mechanism of extrinsic motivation worsens the intuition-base performance. Arousal levels did not significantly differ between the motivation and control condition. However, no variables in this study measured whether deliberation levels vary between the two conditions. This was resolved with study 4 that examined whether unconscious factors account for this lowered performance. In addition, although the current study indicated that confidence levels are more accurate for the control group then the extrinsic motivation group, it does not indicate whether this difference in confidence levels actually translates to differences in accuracy. This concern was addressed in Study 3 by requiring participants to classify the strings in the intuition task as grammatically correct or incorrect. It was expected that participants in the control condition would perform better than chance at classifying correct strings. Conversely, participants in the extrinsic motivation condition would perform no better than chance.

Study Three

Study 3 replicated Study 2 by manipulating extrinsic motivation via gift cards. However, participants classified the test strings in the intuition task as correct or incorrect as opposed to measuring confidence.

Participants

Sixty-nine undergraduates at Ohio University completed the experiment in exchange for course credit. Seventeen participants were removed for failing to follow instructions, previous completion of the study, exceeding two-standard deviations in responses, or lacking belief in the validity of the $50 gift card. This resulted in a final sample of 52 participants.

Procedure

Implicit learning task. This task replicated the implicit learning task from Study 1.

Gift card manipulation. This manipulation replicates the manipulation employed in Study 2.

Intuition task. Preceding an explanation about the grammar string system, participants classified new letter strings as correct or incorrect based upon their gut feeling.

Process questionnaire. This task was used in Studies 1-2.

Manipulation check. Participants in the gift card condition assessed how excited they were about the gift cards. Analyses excluded participants who admitted to no excitement concerning the gift card.

PANAS. This questionnaire was employed in Studies 1-2.

Results

Intuition Task Accuracy

A one sample t-test was performed for each condition, which compared the mean percentage of correctly identified correct grammar strings against chance (0.5). Results indicated that only the control condition ($M = .59$; $SD = .15$) performed significantly better than chance at classifying correct grammar strings, $t(26) = 3.08$, $p = .005$. The extrinsic motivation condition (*M* = .56; *SD* = .19) did not perform significantly better than chance at classifying these strings, $t(24) = 1.57$, $p = .13$. Neither the control condition (*M* =.50; *SD* =.16) nor the extrinsic motivation condition (*M*=.54; *SD* =.16) performed better than chance on classifying the false strings, all *t*s < 1. Finally, the control condition (*M* = .54; *SD* = .10) performed significantly better than chance at overall classification, $t(26) = 2.16$, $p = .040$, whereas the extrinsic motivation condition (*M* = .55, *SD* = .16) did not perform significantly better than chance overall at classifying the letter strings, $t(24) = 1.60$, $p = .12$ (see Figure 1).

PANAS

A factor analysis on items in the PANAS scale resulted in two indices representing positive and negative emotions. The positive emotion index includes inspired, proud, active, and enthusiastic, (α= .787). The negative mood index includes irritable, upset, afraid, guilty, hostile, and distressed, (α= .940). After performing an independent t-test for each component, results revealed a marginally significant difference between conditions, where participants in the extrinsic motivation condition (*M* = 3.16, *SD* = .78) reported more positive emotions than the participants in the control condition (*M* = 2.74, *SD* = .90), $t(50) = 1.79$, $p = .080$. Negative emotion ratings were not significantly different between the control condition (*M* = 1.25, *SD* = .60) and extrinsic motivation condition (*M* = 1.42, *SD* = .74), $t < 1$.

Discussion

When asked to classify strings as correct or incorrect, only the control condition could discriminate strings significantly better than chance levels; the motivation condition could not discriminate better than chance. Interestingly, there was no significant difference in response reaction times between the two conditions. The PANAS scale indicated a marginally significant difference in emotion, where the motivation condition reported higher levels of positive emotions compared to the control condition. However, it is unlikely that positive emotion accounted for differing performance on the intuition task since past research has overwhelmingly found that improvements in mood improve performance (Bolte et al., 2003) and in this case, the condition with the better mood still performed worse on the intuition task. In sum, despite the increase in positive emotion, the participants in the extrinsic motivation condition could not discriminate correct from incorrect strings.

Limitations

One limitation of the current study concerns the methodology. Because the purpose of the study was to examine the effects of motivation on decision-making, the intuition task included a force dichotomous response. Consequently, intuitive accuracy was examined by employing t-tests contrasted against chance because, as found in past research (Lieberman et al., 2004; Reber, 1989; Reber & Perruchet, 2003) it is rare for differences in the decision-making to be dramatic enough to be significantly different between two conditions. However, Study 2 mitigated this concern by demonstrating differences in intuitive confidence between conditions.

CHAPTER 5: STUDIES 4-6

Overview of Studies

The fourth study added a retrieval deadline to the intuition task. This minimized the conscious contributions of intuition. Performance was still negatively affected inferring that motivation is influencing an unconscious mechanism, such as fluency, or attention to the stimuli. Because the fourth study demonstrated diminished intuitive performance despite the diminution of conscious awareness, the fifth study hypothesized that deficits in attention to the stimuli during encoding accounted for this interruption in intuitive accuracy (see Figure 6). The sixth study had two hypotheses— first, intrinsic motivation would increase intuitive accuracy and second, extrinsic motivation would not worsen intuitive-based performance for an intuitive task that accounted for deficits in attention.

Study Four

This study examined whether conscious or unconscious mechanisms such as, deliberate thinking or fluency, account for extrinsic motivation's effect on intuitive performance. As stated earlier, research has demonstrated that cognitive fluency is an unconscious mechanism, one that a person cannot control (Topolinski & Strack, 2009b). Because fluency is unconscious, adding a time limit to the intuitive task should not change unconscious processes, such as the experience of fluency. Conversely, deliberate thinking occurs consciously (Dijksterhuis & Nordgren, 2006; Rydell & McConnell, 2006). Therefore, it is reasonable to expect that the addition of a time limit to the intuition task will inhibit one's ability to rely on deliberate thought. If the response limit deadline improves performance then we can deduce that a conscious mechanism is responsible for hampering the intuition process. (See fig. 5). However, if the deadline does not enhance performance then the conscious mechanisms may not account for this effect and extrinsic motivation may be obstructing an unconscious mechanism of the intuition process (See fig. 6). We hypothesized that adding the deadline would not improve performance between the gift card and control conditions, which excluded mechanisms that require conscious awareness or control as the source for the detriment in performance.

