SELF-EFFICACY'S AFFECTS ON PERFORMANCE AND STRATEGY

A Thesis

Presented to the Faculty of the Graduate School

of Cornell University

in Partial of the Degree Requirements for the Degree of

Master of Science

by

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May 2009

ABSTRACT

Although self-efficacy has always been considered a motivational construct, this theoretical proposition has never been experimentally assessed. In light of new arguments in favor of Control Theory's motivational influence on performance and against Social Cognitive Theory's motivational influence on performance, study one of the current paper manipulates both self-efficacy and task type in order to experimentally reproduce the findings of both viewpoints. Study one also shows results of a motivational theory affecting performance. This supports Social Cognitive Theory and goes against premises of Control Theory. 252 undergraduates completed either a skill task or an effort task in either a high self-efficacy or low self-efficacy condition. Analysis was done at the between-person level and at the within-person level controlling for past performance. It is shown that when someone performs better than expected on an effort task they perform better on a secondary similar task. Findings of Control Theory are also replicated and shown to be due to an artifact of self-efficacy measurement, not motivational effects.

Study two of the current paper investigates how people mentally categorize their confidences in search and processing information. It also investigates how these divisions influence the strategies used in confronting information through the use of traditional judgmental heuristics. It was hypothesized (Wood, Atkins, & Tabernero, 2000) that search self-efficacy would break down into four components based on search modality and that processing self-efficacy would break down into three components based on task characteristics. It was also hypothesized that increased search self-efficacy would decrease use of the availability heuristic and increased processing self-efficacy would decrease use of the representativeness and anchoring and adjustment heuristics. However, these hypotheses are contrary to the expertise literature. Study two was conducted in two phases. In phase one 535 undergraduates

completed a 138 question preliminary search and processing self-efficacy questionnaire. 47 of these questions weighted significantly into six components. These components broke down into personal and interpersonal search self-efficacy; and logical, verbal, spatial, and interpersonal processing self-efficacy. Therefore search and processing categorization hypotheses were supported, but sub-categorization hypotheses were not. In phases two, 173 students completed the 47 questions as well as some questions measuring the use of traditional judgmental heuristics. Support for the expertise literature was found.

BIOGRAPHICAL SKETCH

Kyle J. Emich was born in Poughkeepsie, New York on March 17, 1984. He graduated from Spackenkill High School in 2002 as a varsity soccer and baseball player and a member of the National Thespian Society. He earned a summa cum laude Bachelor of Arts degree in psychology from the State University of New York College at Oswego in 2002. While there, he was a Resident Assistant for three years and received the Helen B. Daly Undergraduate Award for Excellence in Psychological Research for his projects investigating academic self-efficacy, the productivity of first-year assimilation programs, and gender effects. He also was a co-founder of the SUNY Oswego racquetball club and played second singles for three years. In August of the same year he began graduate studies in Organizational Behavior in the Industrial and Labor Relations School of Cornell University in Ithaca, New York under the supervision of Tove Hammer.

ACKNOWLEDGMENTS

I would like to express my great appreciation to my advisor, Dr. Tove Hammer, for supporting me through all of my theoretical and experimental brainstorming, giving me guidance through the data collection and writing phases of this project, and for instilling hope in me that I would be able to complete this project. I would also like to thank Brad Bell for being my minor committee chair and providing his insight into this project.

In addition I would like to thank Dr. T. Mark Morey for guiding and supporting me to pursue study in the field of organizational behavior and social psychology, and for providing me with a strong research base. I would also like to thank him for his continued support on this project above and beyond what I could have asked. In addition, I would like to thank Sharon Kim for verbal support and brainstorming help over my first year and a half at Cornell.

I would also like to thank my parents, Rob and Gail Emich, for their enthusiastic support on this project and their help in analyzing the rough draft of this paper. In addition, I would like to thank my roommate Adam Kanar for his constant discussion of ideas.

Lastly, I would like to thank my girlfriend Emily Johnson for motivating me to work hard and for her patience in listening to my ideas. I would also like to thank her for her continued hard work in helping me correct previous drafts of this paper above and beyond what could have been expected. It was greatly appreciated and this paper could not have made it to its current form without her.

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Over the last twenty-five years, self-efficacy has been one of the most instrumental constructs in the field of performance improvement. In fact, a search of psycINFO for the terms "self-efficacy" and "performance" will result in over 1,500 research articles. Self-efficacy is "the belief in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997: 3). Although the link between self-efficacy and performance has been well established in Social Cognitive Theory (Bandura, 1997), recent empirical literature has begun to criticize this link (Powers, 1991; Vancouver, Et al., 2001; 2002; Yeo & Neal, 2006). Both the motivational basis (Powers, 1991) and the research methodology (Vancouver, et al., 2001) of the theory and its supporting empirical publications have been criticized. The motivational basis has been criticized by the proponents Control Theory (Powers, 1973; 1991). The methodology of most self-efficacy studies has been criticized because it is correlational in format and therefore no causal linkages between self-efficacy and performance can be made. In contrast to these correlational studies, Vancouver and his colleagues (2001; 2002) manipulated self-efficacy condition in order to show that self-efficacy is not causally related to performance. However, despite addressing this concern, they did not control for task type in the form of skill versus effort tasks. Therefore, they are unable to make causal motivational assertions and test the true nature of Social Cognitive Theory. In this thesis, I will describe the results of two studies. The first has four purposes. First, it will show experimentally that self-efficacy is a motivational construct and therefore affects the effort that a person puts into a task. Second, it will show that when skill tasks are separated from effort tasks self-efficacy does not necessarily increase task performance. Third, it will show that the relationship between self-efficacy and performance weakens as tasks become more complex, and that previously studies which found that self-efficacy had negative affects on performance contained skill

tasks instead of effort tasks. Self-efficacy is a motivational mechanism and cannot increase performance without affecting effort. Fourth, the study will empirically support the causal pathway between self-efficacy and performance described by Social Cognitive Theory as opposed to the one predicted by Control Theory. Social Cognitive Theory states that people who perform better than expected increase their self-efficacy which will increase their motivation to perform a task and, consequently, increase their performance. Conversely, people who perform worse than expected lower their self-efficacy which lowers their motivation to complete a task and, as a result, lower their performance.

Searching out and processing information are vital to our everyday lives. People make decisions constantly. In order to make these decisions, people must search out and process information. Therefore, their search and processing self-efficacy is immediately relevant. The mechanisms by which decisions are made and the way that search and processing mechanisms have been categorized by the mind are described by theory, but have not been supported empirically (Wood, Atkins & Tabernero, 2000). By utilizing Kahneman and Tversky's (1979) work on judgmental heuristics, it has been hypothesized that those with lower search self-efficacy will make more use of the availability heuristic and those with lower processing self-efficacy will make more use of the representativeness and anchoring and adjustment heuristics. In addition, it has been hypothesized that search self-efficacy differs across search modalities, specifically experimentation, interpersonal search, electronic search and passive study. Processing self-efficacy is hypothesized to differ among a wider range of task specific traits, such as those found in verbal versus mathematical tasks. Therefore, the second study will serve two purposes. First, it will categorize the way individuals see decision making in terms of searching out and processing information. Second, it will investigate the relationship between search and processing self-efficacy

and the use of traditional judgmental heuristics. Hypotheses and directions for future research are then discussed.

BACKGROUND ON SELF-EFFICACY

In 1941 Miller and Dollard proposed Social Learning Theory in order to explain human behavior. This theory posits that humans learn behavior through the observation of other humans. Once learned, behavior is then rewarded and reinforced. This theory was revolutionary in that it strictly opposed behaviorist theories, in which an individual's environment could completely explain one's behavior. In 1963, Bandura and Walters took this theory and added the elements of observational learning and vicarious reinforcement that will be discussed later. In 1986, Bandura published a book in which he updated Social Learning Theory by providing the basic premises of triadic reciprocity and self-efficacy. Triadic reciprocity refers to environmental factors, personal factors in the form of cognitive, affective and biological events, and a person's behavior, all having bidirectional effects on each other. Bandura saw humans are agents which create behaviors inside an environment which is affected by personal factors. In order to focus on the role of cognition in human behavior, Bandura altered the name of this theory from Social Learning Theory to Social Cognitive Theory (1986). Again, this is significant because it claims that people are not merely beings who react to changes in personality, changes in the environment, or biologically driven impulses. Instead, humans are agents that can cause change in these factors while simultaneously being acted on by them. This is contrary to theories which claim that biological or environmental factors can explain all of human behavior. In addition, the theory contains premises that allow people some degree of control over their behavior and their environment. People decide how

to use their agency to exercise control over their environment through their self-efficacy beliefs.