HYPOTHESIS 1: There was a main effect for the gift card condition where participants in the control groups will perform better at discriminating strings compared to participants who believe that top performers will receive a gift card.

HYPOTHESIS 2: There was no main effect for the time limit condition compared to control condition.

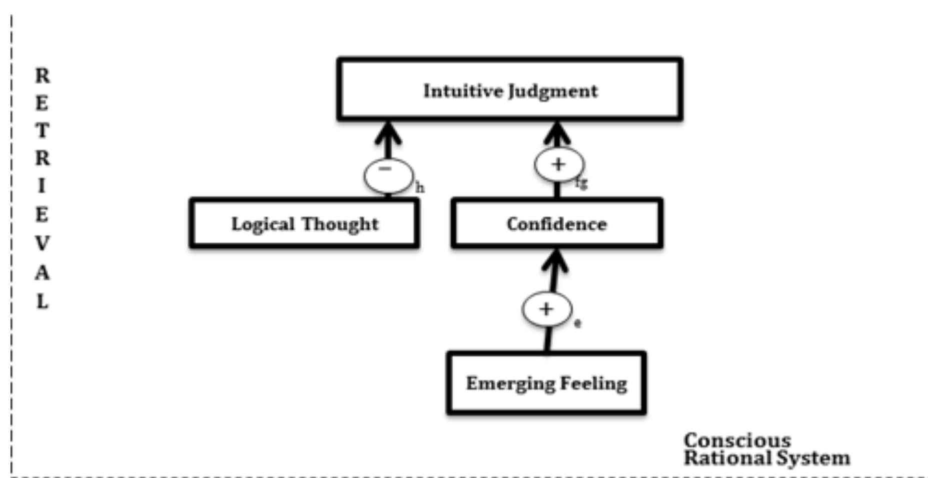

Figure 5. Descriptive model of factors in the rational system that contribute to intuitive performance

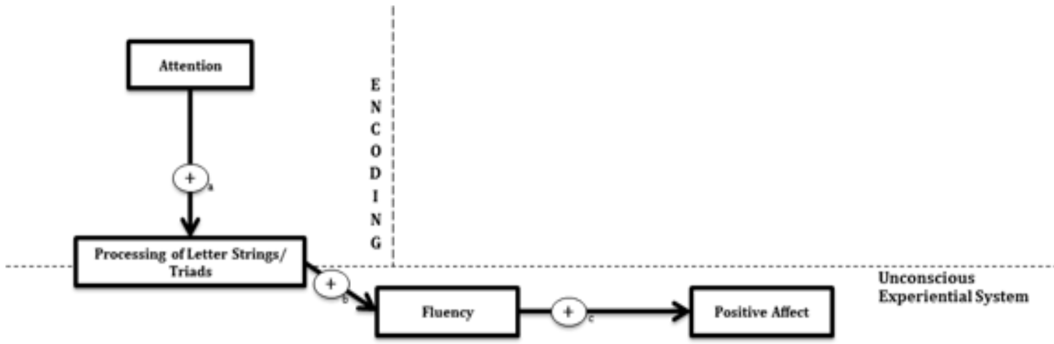

Figure 6. Descriptive model of factors in the experiential system that contribute to intuitive performance

Participants

One hundred and two undergraduates at Ohio University completed the experiment in exchange for course credit. Analyses excluded 43 participants who failed to follow instructions (6 participants), pressed the same choice at least 18/20 times (34 participants[1]), or lacked any excitement or belief in the validity of the $50 gift card (3 participants).

Procedure

The experiment implemented a 2 (Group: gift card vs. control) X 2 (response time: deadline vs. no deadline) between subjects design.

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[1] Given the high number of participants excluded for response pressing the same choice, footnotes included analyses including these participants. The only change in significance relates to the main effect of discrimination ratings for the deadline conditions.

Implicit learning task. This task replicated the implicit learning task from the first study.

Gift card manipulation. Experimenters randomly placed participants to a gift card or control condition. Participants in a gift card condition read that top performers on the intuition task would receive a $50 gift card. Participants in a control condition received no information about a gift card.

Intuition task. For this task, participants first classified 20 strings as grammatically correct or incorrect and then rated their confidence of the string's grammaticality on scale 1-6. Two conditions, had a time limit where first a warning signal will alarm at 1.5 seconds and at 2 seconds the alarm will remain in until the participant classifies the string. Past research has shown that 1.5 seconds is adequate time to intuitively respond (Bolte & Goschke, 2005). Before completing the task, participants read instructions concerning the task. Then participants reordered the instructions on the next screen. This subtask will ensured that participants understood the time limit.

Process questionnaire. This questionnaire replicated previous studies.

Manipulation check. This questionnaire replicated previous studies.

PANAS. This questionnaire replicated previous studies.

Results for Study Four

Intuition Task

Confidence ratings. A 2 (Group: gift card vs. control) X 2 (response time: deadline vs. no deadline) between subject analysis of variance (ANOVA) examined the relationship for overall discrimination. The motivation manipulation revealed a significant main effect for discrimination ratings between the control conditions (*M* = 1.21, *SE* = .29) and gift card conditions (*M* = .16, *SE* = .32), *F* (1, 55) = 5.95, $p < .02$[2], where the control conditions had higher discrimination ratings [figure 6].

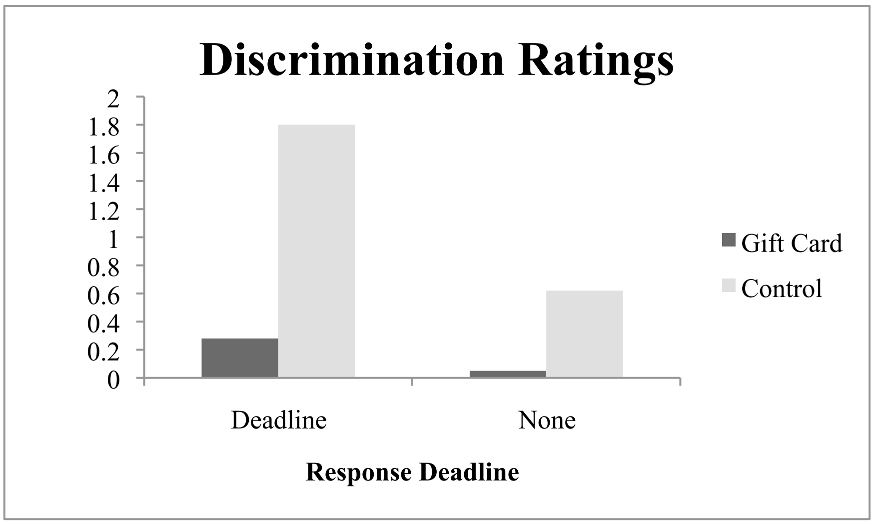

Figure 7. Graph of Study Four discrimination ratings

The deadline conditions (*M* = 1.04, *SE* = .29) and no deadline conditions (*M* = .33, *SE* = .32) demonstrated no significant main effects for discrimination ratings, *F (1, 55*) = 2.70, *p* = .11[3]. Results did not reveal a significant 2 (Group: gift card vs. control) X

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[2] With excluded participants, the motivation manipulation revealed a significant main effect for discrimination ratings between the control conditions (*M* = .76, *SE* = .19) and gift card conditions (*M* = .14, *SE* = .21), *F* (1, 98) = 4.77, $p < .04$.

[3] With excluded participants, the motivation manipulation revealed a significant main effect for discrimination ratings between the deadline conditions (*M* = .73, *SE* = .19) and

2 (response time: deadline vs. no deadline) interaction, *F (1, 55*) = 1.22, *p* > .25[4], which was expected since I hypothesized that a response deadline would not improve performance for the gift card condition.

Classification percentage. A 2 (Group: gift card vs. control) X 2 (response time: deadline vs. no deadline) between subject analysis of variance (ANOVA) examined the relationship for overall classification. The motivation manipulation revealed a marginally significant main effect for classification between the control conditions (*M* = .58, *SE* = .02) and gift card conditions (*M* = .53, *SE* = .02), *F* (1, 55) = 2.83, *p* < .1, where the control conditions had higher classification[5].

The deadline conditions (*M* = .56, *SE* = .019) and no deadline conditions (*M* = .53, *SE* = .021) demonstrated no significant main effect for classification, *F (1, 55*) = 1.42, *p* > .24.

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no deadline conditions (*M* = .17, *SE* = .20), *F* (1, 98) = 3.99, *p* < .05.

[4] Results did not reveal a significant 2 (Group: gift card vs. control) X 2 (response time: deadline vs. no deadline) interaction, *F (1, 98*) = 1.22, *p* > .20

[5] The motivation manipulation revealed a marginally significant main effect for classification between the control conditions (*M* = .55, *SE* = .012) and gift card conditions (*M* = .52, *SE* = .014), *F* (1, 98) = 1.66, *p* < .1, where the control conditions had higher classification.

Reaction Time

A 2 (Group: gift card vs. control) X 2 (response time: deadline vs. no deadline) between subject analysis of variance (ANOVA) examined the log-transformed reaction times for correct and incorrect strings. There were no significant main effects between the gift card condition (M = 3.09, SE = .034; M = 3.06, SE = .033) and control conditions (M = 3.06, SE = .032; M = 3.07, SE = .03) for correct strings, F (1, 55) < 1 or incorrect strings, F (1, 55) < 1. Not surprisingly, there were significant main effects for response deadline for correct and incorrect strings, where participants with a response deadline condition (M = 2.97, SE = .031; M = 2.97, SE = .03) reacted significantly faster than participants without a deadline (M = 3.18, SE = .034; M = 3.16, SE = .033), F (1, 55) = 21.29, p < .001, F (1, 55) = 18.54, p < .001.

PANAS

A factor analysis on items in the PANAS scale resulted in two indices representing positive and negative emotions. The positive emotion index includes inspired, proud, active, alert, interested, attentive, determined, excited, and enthusiastic, (α = .87). The negative mood index includes ashamed, upset, and distressed, (α= .75). Tests of main effect for response time indicated no difference between the deadline (M = 3.00, SE = .12) and no deadline (M = 3.02, SE = .14) conditions for positive emotion, F (1, 55) < 1. In addition, there was no significant difference between the deadline (M = 1.24, SE = .10) and no deadline (M = 1.34, SE = .11) conditions for negative emotions, F (1, 55) < 1.

Tests of main effects for group indicated no significant difference between the control (*M* = 1.27, *SE* = .10) and gift card (*M* = 1.32, *SE* = .11) condition for negative emotions, $F(1, 55) < 1$. There was a significant difference between the control (*M* = 2.70, *SE* = .12) and gift card (*M* = 3.22, *SE* = .12) condition for positive emotion, where participants in the gift card condition reported higher levels of positive emotion compared to the control conditions, $F(1, 55) = 8.16$, $p < .01$.[6] This is not surprising given that prospect of receiving a gift card may increase the components of the positive emotion index: excitement, determination, interest, and enthusiasm.

Discussion

The results support the hypotheses that only participants in the control group (i.e. without extrinsic motivation) will perform significantly better at discriminating strings compared to the gift card group (i.e. extrinsic motivation). However, groups will perform equally when manipulating the response deadline. Indeed, the control group provided higher confidence ratings compared to the gift card group and overall classification percentages were marginally higher for the control group compared to the gift card group. The reaction times results supported the effectiveness of the response deadline manipulation where participants with the deadline on average reacted faster when responding to correct and incorrect strings compared to the participants without a response deadline. However, the response deadline did not result in significantly better

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[6] After accounting for the positive emotion index, the main effects for the gift card conditions was marginally significant, $F(1, 54) = 3.36$, $p < .08$.

performance. Similar to an earlier study using the gift card manipulation, positive emotion was significantly higher for participants in the gift card condition compared to the control condition. This does not undermine the hypothesis because positive emotion should improve performance, not undermine it (Bolte et al., 2003). Overall the results demonstrate how extrinsic motivation adversely affects intuitive-based performance, as well as eliminate conscious mechanisms as accounting for this lowered performance.