The concept of self-efficacy comes from the idea that people will exercise their agency in areas where they feel their effort will be rewarded. Therefore, self-efficacy should have a significant effect on one's actions. Self-efficacy is also context specific and malleable. This distinction differentiates self-efficacy from the similar concept of self-esteem. For example, one can have confidence in one's skills on the golf course, but have no confidence in one's abilities to perform the skills that allow him or her to throw a ball through a hoop. However, a person with high self-esteem will feel good independent of context. In addition, self-efficacy can increase or decrease based on someone's immediate performance, for example, whether he or she shoots one under or five over par at the golf course on a particular day.

When Social Cognitive Theory was proposed, Bandura (1986) described four sources of self-efficacy: enactive mastery experiences, vicarious experiences, verbal persuasions, and physiological and affective state. These four sources are also the four ways by which self-efficacy beliefs can be changed in an individual. Enactive mastery experience involves the confidence in one's skills gained from succeeding at a specific task, and the confidence lost when those skills are undermined through failure (Bandura, 1997). This is the most prominent source of self-efficacy and self-efficacy change. Success and failure are self-defined based on certain aspects of the task, such as its perceived difficulty, the amount of external aid received, one's previous perception of his or her own abilities, and the way that the success or failure is retained in memory. Therefore, the success or failure one experiences during a specific event does not necessarily change one's self-efficacy by the same amount as a success or failure during any other event. For example, people who achieve multiple successes and have low confidence in their ability will more likely attribute those successes to

hard work or luck than ability. Also, if people believe that a task is simple or that they received a lot of help on it, they will subsequently attribute their successes to those factors instead of to their abilities. Similarly, if people do not try very hard and fail, they will not necessarily blame it on their skills, but on the amount of effort expended. Conversely, if people fail after expending a high amount of effort, it will seriously affect their confidence in their abilities (Bandura, 1997).

The second source of self-efficacy is vicarious experience. Vicarious experience involves social comparison, or individuals rating their abilities based on the performance of others. This is most effective when one's skills in a certain area are unknown, when the modeled situation is very close to the direct experience of the observer, or when the actor in the situation is similar to the observer (Bandura, 1997). Vicarious experiences increase self-efficacy because they increase the perceived predictability and controllability of a given situation. In other words, if someone watches another person succeed in a given situation he or she will be more confident visualizing possible outcomes of the situation and will also be more confident in his or her abilities to overcome obstacles within it. Again, this is more likely to take place if the person who overcomes the situation is similar to the observer in characteristics such as age, sex, race, and educational level.

The third source of self-efficacy is verbal persuasion, an important category because it involves the most common experimental self-efficacy manipulation, task performance feedback. Generally, if people are given poor performance feedback, they will be less confident that their abilities will allow them to achieve desired outcomes. In contrast, if people are given good performance feedback, they will be more confident that their abilities will allow them to achieve those outcomes. The reason is because feedback provides a direct evaluation of one's progress at achieving a desired

outcome (Bandura, 1997). However, this depends on the perceived credibility of the source or sources of feedback.

One possible source of feedback is oneself. Many people are more confident about their own appraisals of their abilities than other's appraisals (Bandura, 1997). For example, if one is a painter, after painting a picture that person can either believe that it was painted well or poorly. A second source of feedback is the task itself. For example, if one is bowling, the score is the immediate feedback based on the task. The score cannot be argued because the feedback is built into the task. The third type of task feedback is interpersonal, where another individual or group of individuals gives one feedback. One common example of this occurs when a judge rates a figure skater. The judge gives the figure skater feedback through a rating system based on performance, but the feedback is not inherent in the task.

Again, the effect that feedback has depends on the credibility of the source giving the feedback. For example, if a graduate student is developing a research idea and an undergraduate says an appropriate literature review was not done, the graduate student may ignore the criticism and will probably remain highly confident in their ability to conduct a literature review. However, if a professor tells the graduate student that his the literature review is incomplete or weak, it is more likely that the criticism will be heeded. Consequently, the student's literature search self-efficacy will more likely be negatively affected. The reverse also holds for positive feedback.

The final way that one's self-efficacy can be influenced is through one's affective and physiological state. In this case, a person's physiological state refers to their level of arousal. Once people are aroused, their interpretation of their arousal affects their self-efficacy. If they interpret their arousal as positive, their confidence in their skills will temporarily increase, whereas if they view their arousal as being due to stress or anxiety their view of their abilities will decrease. The affective component

deals with positive and negative emotions. For example, if people feel happy they tend to feel more confident in their abilities, while if they are feeling sad, they tend have less confidence in their abilities to complete the same task. In addition, positive feelings conjure up past feelings and memories of successes, while negative feelings provoke past feelings and memories of failures. Recalling positive experiences will increase self-efficacy, while recalling negative experiences will decrease it. Finally, mood affects how much an event influences self-efficacy. Achieving a success while in a positive mood will increase self-efficacy more than a success attained while in a negative mood, and a failure experienced while in a negative mood will lower self-efficacy more than a failure experienced while in a positive mood (Bandura, 1997).

In summary, people are more likely to exercise their control over the environment, through their use of agency, in areas where they are highly confident in their skills. Confidence in their skills can be influenced by mastery experience, vicarious experience, verbal persuasion, and affective and physiological state. It seems logical that people with more confidence in their abilities in a particular area are also more likely to perform better in that area. However, in the next section, both Bandura's argument for why this is the case and some counterarguments are discussed. Empirical evidence is provided and criticized by those supporting and against a positive causal link existing between self-efficacy and performance.

SELF-EFFICACY AND PERFORMANCE

In 1983, Bandura and Cervone published an article in which they concluded that personal standards and knowledge of performance are needed to create a cognitive comparison between performance levels and expected performance levels. Closing the gap between these levels motivates people to perform and expected performance levels are controlled by self-efficacy. Therefore, if you are confident that you have the

skills necessary to complete a given task, you will expect to perform better on that task. Eliminating the disparity between performance and expected performance will create even higher expected performance, thus creating another disparity between performance and expected performance levels, and again motivating individuals to close this gap through increased performance. This reasoning led to the theoretical formation of a continually increasing performance spiral that is created when an individual's self-efficacy is increased.

Again, the reason that self-efficacy should have a continuously positive effect on performance is because of the concepts of disparity and human agency. According to Bandura, (1989) people are agents, which means they have control over their biological selves and the environments in which they live. Therefore, in order to increase motivation to complete a task people set goals for themselves' thereby creating gaps which they close by performing. Since it has been shown that higher goals are set by people who have higher self-efficacy (Bouffard-Bouchard, 1990), this part of Social Cognitive Theory implies that having higher self-efficacy will only be beneficial as it allows people to set higher and higher goals which lead to increasingly better performance. This claim appears to be supported by meta-analysis (Stajkovic & Luthans, 1998). Still, it must be remembered that creating higher and larger gaps only increases motivation. It does not directly increase performance.

However, in 1991 William Powers offered an alternative explanation of Bandura's early data and a critique of his agency-motivation process theory. Powers' counterargument is that by including the motivational effects of discrepancies in Social Cognitive Theory, Bandura really explains this phenomenon by using Control Theory, which relies on negative feedback loops in order to explain motivation. Powers accounts for increasing goals by explaining that people can create alternative selves and choose the most beneficial self through information from feedback loops. If

the alternate selves succeed in the predictions created through the loops, they are adapted. He also states that lowering self-efficacy should increase performance because it would create a larger discrepancy to close and therefore increase the necessary effort to close the gap, which, in turn, would cause performance to increase to eliminate the discrepancy. Bandura (1991) then countered with a restatement of his agency argument. He stated that Control Theory can only explain part of the motivation effect which leads to increased performance. He claimed that people are proactive and that this accounts for another part of the motivation needed to increase performance. Proactive thinking is further expressed through self-efficacy. Essentially, Control Theory cannot completely explain increased performance over time. He also stated that Control Theory cannot adequately explain the adoption of new goals, as human agency can. Locke (1991) agreed with this from the perspective of goal theory. Bandura also claimed that Control Theory is not specific enough to explain increased performance based on motivational factors, that there is more than one explanation for motivation, and that there was no empirical evidence for Control Theory being applied to the area of human performance prior to the publication of Power's comments in 1991.