Study Five

Study two further assessed the mechanisms by which extrinsic motivation hindered intuitive performance by employing a new artificial grammar task. Study four supported the belief that extrinsic motivation hinders the implicit (unconscious) components of intuition. As such, this second study applied a new artificial grammar paradigm implemented by Helman and Berry (2003) that exposed participants to two types of incorrect strings based on either positional violations or bigram violations (Fig. 7). Compared to the past studies whose artificial grammar paradigm followed a specific pattern and presented mostly positional violations (See fig. 4; Meulemans & Van Der Linden, 1997), the new artificial grammar paradigm incorporates easier bigram violations. Positional violations are difficult to identify because only one letter in the string is in an incorrect position. For example, the letter 'MVR**V**V' is correct, but the letter 'MVR**R**V' is incorrect. A bigram violation, conversely, is easier to identify because specific bigrams (meaning letter chunks such as 'MX') allotted for one position (e.g. the beginning) incorrectly resides in another (e.g. the end).

HYPOTHESIS 1: Participants in the control condition and the challenge condition rated (and classified) correct strings significantly higher than strings with a bigram violation.

HYPOTHESIS 2: Participants in the control condition rated (and classified) correct strings significantly higher than strings with a positional violation. There was no significant difference for challenge condition.

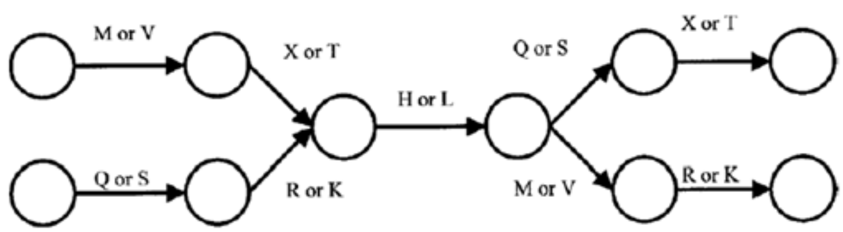

Figure 8. Letter String Pattern

The paradigm by Helman and Berry (2003) examined how divided attention led to analytic (compared to holistic) processing. The authors suggest that analytic processing fractures encoding, which prevents participants from correctly identifying the subtle positional violations. However, bigram violations are salient and recognizable when processed analytically, preventing the detriment in performance.

Likewise, we hypothesized that extrinsically motivated participants would process the grammar strings analytically compared to holistically. Consequently, they would not discriminate between correct grammar strings and strings with positional violations (the same violation type as past studies). However, these extrinsically motivated participants (in an analytical processing style) would discriminate between correct strings and strings with the salient bigram violations.

Participants

One hundred and sixteen undergraduates at Ohio University completed the experiment in exchange for course credit. Analyses excluded 29 participants who failed to follow instructions, pressed the same choice at least 18/20 times, chose not to take the challenge in the additional task condition (which related to the extrinsic motivation manipulation), or exceeded 2 standard deviations for incorrectly retyping the learning strings during the implicit learning task. This left 87 participants.

Procedure

A 2 (between: extrinsic motivation: multiple task vs. control) X 2 (within: positional violations vs. bigram violations) mixed design was implemented.

Implicit learning task. Participants completed an implicit learning paradigm from the Helman and Berry (2003) article, which uses a different set of grammar strings that allow for both bigram and positional violations (in the test phase). They first retyped 16 correct strings. Following the Helman and Berry (2003) technique, the computer program randomized the strings and repeated all 16 strings four times. Due to the increase in the number of strings in this learning phase, the program was not set up to repeat strings that participants retyped incorrectly. Subsequently, analyses excluded participants who exceeded two standard deviations in their number of incorrectly retyped strings.

Challenge manipulation. Researchers randomly assigned participants to either the additional task condition or a control condition. Participants in the additional task condition had a choice of the type of task they would complete. The first choice was an intuition task, where if they performed well, they progressed toward the end of the experiment. However, if they did not perform well, they would complete an additional math task. The second choice was a creative task followed by the same math task.

Providing participants with a choice increases a sense of autonomy, which tends to increase accuracy motivation (Deci & Ryan, 2000; Higgins, 2011). Participants who chose the first task should want to perform well on the intuition task because the experiment would end sooner and failure to perform well results in more math problems. In actuality, all experiments ended when participants completed the intuition task. Participants who chose the intuition task and participants in the control condition completed the artificial grammar task, however the latter group was oblivious about a second possible task or a task choice. I will not discuss and further data will exclude participants who chose the creative task because this choice lacked an incentive to perform well.

Intuition task. Participants first learned about the grammar pattern and then classified and rated these strings as grammatically correct. The test strings included correct strings, as well as strings with a bigram or a positional violation.

Process questionnaire. This questionnaire replicated previous studies.

PANAS. The PANAS measured positive and negative emotion in addition to arousal (Watson, Clark, & Tellegen, 1988).

Results Study Five

Intuition Task

Confidence ratings. A Mixed 2 ([between] task: challenge/control) X 3 ([within] string: correct/bigram violation/positional violation) mixed model ANOVA indicated a significant main effect for ratings based on string type, F (2, 170) = 9.74, *p* < .001. There was no main effect for task, *F* (1, 85) = 2.24, *p* < .20. Additionally, a task by string interaction was not significant, F (2, 170) < 1.