This debate then quelled until Stajkovic and Luthans published their 1998 meta-analysis entitled "Self-efficacy and work related performance: A meta-analysis." Again, this analysis definitively concluded that self-efficacy is a prominent predictor of performance, however, more so in complex than simple tasks. This conclusion stirred up the debate about Control Theory and whether self-efficacy is always beneficial to performance. In 2000 and 2001, Vancouver and his colleagues reported on a line of research suggesting that increasing an individual's self-efficacy does not always increase performance. This research also criticized the studies used in Stajkovic and Luthans' meta-analysis because they used correlational analysis to show

that performance and self-efficacy were related, which mean that one could not conclude that self-efficacy causes increased performance, only that a relationship exists between the two variables. They stated that improved performance could actually be causing increased self-efficacy. Further, results of their experiments concluded that when previous performance was controlled, higher within-subject self-efficacy had negative effects on within-person performance, and lower within-subject self-efficacy increased within-person performance. In these studies causality could be inferred because experimental conditions were created by manipulating self-efficacy through positive or negative feedback. Vancouver et al. (2001) also claimed that most past research involved between-person analysis and that self-efficacy can only be shown to be debilitating at the within-person level. Vancouver et al. (2001) interpreted this result as support for Control Theory and its motivational premises and support against Social Cognitive Theory. Vancouver and his colleagues did not, however, look at the intermediary construct of motivation by controlling for effort versus skill tasks as is done in the current study, and therefore they cannot make causal assertion about motivational mechanisms.

Additionally, Bandura and Locke (2003) responded to these studies by stating that research had been done supporting a positive relationship between self-efficacy and performance while controlling for previous performance. However, after considering their most prominent example of this (Schunk & Rice, 1993) I conclude that previous performance was not adequately controlled for based on Bandura and Locke's next argument. They argue that part of past performance is caused by self-efficacy and therefore controlling for past performance rules out some of the effects of self-efficacy. However, this claim was not empirically supported. It is in the current study. Bandura and Locke restated that through proactive thought, high self-efficacy

should increase goals and therefore increase the discrepancies that need to be closed between expected and actual performance, causing higher motivation.

Another criticism of the Vancouver et al. studies was the task that was used in their experiments, playing a game of Mastermind. Mastermind is a game where there is a row of four beads hidden from view and each bead is one of four colors. The participant guesses the combination of colors and then is given feedback about whether the colors they chose are correct and in the correct spot, correct but not in the correct spot, or not in the hidden row at all. Participants then modify their guess based on the information acquired from their previous guess until they can deduce the correct hidden color combination. Performance was measured by the number of guesses the participant used to deduce the correct combination, and self-efficacy was measured by the number of guesses the participant thought he or she would need to guess the combination. However, the Mastermind task does not involve a dynamic environment where changes in perceived self-efficacy and performance can occur. For example, no matter how skilled one becomes at the game, one can never guess the combination in one try, other than by coincidence. In addition, guessing the combination on the second or third try would also be highly unlikely unless the first guess correctly identifies some of the colors. Bandura and Locke also questioned the effects of prolonged negative feedback on individuals if negative feedback is to be considered superior for performance. It is quite possible that the effects of prolonged negative feedback on performance will be negative, even at the within-person level. Smith, Kass, Rotunda, and Schneider (2006) investigated this criticism and found that negative feedback in the form of failure at a task, induced by making participants attempt to solve impossible anagrams, decreased self-efficacy and subsequent performance as compared to a control group.

The most recent study done to show that self-efficacy may not always have a positive effect on performance has addressed Bandura's criticism of Vancouver. Yeo and Neal (2006) used a version of the airplane landing task that Wood (1986) originally defined as a complex task when defining the construct. They used hierarchal linear modeling to show the negative within-subject effect that Vancouver predicted and found. In addition, Yeo and Neal showed that increased self-efficacy caused increased between person positive outcomes, but decreased within person positive outcomes. However, again, self-efficacy is a motivational construct and therefore its effects may be lessened on a complex task. Additionally, in contrast to this study Richard, Diefendorff and Martin (2006) report a positive within-person effect of self-efficacy on performance in both exam performance in a classroom setting and a computerized learning task in a laboratory setting. However, interestingly, and contrary to all previous studies in this debate, they failed to find a significant between-person effect of self-efficacy on performance. Still, none of these studies used experimental procedures to control self-efficacy and therefore causality cannot be assumed, an original criticism by Vancouver et al. (2001) of most self-efficacy work. Vancouver and Kendall (2006) revisit this issue in the domain of academic testing. Participants were students in an introductory organizational psychology course and took five exams over the course of a semester. Vancouver and Kendall measured expected exam performance (self-efficacy), actual exam performance (performance), predicted study time (expected motivation), actual study time (motivation), and goal grade. They found a significant negative effect on motivation, operationalized by predicted study time when self-efficacy was high. However, they found this after controlling for goals. And, following Bandura and Locke's (2003) original criticism of Vancouver et al.'s studies, controlling for goals also controls for part of the motivational mechanism that is theorized to link self-efficacy to performance. This is

because goals provide the upper level for expected performance. This is the same as controlling for the ideal performance self in Control Theory. In either case, controlling for one bound of the motivation gap is going to severely affect the results of, and remove validity from, the study.

Elevating the controversy further, Judge and others (2007) published another meta-analysis entitled "Self-efficacy and work related performance: The integral role of individual differences." This seems to be a play on Stajkovic and Luthans' (1998) title as well as a response in the form of a second meta-analysis. Judge et al. concluded that when the big five personality traits, intelligence, and task experience are controlled for, self-efficacy has little or no effect on performance in tasks of moderate or high complexity. But, they do concede that self-efficacy predicts performance in tasks of low complexity. Judge et al. coded for task complexity by using Wood's model (1986) which defines complex tasks as requiring more skill than noncomplex ones. In addition, they explicitly stated that complex tasks included jobs which require more knowledge, skill and ability. Again Judge et al. did not consider self-efficacy's effect on motivation in their analysis.

SEARCH AND PROCESSING SELF-EFFICACY

This section of the current paper is being written in response to an article by Wood, Atkins and Tabernero (2000) entitled "Self-efficacy and strategy on complex tasks." The article concerns the effects of task complexity and search and processing self-efficacy on the choice of performance strategies. Wood and his colleagues claim that complex tasks require more searching out and processing of information in order to be successfully completed than simple tasks. Therefore, the level of an individual's search and processing self-efficacy should interact with the level of task complexity in order to determine his or her strategy for completing the given task. It was also

predicted that these two types of self-efficacy beliefs would have moderating effects on search and processing performance by affecting one's use of traditional judgmental heuristics (Kahneman & Tversky, 1974).

First, the issue of how to operationally define search and processing self-efficacy must be addressed. Wood and his colleagues (2000) theorized that search self-efficacy will be divided into four categories based on search modality: experimentation, interpersonal search, electronic search, and passive study. Processing self-efficacy was expected to differentiate across fewer domains based on task characteristics. Still, some distinctions are expected such as those between verbal and mathematical processing. The current study defines this by using three groups: verbal processing, logical processing, and spatial processing.

To address complex task strategies, Wood and his colleagues (2000) created a 2 (low search self-efficacy, high search self-efficacy) x 2 (low processing self-efficacy, high processing self-efficacy) matrix and linked a different strategy to each quadrant. Wood et al. predicted that an individual with low search and low processing self-efficacy will use a strategy of repetitive recycling in which they recycle past responses in new situations and sometimes adopt small incremental changes. Next, an individual with low search and high processing self-efficacy is likely to use a deep drilling strategy in which he or she chooses one search process and examines and analyzes information through that process in extreme depth. Third, individuals with high search and low processing self-efficacy are expected to use a strategy of surfing, in which they use a wide range of search strategies, but examine minimal information with each. A fourth prediction is that individuals with moderate levels of both search and processing self-efficacy will use a berry picking strategy. This strategy is similar to surfing except for these individuals go a little more in depth into each search strategy, but the strategies chosen are unconnected. Finally, if one has high levels of

both search and processing of self-efficacy, he or she will use a systematic-comprehensive strategy in which they search a defined task environment and process the information found according to a planned set of attributes. This strategy is theorized to be the most useful in successfully obtaining and processing the information necessary to complete a complex task. The current study does not investigate this aspect of strategy categorization.

Search and processing self-efficacy are predicted to interact with traditional judgmental heuristics (Kahneman & Tversky, 1974) in order to invoke the strategies mentioned. Increased search self-efficacy is predicted to decrease an individual's use of the availability heuristic (Wood, Atkins & Tabernero, 2000) as individuals will be more likely to search out information instead of relying on memory. Increased processing self-efficacy is theorized to lead to decreased use of both the representativeness and anchoring and adjustment heuristics (Wood, Atkins & Tabernero, 2000). This is because these individuals will be less likely to need the reduced cognitive load in processing information provided by the use of these heuristics. In other words, people higher in search and processing self-efficacy are more likely to make thoughtful responses during complex tasks as opposed to automated ones. Dual systems literature does not support this claim.

The dual systems view states that there are two systems that operate when people make judgments and decisions about everyday life. The first is a system of intuition and the second is a system of reasoning (Kahneman, 2003). Each system involves a separate set of characteristics. System one involves operations that are fast, automatic, effortless, associative, and implicit. It is controlled by habit and therefore can be difficult to control or change. System two involves thought processes that are more deliberate and slow. These processes are effortful and involve conscious thought (Kahneman, 2003). The important point for the current study is that these two systems

grew out of the theory of bounded rationality proposed by Simon (1955). This theory states that humans do not have the capability to process an unlimited amount of information about options in a decision and therefore must make decisions based on their subjective imperfect information. This information is based on the cognitive load a specific individual is able to handle. Kahneman and Tversky (1974) took this one step further by providing mechanisms by which people process their limited information in order to comprehend the vast amount of stimuli barraging a person at any one moment.

However, Wood and colleagues (2000) claim that increasing self-efficacy in a certain area will cause less use of system one heuristics and increased use of system two's conscious thought. But the current study posits that people will still have the same amount of cognitive space to use independent of their confidence in their abilities. Wood et al. (2000) got around this by claiming that individuals will choose to allocate less mental effort to tasks in which they are less confident. This aligns with the predictions of Social Cognitive Theory (Bandura, 1986), but does not acknowledge the link between self-efficacy and performance (Stajkovic and Luthans, 1998) or the expertise literature. Although, as has already been mentioned in this paper, while the causal link between self-efficacy and increased performance has been questioned and the within-person effect of self-efficacy on performance has been questioned (Vancouver et al. 2001, 2002), the relationship between self-efficacy and performance has not. Therefore those with higher self-efficacy also have greater performance in a specific task, although the causal chain has been questioned. Thus, people with extremely high self-efficacy can be thought of as moving towards expertise at a task. And, as the current paper claims, in light of new literature on dual systems and expertise, individual's will continue to use heuristics as their search and processing

efficacy increases, but these heuristics will change based upon newfound information acquired from becoming familiarized and skilled in a particular area.

Let us look at an example of how expertise creates more accurate judgmental heuristics, thus allowing the mind to focus on novel areas of a task. Let us look at an example that is familiar to most American adolescents and adults, driving a car. The first time a people drive a car, they are aware of everything on the road. They see every sign and every other car, and react accordingly. In fact, the first few times someone drives a car, they can barely concentrate on anything else except driving. The tasks of manipulating the pedals and wheel require all of a person's cognitive effort, thus not allowing much surplus effort for novel occurrences, such as an animal running across the road. However, in a few years this same person will be able to hold a conversation, listen to music, and look for a favorite fast food restaurant on the side of the road, all while driving. In this example, the balance of effort for system one and system two processing do not change, but their foci are altered.

In addition, Simon and Chase (1973) have investigated this phenomenon in chess players. They noticed that expert chess players reacted to situations in the game by very quickly assessing all the possible moves and then making their play. In fact, they did this so quickly that they were not calculating at all, but reacting to a pattern in the game that became recognizable because of the amount of time spent playing chess. The chess player transformed from a novice to an expert by creating new heuristics based on experience. More recently, Klein and his colleagues (Klein & Peio, 1989; Hoffman, Shadbolt, Burton, & Klein, 1995) have studied this phenomenon. Klein's most relevant paper to the current study (1997) involves his suggestion for implementing a decision making training program based on research on decision making in experts. In this paper, he proposes improving decision skills by attempting to speed up the expertise process, as opposed to previous methods of training.

Therefore, again, the researchers were trying to increase performance by changing heuristic use within a sample, not by eliminating the use of heuristics. This is because the use of judgmental heuristics is necessary since people will not be able to process more information than their cognitive load can handle.

STUDY ONE

The first study in the current paper addresses the issue of self-efficacy relating to performance. I argue that previous findings are an artifact of a misinterpretation of self-efficacy. Self-efficacy is meant to be a motivational construct and therefore should have different effects on skill tasks and effort tasks. Thus, in this study, for the first time as far as I know, task type will be manipulated in order to assess motivational effects. All tasks are hypothesized to vary on two dimensions called skill weight and effort weight. However, self-efficacy is only expected to influence the effort component of a task. This is hypothesized to be a multiplicative relationship in the form:

i) Task Performance = X_1(Skill) x X_2(Effort)

In this case $X_1 + X_2 = 1$, and each task will have a different combination of X_1 and X_2. Also, X_1 and X_2 can never be zero, since all tasks require at least a minimal amount of effort and a minimal amount of skill. A task will be designated an effort task if $X_1 < .50$ and a skill task if $X_1 > .50$. As X_1 decreases, self-efficacy is expected to have an increasingly significant affect on performance. Complex tasks are defined, as having inherently high levels of X_1, the amount of skill needed to perform a task. Therefore, as a task becomes more complex, the absolute value of the correlation coefficient between self-efficacy and performance decreases. So, the question of how self-efficacy affects performance should be reframed into: How does self-efficacy affect the effort put into a task and thereby affect performance? In order to investigate

this question, the relationship between self-efficacy and performance on a task that is primarily skill based and one that is primarily effort based must be investigated. Social Cognitive Theory views self-efficacy as a motivational mechanism and therefore predicts that a direct positive relationship will be found between self-efficacy and performance on an effort based task. However, on a skill based task, it is expected that the Yerkes-Dodson Law (1908) will come into effect, which would result in a curvilinear relationship between self-efficacy and performance. This is because if someone has too low or too high a level of self-efficacy they will become minimally or maximally aroused and put either an extremely low or extremely high amount of effort into a given task. The Yerkes-Dodson Law states that there is an optimal arousal level for a given task and that arousal above or below this level will decrease performance. Therefore, for a task that involves solely effort the optimal arousal point will be equivalent with the maximum arousal point, which as stated will never happen in practice, whereas in a skill based task a mid-range optimal arousal point will allow for decreasing performance on both sides of this optimal value. For example, if your task is to push a rock up a smooth slope, a highly effort based task, then you will need to be highly aroused and put in the maximum effort possible in order to push the rock up the slope as quickly as possible. In contrast, if your task is to work on a complex math problem, a highly skill based task, an above optimal arousal level will cause nervousness and stress and thereby cause less than optimal performance. In both effort and skill tasks, less than optimal effort will cause less than optimal performance. In study one, self-efficacy and task type will be manipulated in order to investigate the motivational effects of self-efficacy as stated in Social Cognitive Theory (Bandura, 1986). Therefore, study one will be conducted to investigate the following hypotheses:

H1: In the effort based task the low self-efficacy group will perform worse than the high self-efficacy group

This positive relationship is not expected to hold for a skill task. After this hypothesis is investigated, the assumptions of Control and Social Cognitive Theories will be. If Control Theory is correct then those whose initial performance falls below their initial predicted performance will counter this effect by increasing effort and thus increasing performance on a future similar task (Powers, 1991). However, Social Cognitive Theory posits that if initial performance exceeds initial predicted performance self-efficacy should increase future effort and thereby increase future performance (Bandura, 1997). Therefore, the current study will test the following hypotheses:

H2a: Those whose initial performance is better than their initial expected performance will increase self-efficacy significantly more than those whose initial expected performance is worse then their initial expected performance.

H2b: The difference between initial performance and initial expected performance will be positively related to final task performance on the effort task.

Lastly, the negative relationship between self-efficacy and performance found through within-person analysis while controlling for previous performance is expected to be found as in Vancouver et al. (2001, 2002). Within subject investigation and controlling for performance will both be accomplished by analyzing performance differential, or the difference between initial and final performance, instead of analyzing between-person final performance. However, as the negative relationship

hypothesized between self-efficacy and performance differential is expected to be due to an artifact created by the traditional measurement technique used for self-efficacy, not due to true motivational differences, the effect predicted by Control Theory is not expected to have a different effect based on task type (skill vs. effort). This will be explained in the results section.

The reason that support is expected to be found for hypothesis 3a and 3b will be explained by supplementing the argument of Bandura and Locke (2003), that when past performance is controlled for part of self-efficacy is also controlled for. This will be done by explaining their arguments against the validity of Vancouver et al. (2001) in terms of the mathematical model used to control performance in the current study. Therefore, the following final hypotheses will be investigated in study 1:

> H3a: There will be a significant negative relationship between expected performance differential on the initial task and performance differential between tasks one and two in the effort task when controlling for past performance.