Planned comparisons indicated that overall participants in the control condition rated correct strings (*M* = 7.39; *SE* = .23) significantly higher than the strings with positional violations (*M* = 6.70; *SE* = .18), t (38) = 3.43, *p* = .001 and bigram violations (*M* = 6.75; *SE* = .21), t (38) = 3.02, *p* = .003.[7] Participants in the challenge condition overall rated correct strings (*M* = 6.85; *SE* = .21) significantly higher than the strings with bigram violations (*M* = 6.41; *SE* = .19), t (47) = 2.28, *p* = .025 but only marginally higher than strings with positional violations (*M* = 6.54; *SE* = .16), t (47) = 1.71, *p* = .09. [figure 8]

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[7] With bonferroni adjustments, the control condition rated correct strings significantly higher than the strings with positional violations, t (38) = 3.42, *p* = .003 and bigram violations, t (38) = 3.02, *p* = .01, and participants in the challenge condition rated correct strings marginally higher than the strings with bigram violations, t (47) = 2.28, *p* = .075 but not significantly higher than strings with positional violations, t (47) = 1.71, *p* = .27.

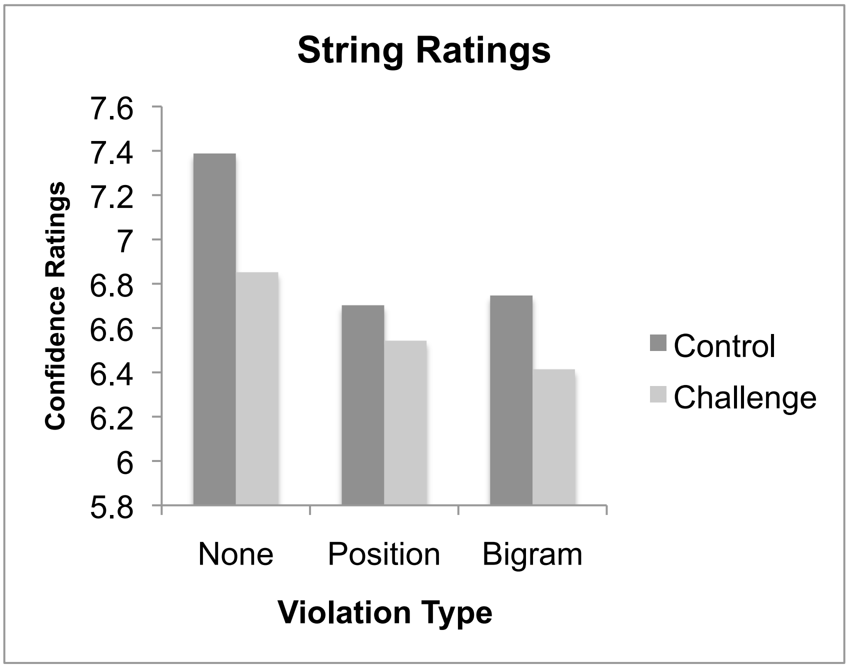

Figure 9. Graph of Study Five discrimination ratings

Classification percentage. A Mixed 2 ([between] task: challenge/control) X 3 ([within] string: correct/bigram violation/positional violation) mixed model ANOVA indicated a significant main effect for classification percentages based on string type, F (2, 170) = 4.78, $p < .03$. There was no main effect for task, F (1, 85) < 1. Additionally, a task by string interaction was not significant, F (2, 170) < 1.

Planned comparisons indicated that overall participants in the control condition classified correct strings (M = .56; SE = .05) significantly higher than the strings with positional violations (M = .50; SE = .03), t (38) = 2.14, p = .03 and bigram violations (M

= .50; *SE* = .03), t (38) = 1.97, *p* = .05.[8] Participants in the challenge condition overall classified correct strings (*M* = .54; *SE* = .03) significantly higher than the strings with bigram violations (*M* = .47; *SE* = .03), t (47) = 1.97, *p* = .05, but not significantly different from strings with positional violations (*M* = .51; *SE* = .03), t (47) = 1, *p* = .32.

PANAS

A factor analysis on items in the PANAS scale resulted in two indices representing positive and negative emotions. The positive emotion index includes inspired, determined, alert, and enthusiastic, (α= .84). The negative mood index includes ashamed, hostile, and guilty (α= .87). An independent t-test indicated participants in the control condition (*M* = 2.72, *SD* = .88) reported marginally higher levels of positive emotion compared to the challenge condition (*M* = 2.36, *SD* = .90) for positive emotion, *t* (85) = 1.84, *p* = .069. There was no significant difference between the control (*M* = .1.07, *SD* = .20) and gift card (*M* = 1.07, *SD* = .20) conditions for negative emotions, *F* (1, 64.46) = -1.65, *p* = .10.

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[8] With bonferroni adjustments, all the planned comparisons became not significant. For control condition, there was no significant difference between the classification of correct strings and strings with positional violations, t (38) = 2.14, *p* = .101 or bigram violations, t (38) = 1.97, *p* = .16. For the challenge condition correct strings were not significantly different from strings with bigram violations, t (47) = 1.97, *p* = .16 nor strings with positional violations, t (47) = 1, *p* = .95.

Discussion

Planned comparisons confirmed that participants in the control condition would rate correct strings significantly higher than strings with bigram and positional violations, whereas participants in the challenge condition would only rate correct strings significantly higher than strings with a bigram violation. However, these results were not significantly different between the motivation and control conditions. Perhaps, the motivation manipulation was weaker compared to the past manipulation involving cash prizes. Unlike Study Four, no scale was added that measured the effect of the motivational incentive. Another possibility pertains to the new grammar task, which may be easier to complete because of the simpler pattern or the increased exposure to grammar strings in the implicit learning task, thus diminishing the negative impact of motivation. It was expected that participants in the challenge condition would struggle with strings that had positional violations because their attention and processing would be more analytical than holistic, which has resulted in this discrepancy in past research (Helman & Berry, 2003). However, the trend supports a combinatory effect of decreased ratings of correct strings that only marginally differ from the ratings of strings with bigram violations.

Study Six

This study tested two hypotheses: first, whether intrinsic motivation would improve intuitive performance and second, whether extrinsically motivated participants' performances improve when the intuition task eliminates the dependency on visual attention. The first hypothesis states that intrinsic motivation will improve performance, similarly to results that Bijleveld and colleagues found using unconscious motivation (2011). Participants who are intrinsically motivated should be more concerned with identifying the experience of intuition than the outcome of intuition. Second, Study Six supported the premise that analytic processing hinders performance on an intuition task for extrinsically motivated participants. Subsequently, using a semantic coherence task (SCT) should remove this impediment because participants will not need to holistically attend to the words in order to receive their semantic meaning. In other words, the last study demonstrated that participants couldn't theoretically attend to the entire grammar string because they were analytically processing the strings (vs. holistically). Conversely, the SCT uses words that participants semantically process wholly without needing to attend to every letter (Ehri, 1995). For that reason, we hypothesize that the SCT overcomes the adverse effect of extrinsic motivation on intuitive accuracy.

HYPOTHESIS 1: Participants in the intrinsic motivation condition would have significantly higher discrimination ratings compared to the control condition.

HYPOTHESIS 2: Participants in the extrinsic motivation condition would not have significantly lower discrimination ratings compared to the control condition.

Participants

One-hundred and sixteen undergraduates at Ohio University completed the experiment in exchange for course credit. Ten participants were removed for failing the process check, leaving 106 participants.

Procedure

Motivation manipulation. Three conditions manipulated intrinsic or extrinsic motivation, or remove any external motivation. The mastery motivation condition increased intrinsic motivation by encouraging students to focus on the learning and experience of intuition. The performance orientation condition encouraged students to compare their intuitive performance to other students. This type of motivation is an ego-based introjected extrinsic motivation. The control condition lacked intrinsic or extrinsic motivation.

Intuition task. This task was the Semantic Coherence Task, where participants saw three words that were possibly semantically related to a fourth word. The participants must intuitively classify the words as related or unrelated and then rate their confidence. See table 1 for examples of the triads.

Process questionnaire. This questionnaire replicated previous studies with the exception that questions asked about rating the triads instead of rating grammar strings.

PANAS. The PANAS measured positive and negative emotion in addition to arousal (Watson, Clark, & Tellegen, 1988).

Table 1

Semantic Coherence Task Word Triads

Word Triad			Fourth Word
club	sky	mare	night
guy	owl	man	wise
soul	busy	guard	body
dog	pizza	can	-
tea	lotion	wall	-
green	toe	picture	-

Results Study Six

Intuition Task

Confidence ratings. A One-way ANOVA indicated a marginally significant difference in discrimination ratings, F (2, 103) = 2.61, $p < .08$. Levine's test of was also significant for discrimination ratings, F (2, 103) =8.28, $p < .001$. Planned contrasts compared (1) participants in the mastery condition to participants in the control condition, (2) participants in the mastery condition to participants in the performance condition, and (3) participants in the control condition to participants in the performance condition. The first planned comparison revealed that the Mastery condition (M = 1.39, SD = .83) performed marginally better at discriminating triads compared to the Control condition (*M* = 1.07, *SD* = .59), t (61.88) = 1.90, *p* = .062. The second planned comparison revealed that the Mastery condition (*M* = 1.39, *SD* = .83) performed marginally better at discriminating triads compared to the Performance condition (*M* = 1.09, *SD* = .49), t (58.08) = -1.80, *p* = .077. As expected, the third planned comparison revealed no significant difference between that the Control condition (*M* = 1.07, *SD* = .59) and the Performance condition (*M* = 1.09, *SD* = .49), t (64.77) < 1.

Classification Percentages. A One-way ANOVA indicated no significant difference in overall percentage of correctly classified triads, F (2, 103) = 1.73, *p* > .18. Levine's test of was significant for triad classification, F (2, 103) =6.56, *p* <.003. Planned contrasts compared (1) participants in the mastery condition to participants in the control condition, and (2) participants in the mastery condition to participants in the performance condition. The first planned comparison revealed that the Mastery condition (*M* = .61, *SD* = .08) performed marginally better at classifying triads compared to the Control condition (*M* = .58, *SD* = .06), t (59.62) = 1.68, *p* = .099. The second planned comparison revealed no significant different between the Mastery condition (*M* = .61, *SD* = .08) and Performance condition (*M* = .60, *SD* = .05) at classifying triads, t (59.62) < 1. As expected, the third planned comparison revealed no significant difference between that the Control condition (*M* = .58, *SD* = .06) and the Performance condition (*M* = .60, *SD* = .05), t (61.11) = 1.27, *p* = 0.21.

PANAS

A factor analysis on items in the PANAS scale resulted in two indices representing positive and negative emotions. The positive emotion index includes active, alert, and enthusiastic, (α= .75). The negative mood index includes afraid, distressed, upset, irritable, and guilty (α= .78). A One-way ANOVA indicated no significant difference between the Mastery, Performance, and Control conditions for the positive (*M* = 2.67, *SD* = .91; *M* = 2.75, *SD* = .1.0; *M* = 2.83, *SD* = .86) or negative indices (*M* = 1.46, *SD* = .53; *M* = 1.66, *SD* = .94; *M* = 1.49, *SD* = .46), $F(2, 103) < 1$, $F(2, 103) < 1$.

Discussion

Results marginally support the hypothesis that participants encouraged to emphasize the intuitive experience (mastery) can perform better on an intuitive task than participants lacking motivation or participants who are motivated to perform well. Results also supported the hypothesis that the semantic triads may negate the hindered intuition-based performance by bypassing the fragmented visual attention problem that was influencing extrinsically motivated participants. Although the mastery condition marginally performed better than the control and performance conditions, the control condition performed roughly equal to the performance condition. Participants in the mastery condition also marginally classified triads more accurately than the control condition. The PANAS indices did not reveal a relationship between positive or negative emotions that could account for this effect. Although the relationship between mastery motivation and increased intuitive accuracy was marginal, I expect that if participants experienced a stronger manipulation (or natural tendency) for mastery over the intuitive experience, results would evince a stronger effect. Manipulating intrinsic motivation (i.e. inciting the desire to experience the task without the need for external rewards) in the lab can engender mixed results since intrinsic motivation is usually a naturally occurring phenomena (Ryan & Deci, 2000).