> H3b: There will be a significant negative relationship between expected performance differential on the initial task and performance differential between tasks one and two in the skill task when controlling for past performance.

Participants

252 students from one large northeastern university and one mid-size northeastern university participated in this study in exchange for course credit and for a chance at one of two $50.00 cash prizes. Participants were 65% female and 73%

white. The mean age of the participants was 19.6, *SD* = 2.7. Four participants were removed due to guessing the intent of the manipulations; therefore the final sample was 248 students.

Procedure

Participants were recruited expecting to participate in an experiment called "Cognitive Training" for course credit and a chance at one of two $50.00 cash prizes. They signed up for a time slot either in class or online. Groups of ten to twenty people took part in the experiment during each time slot. Packets were shuffled and handed out to participants so that condition assignment was random. Participants were told that the experiment involved two conditions called spatial training and logic training, so that if they saw that someone sitting next to them had a different packet they were to attribute it to that person being in a different condition. They were also told that they should concentrate on their own packets. Participants were given informed consent and instructed to sign the consent form, open their packet to the first page, fill out the demographic questions, and then stop. Once everyone had completed this, they were told to proceed to the first task and that they would be given seven minutes to complete it. They were also told that if they finished early they must stop and wait for everyone to finish because it was vital to the experiment that everyone received the same amount of time for each section. No one finished the first initial task early. They were then told to answer the self-efficacy questions. Next, they were told to begin the second task, that they would be given ten minutes to complete it and to not continue if they finished early. No one finished the second initial task early. Participants were then told to answer the self-efficacy questions and begin the training. Participants had ten minutes to complete the training. Some people finished this section early, but did not go ahead to the final task. After the training, participants were told to answer the

self-efficacy questions and to proceed to the final task. They were told that they would have fifteen minutes to complete the final task and that if they finished early they could hand it in, but they must stay to be debriefed. This was to prevent them from looking at others' answers upon completion. Many in the logic condition finished early. Six out of 126 in the word condition found all twenty five words and handed in their packet early. Participants were then thanked and asked if they found anything strange about the procedure. Four participants expressed that they thought the averages in the manipulations were incorrect. As mentioned, their data was removed from the final data set. Everyone else said nothing seemed strange or guessed something irrelevant to the experiment (e.g. there was a grammar mistake in the training). Participants were then debriefed and given credit. After everyone had participated, the two $50.00 prizes were awarded.

Materials

Participants received one of four packets based on the group to which they were randomly assigned. These groups were defined on a 2 (high vs. low self-efficacy) x 2 (skill vs. effort task) matrix. Each packet, regardless of group, began with an informed consent form and a demographics questionnaire asking participants their age, sex, year in school and ethnicity. Each packet contained three self-efficacy manipulations followed by a final task. The first two manipulations were initial tasks mirroring the final task and the final manipulation was a phony training program. The program was phony in that it was not meant to train participants, but rather to manipulate their self-efficacy. Three manipulations were used since it was believed that it would be difficult to manipulate someone's confidence without providing repeated feedback about their abilities within a specific task domain. In addition, Bandura and Locke (2003) state that self-efficacy develops over time and therefore

this manipulation was thought to create the most realistic scenario possible while maintaining controlled manipulations. More than three manipulations were not used because the task was designed to be completed within a one hour time frame.

The effort task that was chosen was completing a word find. A word find is a task where words are hidden within a matrix of letters. Participants were told that this was a "spatial task" as opposed to an "effort task." The low and high self-efficacy groups differed on the three manipulations in the manner described below. First, the low self-efficacy group was given a 25x25 word find containing twenty five words. The words within the puzzle contained six or seven letters and contained no double letters such as the "tt" found in "rattle". This is because double letters and longer words are easier to spot within a word matrix. Participants were instructed that the task "should not be that difficult due to the amount of space given and the length of words. The average number of words found during this seven minute period is 19.8." The true mean was 5.4. In fact the maximum anyone found was 11. In contrast those in the high self-efficacy condition were given a 15x15 matrix containing twenty five words of between four and eleven letters, nine of which contained double letters. They were instructed that the task "will be difficult due to the amount of letters in the words given and the small amount of space the words are forced into. The average number of words found during this seven minute period is 6.4." The true mean was 14.7. However, three people out of the sixty four in this group scored below a 6. Next, two self-efficacy questions were asked to assess both the strength and level of self-efficacy beliefs as recommended by Pajares (1996). Participants were asked how many words they were confident they could find in the next word find as well as how many they were 100% sure that they would find. They were told that the next word find would also contain twenty-five words.

The second task was equivalent for both groups in order to measure the effect of the first manipulation; however it was also a manipulation in itself. This task was a 20x20 matrix containing 25 words like those in the low self-efficacy initial task, but two of the words contained double letters. However, again, the manipulation was placed in the instructions. Those in the low self-efficacy condition were told, "Next you will be asked to complete a second puzzle. This puzzle will be a little easier due to its size. You will be given 10 minutes to complete the puzzle. Due to this the average number of words found in this puzzle in 10 minutes is 23.1." The actual mean was 10.9 and the maximum was 21. Conversely, those in the high self-efficacy were told, "Next you will be asked to complete a second puzzle. This puzzle will be a little harder due to the length of the words in the puzzle. You will be given 10 minutes to complete the puzzle. Due to the shorter words and longer time period provided, the average number of words found in this puzzle in 10 minutes is also 6.4." The actual mean was 12.1 and four people scored below of six. The self-efficacy questions were then repeated.

The third and final manipulation was in the form of a training task. The training task was a reading comprehension questionnaire in which participants were asked to read a brief passage and answer a few questions about it. The answers to these questions were then given and explained. The passage was prefaced with the explanation that the same spatial skills needed to find the correct answers within a long passage were those needed to find words within the word find puzzle. This manipulation also provided the cover for the experiment as participants believed that they were taking part in a cognitive training experiment. Manipulations were done in a similar manner to the first two manipulations. Participants in the low self-efficacy group were given a section from the GRE's and told that it should be relatively simple, while those in the high self-efficacy group were given a section from the SAT's and

told that their passage may be difficult to understand. Self-efficacy was again assessed after this manipulation. For the final task, both groups were given identical word finds with identical instructions. This word find was a 20x20 matrix and contained twenty five words of between six and eight letters, again two of the words contained double letters. Participants were not told anything about mean scores on the final task and were simply instructed, "The following is the final part of a study on spatial reasoning. You will be given fifteen minutes to complete one final word find below."

The skill task consisted of questions from a logic questionnaire. Participants were told this was a "logic task" instead of a "skill task". The low and high self-efficacy groups again differed on the three manipulations in a manner similar to the word finds. First, those in the high self-efficacy group received a series of five questions that were pre-tested as easy. An example question is, "Which is the better bargain: A shirt that is marked down 10 percent from its original price and then reduced an additional 40 percent or the same shirt reduced 50 percent from its original price?" They were then given four choices. Participants were told that the average student gets two of the five questions correct. The mean was actually 3.3 questions correct and only 3 people out of 60 scored below a 2. In contrast, participants in the low self-efficacy group received one category/line logic problem. They were told that five gifts were given from five relatives each with a different character on them and they had to decipher who gave what gift and what character that gift was marked with. They were truthfully told that this puzzle received two stars out of five for difficulty on allstarpuzzles.com. They were also told that it normally took someone five minutes to solve and therefore they would be given seven minutes. It actually takes twenty-five minutes to solve. No one solved this problem in the seven minutes given.

The next section contained eight logic questions. An example was, "It has been proven that the "lie detector" can be fooled. If one is truly unaware that one is lying,

when in fact one is, then the "lie detector" is worthless. The author of this argument implies that: A. The lie detector is a useless device B. A good liar can fool the device C. The lie detector is sometimes worthless, or D. No one can fool the lie detector all of the time." At the beginning of this section, participants were asked how many of this type of question out of eight they were confident they would answer correctly and how many questions they were 100% sure they could answer correctly, as a similar self-efficacy measure to the word task. No one was able to answer all eight questions correctly. The only difference between the groups was that those in the low self-efficacy condition were told, "These questions should not be that difficult, the average student answers 7 of 8 correctly," as mentioned, no one scored above this level. Those in the high self-efficacy condition were told, "These questions are more difficult and the average student answers 3 of 8 correctly." Eight of sixty people did not answer at least three correct. However, since these participants were told that the questions were meant to be difficult they should have attributed their below average performance to the difficulty of the task, not their own personal abilities (Bandura, 1997). Self-efficacy was also assessed after this manipulation.

Next, the same training as in the word find task was used. Participants were told that the same skills required to solve logic problems were also the skills needed to answer and understand the comprehension questions in the training. Self-efficacy was again assessed after this. The final task mirrored the eight question second task, except that twelve questions were asked. Once again, no information concerning average score was provided and participants in both groups received the same instruction.

STUDY ONE RESULTS

First, gender did not have a significant effect on either an individual's self-efficacy, t (247) = .69, p = ns, or task score, t (247) = .16, p = ns. In order to

investigate the causal link between self-efficacy and performance a manipulation check was needed. In order to conduct the manipulation check, the logic self-efficacy questions were scaled to the word find questions. There was a significant difference between the mean self-efficacy scores of those in the high self-efficacy condition (M = 15.22, SD = 9.10) and those in the low self-efficacy condition (M =9.32, SD = 5.89), t (248) = 6.007, $p < .001$. Next, two t-tests were conducted in order to investigate hypotheses 1. First, as predicted, no difference in final task score between those in the low-self efficacy and high self-efficacy conditions in the skill task was found, t (120) = 1.704, $p = ns$. Also as predicted by hypothesis 1, a significant difference between the low-self-efficacy and high self-efficacy conditions in the effort task was found, t (124) = 2.01, $p < .05$. These results support both predictions for the effort task and the skill task. In addition, due to the manipulation, it can be causally asserted that self-efficacy caused high performance in the effort task, but not in the skill based task. Therefore, self-efficacy's function as a motivational construct was further supported.

Second, to supplement the results of hypothesis 1, the effects of self-efficacy on task performance were investigated correlationally. This was done by first aggregating the strength and level of self-efficacy beliefs measures into one variable at the first, second and third times of collection. Correlational analysis was then conducted between the score on the first equivalent task, the final task and overall self-efficacy and times one, two and three. This was separated by task type. Results are listed in Table 1.

Table 1 – Self-efficacy's Differentiated Affect on Skill vs. Effort Tasks

Table 1

	Total Self-Efficacy 1	Total Self-Efficacy 2	Total Self-Efficacy 3
Skill Task Score 1	0.136	n/a	n/a
Skill Task Final Score	0.160	0.142	0.170
Effort Task Score 1	.423**	n/a	n/a
Effort Task Final Score	.458**	.522**	.507**

** = p < .01

While one's performance on the skill task was not significantly related to their self-efficacy at time 1, r (122) = .160, p = .ns, time 2, r (122) = .142, p = .ns, or time 3, r (122) = .170, p = .ns; performance on the effort task was highly significant at all three, time 1, r (126) = .458, $p < .01$, time 2, r (126) = .522, $p < .01$, or time 3, r (126) = .507, $p < .01$. In addition, this same effect was found as initial self-efficacy after manipulation one related to score on the initial similar task: skill, r (122) = .136, p = .ns; effort, r (126) = .423, $p < .01$. These data further support self-efficacy's place as a causal motivational mechanism, as predicted. To show further support for these predictions, self-efficacy score was aggregated over all three measures and related to final task performance. The two graphs are shown in Figures 1 and 2.

One can clearly see from these two scatter plots the differential effect of self-efficacy on performance over the two differing task types. This again supports self-efficacy's function as a motivational mechanism.

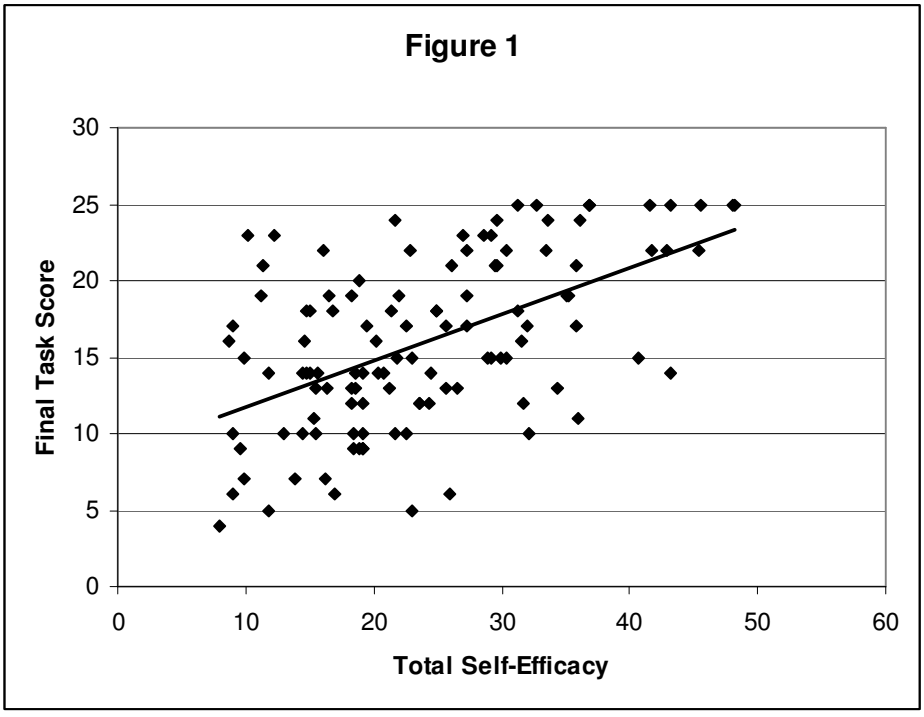

Figure 1 – The Effect of Self-efficacy on an Effort Task

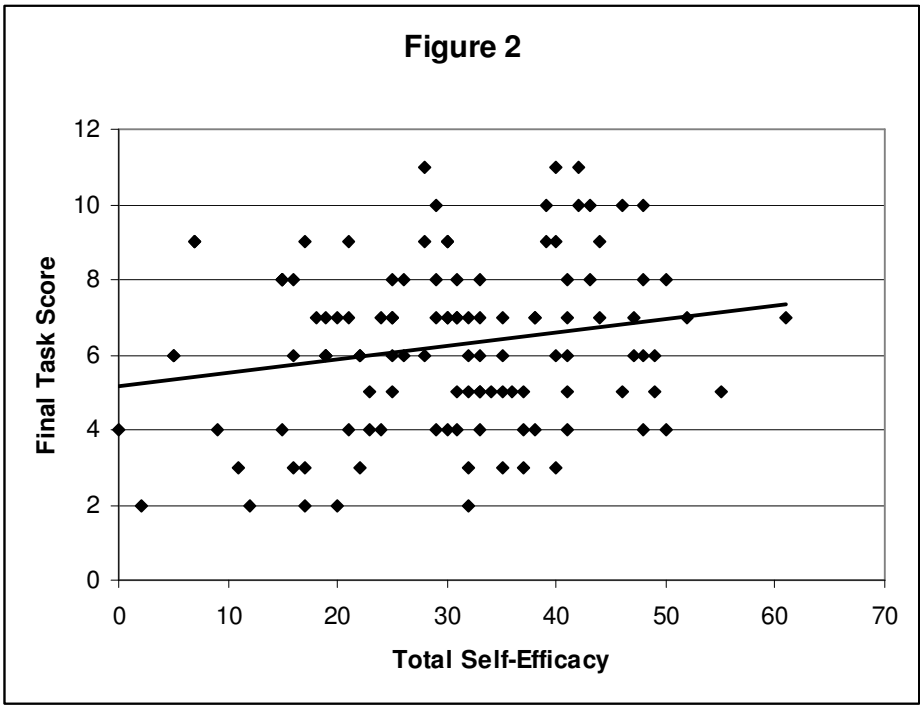

Figure 2 – The Effect of Self-efficacy on a Skill Task

In addition, the controversy between Control Theory and Social Cognitive Theory was addressed. First, a variable called self-efficacy differential was created to assess the differences in self-efficacy of participants before and after completion of the initial task. The variable is simply defined as: post-initial task self-efficacy – pre-initial task self-efficacy. Positive scores on this variable would indicate an increase in self-efficacy and negative scores would indicate a decrease. In addition, expected performance differential was recoded into a binary variable for mean difference analysis. Those who performed worse than expected on the initial task were coded with a '0' and those who performed better than expected on the initial task were coded with a '1'. It was found that those who performed better than expected increased their self-efficacy (M =2.24, SD = 2.82) significantly more than those who performed

worse than expected (M =-.89, SD = 3.37). This supports hypothesis 2a and shows that those who perform better than expected actually do raise their self-efficacy and visa-versa, $t\ (248)$ = 7.646, p < .001. Again to provide additional support corellational analysis was conducted as it appeared that missing one's expectation may have differential affects based on the distance of the miss. Correlational analysis again supported that those who score better than expected raise their self-efficacy and those that score worse then expected lower it, $r(248)$ = .543, p < .001.