General Discussion

I found that extrinsic motivation hinders intuition-based accuracy while intrinsic motivation improves intuition-based performance (marginally). Consistent with the model, I eliminated conscious mechanisms as the source for the detrimental performance of extrinsic motivation and isolated fragmented visual attention as the cause. This implied that analytical (vs. holistic processing) accounted for lowered string classification; study 3 supported this hypothesis because the Semantic Coherence Task, which bypasses the fragmented attention, improved performance to baseline levels. Thus, rewards may lead to better performance in other domains, but in domains that emphasize intuitive thinking, intrinsic motivation should be encouraged over the enticement of monetary benefits.

These results align with current research on unconscious processes and motivation. When researchers applied motivation to the attentional blinking task, which entails detecting two stimuli serially, participants exposed to a picture of a coin only processed the irrelevant stimulus (i.e. fragmented visual attention) (Bijleveld et al., 2011). Activating conscious motivation (the coin) enhanced concentration on task information and interfered with effective processing of peripheral information, similarly to how extrinsic motivation fragmented visual attention and lowered string classification. Mackinnon and colleagues (1985) manipulated motivation to examine its influence on the Stroop interference effect, where participants try to state the word color but struggle because they unconsciously process the word, which spells a different color. Extrinsically motivated participants reported greater effort with lower Stroop interference. An additional study revealed that extrinsic motivation improved performance during the processing of the words, not the retrieval. Notice that in this study, people are motivated (via competition against others for extra credit) to consciously overcome their automatic processes, where in the current research people are motivated to rely on their automatic processes. Similarly, extrinsic motivation hindered the effectiveness of System 1 processing in the current studies just as extrinsic motivation improved System 1 processing in the Stroop study.

Limitations

One limitation is the manipulation for Study Four. Although the extrinsic manipulation (performance motivation) significantly hindered performance compared to the intrinsic manipulation (mastery motivation), the intrinsic manipulation only marginally improved performance compared to no manipulation. Therefore, I may want to consider that the manipulation failed in its effectiveness. Some participants may not have felt intrinsically motivated from the mastery motivation manipulation, and a more robust manipulation may exacerbate the differences between the intrinsic motivation and no motivation group. Similarly, some participants may not have felt extrinsically motivated from the performance motivation manipulation. Perhaps a more robust performance manipulation would also significantly improve performance compared to no manipulation, as long as the intuition task offsets fragmented visual attention.

As second limitation refers to the number of participants excluded from analyses when measuring intuitive accuracy with the artificial grammar task. The type of artificial grammar utilized appears irrelevant to this problem given that the Helman and Berry paradigm (2003; Study 5) resulted in a similar number of participants removed as the Meulemans and Van der Linden (1997) paradigm. Therefore, I argue this problem relates to the length and repetitiveness of the implicit task, where participants retype the strings repeatedly before progressing to the next task. Students from different schools may vary in their ability to perform equally on a task, where a task may not be correctly calibrated for the level of average mental effort exerted by the students (c.f. Alter, Oppenheimer, & Epley, 2013). Ironically, I cannot offer incentives to the students to care more about the study because their performance would then suffer, according to the conclusions in this paper. However, the consistent results, which span over five studies, minimize my concern over this problem given that the removal of these participants would not strengthen the direction of significance. Still, I may want to broaden my future samples beyond University students to reduce the number of participants making a desultory effort.

A third limitation regards the varying effects of motivation on novice vs. expert intuition (Baylor, 2001). The current studies mostly measured novice intuition, where people spent one session implicitly learning information, compared to expert intuition, where people spend years implicitly learning information (Baylor, 2001). For example, people who are chick sexers took years to master the intuition needed to determine the sex of a baby chick, — luckily, the Zen-Nippon Chick Sexing School offers a two-year course for learning this one skill (Horsey, 2002). People with expert intuition in a domain may not suffer from the wrath of extrinsic motivation so easily. For one, they may already experience higher intrinsic motivation, for which the extrinsic rewards may then reinforce (Covington & Müeller, 2001). More research is needed to determine whether extrinsic motivation similarly affects expert intuition as novice intuition.

Future Research

Future research should further examine intrinsic motivation and intuitive performance. Will more robust intrinsic manipulations better improve intuitive accuracy and will these findings hold in organizational settings? Also, I should isolate the mechanism by which intrinsic motivation improves intuition, using the descriptive model presented.

I would also like to further test the relationship between fragmented visual attention and intuition. Assuming the effect can be replicated, in what contexts will fragmented attention worsen intuitive accuracy? Norman and Price (2012) adapted the artificial grammar task to yoga movement, where participants viewed different yoga positions that represented a different letter in the pattern. Would this "social intuition" (Norman & Price, 2012) mitigate the negative outcome of extrinsic motivation? Furthermore, would requiring participants to perform the yoga moves completely negate the effect of extrinsic motivation because the movement precludes visual attention in favor of kinesthetic cues?

Conclusion

The current research used a new descriptive model to demonstrate how extrinsic motivation and intrinsic motivation influence intuitive accuracy and the underlying mechanisms. This may have many implications. For example, many studies implement monetary compensation for participation. This technique may backfire if the dependent variable is an intuitive task. Participants who believe that high performance dictates compensation (such as with online platforms like Mturk) may perform worse on an intuition task as a result. Other implications relate to organizations that also encourage policies emphasizing monetary compensation for high performance on intuitive-based tasks. As an increasing number of articles popularize and encourage intuition as a technique for decision-making increase within the media (Conner, 2013; Griswold, 2014; Joseph, 2012), research concerning how motivation influences intuition-based performance may also increase in importance. People should know the factors that can hinder intuitive-accuracy before they encourage all employees carte blanche to make judgments with their intuition.

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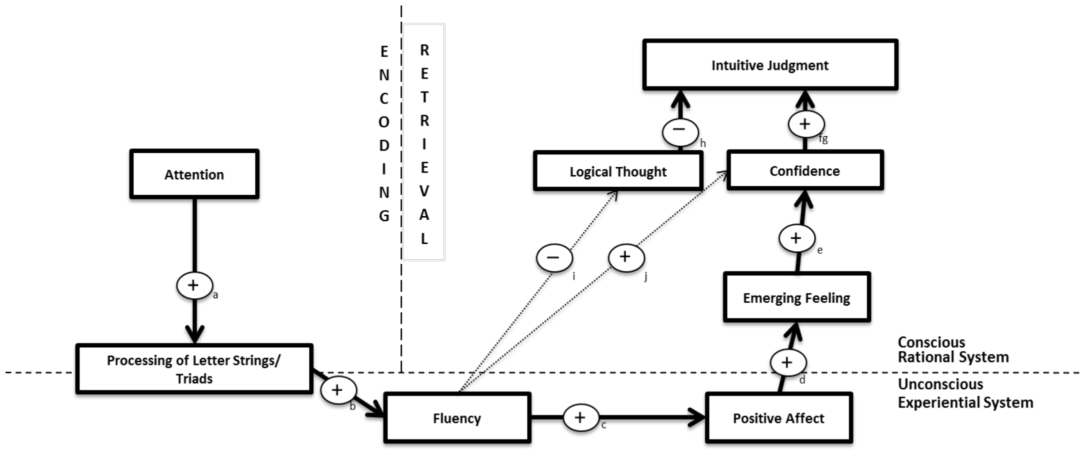
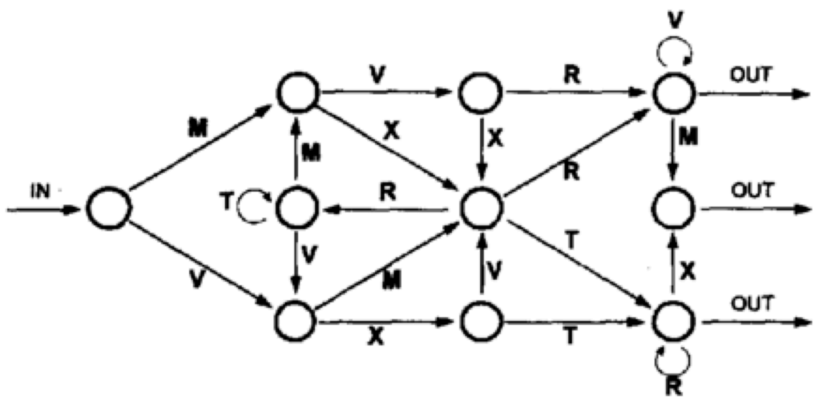
APPENDIX A: COMPLETE FIGURE 1



[ij] Alter et al., 2007; [h]Dijksterhuis et al., 2006; [eg] Gordon & Holyoak, 1983; [a] Helman & Berry, 2003; [f] Kahneman & Klein, 2009; [bcd] Topolinski & Strack, 2009c; [h] Wilson & Schooler, 1991

APPENDIX B: GRAMMAR PATTERN AND STRINGS FOR STUDIES 1-4



(Taken from Meuleman and Van Der Linden, 1997, p.1008)

Learning items

MXRVVVV	MVXRMXT	MVRVVV	VMRVXT
VXTRRRR	MXRVXVR	VMRVVVM	VMRMVR
VXVRVMT	MXRMVRV	MVXTRX	MVXRVMR
MXRVMRM	VMRVMRV	VMRVVM	VMRVXVT
MVXTRR	MVXRM	MXRMVRM	MXTRRRX
VMRTMXR	MXTRR	MVR	VMTX
VXVTRR	MXRMVR	MVXRVXT	VXVTRRX
VMRVMTR	MVXRMXR	MXRVXTR	MVXRVV

Test items

Grammatical and associated	Grammatical and nonassociated	Nongrammatical and associated	Nongrammatical and nonassociated
MVXRVVV	MXRMXTX	MVRMVXT	MVRVRRX
MXRMVXT	MXRTVMR	MVRMXR	MXTRVX
MXRMXRM	VMRTVXT	MVRVMRM	VMRTMTR
MXRVMT	VMTRRRX	MVRVXRM	VMRTRXT
MXRVXVT	VXTX	MVRVXT	VXVMRRR
VMRVMRM	VXVTR	MXRVXRM	VXVRX
VMRVXTR	VXVTRX	VMRVVMR	VXVTMXT
VXVRVXT	VXVTX	VMRVXRM	VXVTRMR

(Taken from Meuleman and Van Der Linden, 1997, p.1027)

APPENDIX C: GRAMMAR PATTERN AND STRINGS FOR STUDY 5

Learning Strings	Grammatical Test Strings	UP Strings	UB Strings
VTHQX	MTHQX	QTHQX	QMHQX
MXHSX	MXHST	MXHSR	MXHSL
VTLSX	VXLSX	VRLSX	VHLSX
MTHST	MTHQT	MTHVT	MTHSQ
MXLMR	VXLMR	VKLMR	MVLMR
MTLVR	MTLVK	MTLVX	MTLVQ
VXHQT	VXHST	VXHMT	VXHQS
VXLVK	VTLVK	SXLVK	VMLVK
SRLQX	QRLQX	MRLQX	SHLQX
QRLQT	QKLQT	MKLQT	QHLQT
SRHVR	SRHMR	SRHQK	SRHVL
SKLST	SKLSX	SKLMX	SKLMH
QRHMR	QKHMR	QXHMR	QVHMR
QKHVK	QKHMK	QKHQR	QKHQL
SKHMK	SRHMK	STHMK	MLHMK
QKLMK	QKLMR	QKLSK	QKLMS

(Taken from Helman & Berry, 2003)

APPENDIX D: MOTIVATION MANIPULATIONS FOR STUDY 6

Mastery Orientation: What we are interested in is how students develop their intuition skills using our intuition task. We're getting students with different levels of intuitional experience and collecting data on how they learn to improve on their intuition.

Control: What we are interested in is students' reactions to intuition-based activities. We're getting students with different levels of intuition-based experience and collecting data on what they think of our tasks.

Performance Orientation: What we are interested in is how well some students use their intuition compared to others. We're getting students with different levels of intuition-based experience and collecting data on how well they use their intuition compared to others.