According to Control Theory, if expected performance falls below actual performance, people will be motivated to improve performance and will put more effort into a task, thereby performing better on the final effort task. Conversely if one performs better than expected on the initial task, no motivation to increase effort will be needed. According to Social Cognitive Theory, if expected performance falls below actual performance, self-efficacy will be decreased thus lowering motivation. However, if actual performance is greater than expected performance, self-efficacy will increase. This will cause an individual's motivation to increase resulting in increased effort and consequently performance on the final effort task. Predicted performance was measured as the mean of the self-efficacy measure, which asked participants how well they were confident they would do on the preliminary task and how well they were 100% sure they would do on the preliminary task. Mean correlation between these two question between all three times was, r = .661, p <.001. Expected performance differential was calculated by subtracting this score from actual performance on the preliminary task. Therefore, those who performed better than expected would receive a positive performance differential score and those that performed worse than expected would receive a negative performance differential score. Control Theory would predict a negative correlation between performance

differential and final task score, while Social Cognitive Theory would predict a positive correlation. The actual correlation for the effort task was r (126) = .211, p <.05. See figure 3. This result supports Social Cognitive Theory and hypothesis 2b. The result for the skill task was insignificantly positive, r (122) = .157, p = *ns*. This is again shows the motivational effect of self-efficacy and supports hypothesis 2b.

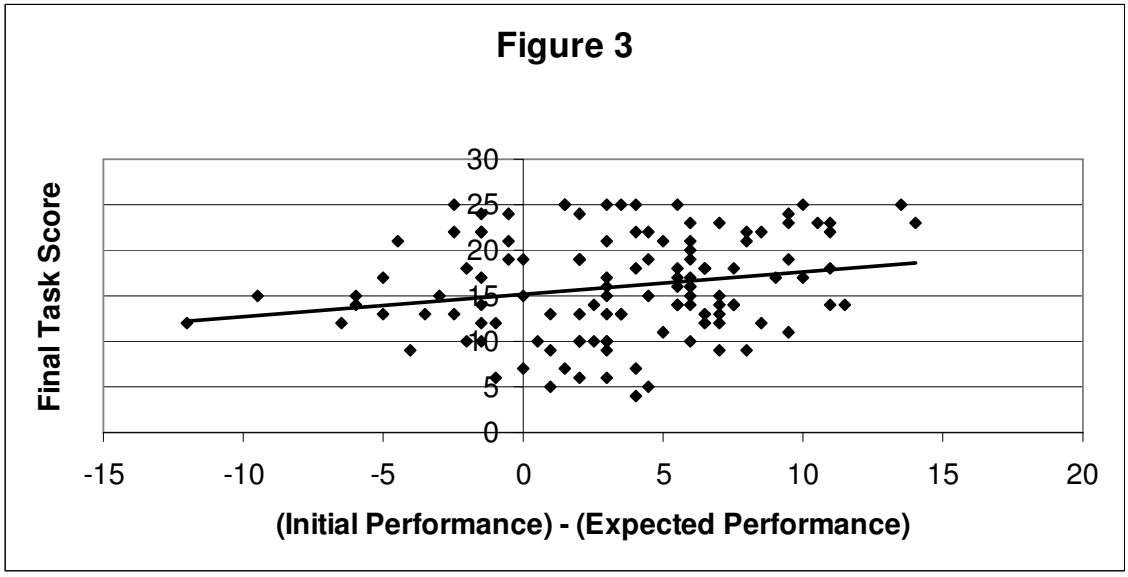

Figure 3 – Effect of Expected Performance Differential on Actual Performance

However, as mentioned in the hypotheses section, control theorists would argue that the statistics done to support hypothesis 2b are flawed because they are not looking at within-subject performance controlling for past performance. As mentioned, within-subject performance controlling for past performance was investigated by looking at performance differential or (final performance – initial performance). A positive performance differential score would indicate increased performance and a negative score would indicate decreased performance. As predicted in both hypotheses 3a and 3b, negative significant relationships were found for both the effort task, r (126) = -.235, p <.05, and the skill task, r (122) = -.271, p <.01. These correlations were not significantly different, $z(248)$ = .30, p = *ns*. Therefore, support for Control Theory seems to be present as argued by Vancouver and his colleagues

(2001, 2002) in that it seems that those who scored above expected on the initial task continued to score lower on the final task and visa-versa as indicated by the correlation. However, the key word in the previous sentence is "seem," as further investigation supports Bandura and Locke's (2003) argument against this conclusion. First, the correlations found in favor of Control Theory should seem "off". This is because the observed effect on both skill and effort tasks are not significantly different, $z = .3$, $p = .76$. However, a motivational mechanism should affect effort, and therefore performance on the effort task, more than performance on the skill task, as the results in support of Social Cognitive Theory did. Therefore an artifact that creates an equally negative effect on both types of tasks should be responsible. This artifact is found if one looks at the two variables being compared in Control's Theory's predicted negative correlations:

i. (Initial Performance – Expected Initial Performance), and

ii. (Final Performance – Initial Performance)

When focusing upon these two variables, it becomes clear that this equally negative effect is generated, as argued by Bandura and Locke (2003), by imposing a penalty on those having a high initial performance. This is because if one has a high initial performance one will most likely have a high **i** score because it becomes harder to expect a final performance above one's initial performance level as their initial performance level increases. This occurs because there is a performance ceiling on both experimental tasks. In addition, as initial performance level increases it becomes harder and harder for final performance to be higher than initial performance. Again, this is due to the performance ceiling inherent in the tasks. Therefore this will create a low **ii** score for participants who score well on the initial task. This high **i** score and low **ii** score will create a negative correlation, an equally negative correlation, for those with high initial performance. Therefore, the results found in support of Control

Theory were artifacts of the experimental tasks having a maximum level, and of predicted performance, which is also operationally defined as self-efficacy, having a maximum level. Bandura and Locke's argument (2003) is supported and that of Control Theory is not. In addition, all tasks that ask for self-efficacy on a scale of 1 to x, where x is a definite, predefined number will incur this false finding, as all of Vancouver and colleague's tasks have; and as far as I know, all self-efficacy studies operationally defining self-efficacy have. Specifically, the four major studies that find the negative relationship between self-efficacy and subsequent performances, as predicted by Control Theory suffer from this artifact. In Vancouver et al.'s studies of 2001 and 2002, the Mastermind game previously described was used. This had a self-efficacy maximum of guessing the correct color combination in one try. Vancouver and Kendall use a classroom setting for their 2006 experiment with a performance maximum set as obtaining an "A". Yeo and Neal (2006) used an airplane landing task with a maximum score of 160 points per trial in their analysis.

STUDY ONE DISCUSSION

It was hypothesized that previous findings involving the relationship between self-efficacy and performance becoming weaker as tasks become more complex (Stajkovic & Luthans, 1998; Judge, et. al. 2007) was an artifact of two specific task characteristics. These characteristics are the skill weight and effort weight of the task. This hypothesis can also be generalized to self-efficacy studies that have attempted to show that self-efficacy is negatively related to performance (e.g. Vancouver et al. 2001, 2002). This is because both conclusions miss the point that self-efficacy was constructed as a motivational mechanism and functions by allowing a person to use his or her agency in order to create high goals for themselves and then close the gap between actual performance and these goals through effort, which leads to increased

performance. However, since effort is not synonymous with performance, increasing self-efficacy is not synonymous with increasing performance.

The current study provides good initial support for this hypothesis. Clearly, the relationship between self-efficacy and performance differentiated between skill and effort tasks. This also held true for both correlational and experimental analysis. The experimental analysis clearly supported hypothesis 1, that self-efficacy causes higher performance in an effort task. Further, since the main component of performance in an effort task is effort, it follows that self-efficacy causes increased task effort and thereby increased performance to the extent of the task's effort weight.

In addition, the debate between Control Theory (e.g. Powers, 1991) and Social Cognitive Theory (e.g. Bandura, 1997) was addressed. It was found that as Social Cognitive Theory predicts, and contrary to Control Theory, those whose expected performance was greater than their actual performance performed worse on the final similar task. Similar theoretical implications were also found in that those who performed better than expected on the initial similar task performed better on the final task. It was also found that those who performed better than expected increased their task-specific self-efficacy across tasks. This finding shows support for Social Cognitive Theory, which states that performing better than expected increases task specific self-efficacy resulting in increased effort and performance. In addition this finding provides support against Control Theory's argument that if one performs worse than expected, motivation and performance will increase. The findings of Vancouver and his colleagues (2001, 2002) were also replicated and could not be explained as motivational effects, as they did not differ across task type. However, their results could be explained as an artifact of penalizing high initial performance. This is inherent in any study which operationally measures self-efficacy beliefs using an upper limit.

In summary, study one concludes that self-efficacy should be viewed as a motivational mechanism, not a mechanism that automatically increases performance without affecting any mediators. Therefore, the effects of self-efficacy should be viewed in light of the task characteristics of skill weight and effort weight. In addition, evidence supporting Social Cognitive Theory and contrary to Control Theory has been found. This was done by showing that the difference between performance and expected performance is positively related to future performance, again in an effort task as these are both motivational mechanisms. It was also shown that previous findings that did not support Social Cognitive Theory were a result of the way self-efficacy has always been operationally defined.

STUDY TWO

The second study in the current paper addresses two of the issues raised by Wood and his colleagues (2000) concerning search and processing self-efficacy. Each issue warranted a separate investigation and therefore study two is divided into two phases. Phase one addresses the issue of how people mentally categorize the searching out and processing of information. Wood et al. originally hypothesized that search self-efficacy would be broken down into the four subcategories based on search modality: experimentation, interpersonal search, electronic search and passive study. It was also hypothesized that processing self-efficacy would be broken down into categories based on task characteristics. These hypotheses were tested. Search self-efficacy actually broke down into two components which fell into the categories of personal search and interpersonal search. Processing self-efficacy broke down into four categories based on task characteristics as predicted.

Phase two of study two deals with the issue of how search and processing self-efficacy affect the use of the representativeness, availability, and anchoring and

adjustment heuristics. According to the dual systems and expertise literature cited earlier, the predictions of this portion of the study is that there will be no significant correlation between search self-efficacy and use of the availability heuristic and that there will be no significant correlation between processing self-efficacy and use of the representativeness or anchoring and adjustment heuristics. However, since hypothesis of non-significance cannot be tested, the following hypotheses, according to Wood, Atkins, and Tabernero (2000), will be investigated in both phases one and two.

H1a: Search self-efficacy will break down into the four components of experimentation, interpersonal search, electronic search and passive study based.

H1b: Processing self-efficacy will break down into the three components of logical, spatial, and verbal processing.

H2a: There will be a significant negative correlation between search self-efficacy and use of the availability heuristic.

H2b: There will be a significant negative correlation between processing self-efficacy and the use of the representativeness heuristic.

H2c: There will be a significant negative correlation between processing self-efficacy and the use of the anchoring and adjustment heuristic.

STUDY TWO – PHASE ONE

Participants

535 students from one large northeastern university and one mid-size northeastern university participated in this study in exchange for course credit and for a chance at one of two $50.00 cash prizes. Participants were 68% female and 74% white. The mean age of the participants was 20.9, *SD* = 4.2.

Question Construction

Questions were constructed under the recommendations of Wood, Atkins & Tabernero (2000). The researcher was in contact with Robert Wood during the construction of the questions and all questions received his approval to fit the categories mentioned. The questions are divided into the categories of search self-efficacy and processing self-efficacy and then each category is subdivided. This section of the paper will be divided similarly. A complete list of the questions used in this study can be found in Appendix 1. Questions have been inspired by various sources by making various questions and theories more or less context specific in order to capture the domain of search and processing self-efficacy.

Search self-efficacy questions where created to fit within the four categories of experimentation, interpersonal search, electronic search and passive study. Experimentation questions were created from four sources. First, questions involving visual search experimentation were based on research by Wolfe (1998). Wolfe's research was responsible for five questions asking about a participant's confidence in identifying relevant information, recognizing recurring themes, creating plans to investigate chosen topics and identifying which information is most important about a specific topic. The second set of questions is based on the research of Fielder, Walther and Nickel (1999). Seven questions based on their comments where created dealing

with creating search strategies to complete specific objectives and using experimental outcomes to make appropriate generalizations. The third set of experimental search questions were created based on work by Carrasco, Giordino & McElree (2006). This yielded four questions dealing with identifying topics that need to be investigated, topics linked to a chosen topic, and obtaining information within that topic area. Finally six questions were taken from Emich (2002) pertaining to identifying problems, choosing the best solution to a problem, identifying the causes of problems, generating effective solutions to a problem, and forming appropriate conclusions from facts. These twenty-two questions were created to assess all aspects of experimental search from generating and identifying search topics to conducting the search and obtaining information through experimentation.

The interpersonal search component of search self-efficacy was the largest section of the survey. It contained thirty one questions based on three seperate research projects. The first was the research of Mevarech and Susak (1993) who study interpersonal questioning behavior in children. The sixteen questions obtained from this research include those about getting another person to summarize, define and differentiate information as well as understanding what that other person says. These questions also included those about working with another person in order to obtain and analyze searched out information. The next set of six questions was based on the work of Keeley, Ali and Gebing (1998) who also work to teach children questioning skills. These questions include those on evaluating the advice given by another person, being able to search further after discussion with another person, and getting another person to give in depth insight about a search topic. Robert Wood and the current researcher suggested the final nine questions as areas which should be included in the domain of interpersonal search, but were not yet discussed. These questions include those on identifying knowledgeable individuals, and asking questions to another person that get

them to evaluate obtained information, possible search strategies, that elicit focused responses, and that get them to evaluate themselves. It also included questions about making comments which correct another's behavior to help in the search and providing instructions to help another person understand the task.

The electronic search scale consisted of twenty eight questions, eleven of which were updated from Wood and his colleague's (2000) electronic search self-efficacy scale. These questions focus on both the specific skills necessary to complete an electronic search and those relating to this area. Questions in this section include those about determining search keywords, using Boolean connectors (e.g. and, or, not), creating searches which produce relevant resources, evaluating a list of given resources and altering the search to make it more productive. The second set of eleven questions came from an article by Quint (1991) which focused on the seven stages of an online search. These questions focused on understanding databases, identifying logical relationships between terms, creating specific search terms, and finding alternate terms if initial ones do not yield appropriate results.

The last subsection of the search self-efficacy scale is the passive study self-efficacy scale. Most questions where taken from the Approaches and Study Skill Inventory for Students (ASSIST, 1997). This measure inspired ten questions involving interpreting and understanding readings, finding ways to understand difficult parts of readings, and relating ideas between readings. The other five questions for this section were suggested by Robert Wood and involve obtaining resources relevant to a search topic and creating strategies to obtain relevant resources.

Processing self-efficacy was theorized to vary less than search self-efficacy and to vary on dimensions related to the specific skills needed to complete tasks. For this scale, those skills were hypothesized to fit into three categories: spatial, verbal, and logical. Questions for these domains were created by relating Wood et al.'s (2000)

suggestions for processing characteristics: making judgments from information, evaluating ideas, comparing information, transforming information, integrating acquired information, rehearsal, elaboration of information, planning, revising plans, and monitoring; and applying these to the aforementioned areas within the context of Gardner's multiple intelligences (1999). Spatial processing deals with finding patterns in stimuli, connecting unique attributes of stimuli, visualizing how stimuli will materialize, and remembering stimuli. Verbal processing deals with interpreting meaning, making judgments based on a person's tone and what they say, comparing written information, executing plans based on verbal information, persuading, and explaining information to people. Finally, logical processing has to do with making arguments, analyzing and fixing problems, integrating information, and performing calculations. 48 processing questions were created to go along with 89 search questions to total 138 questions for the initial analysis.

Procedure

Participants answered questions in two parts online. The first part of the questionnaire contained four demographic questions asking participants their sex, age, ethnicity and year in school. The second part contained the 138 search and processing self-efficacy questions described above. These questions were randomly mixed by surveymonkey.com so that no participant received the same question order. Therefore, fatigue and other ordering effects were minimized. After all participants completed the survey, the two $50.00 prizes were given.

STUDY TWO-PHASE ONE RESULTS

Factor analysis was conducted to determine what, if any, underlying structure existed for the questions of the survey. Principal components analysis was conducted

using a varimax rotation. The analysis revealed six components accounting for 64.68% of the variance. The first component contained ten questions relating to an individual's personal search self-efficacy. This component accounted for 42.63% of the variance and had a Cronbach's alpha of .945. The second component contained eight questions relating to logical processing self-efficacy and accounted for 6.24% of the variance with a Cronbach's alpha of .920. The third component contained nine questions relating to verbal processing self-efficacy and accounted for 5.35% of the variance with a Cronbach's alpha of .919. The fourth component contained nine questions relating to ones interpersonal search efficacy and accounted for 4.23% of the variance with a Cronbach's alpha of .895. The fifth component contained six questions relating to spatial processing self-efficacy and accounted for 3.50% of the variance with a Cronbach's alpha of .895. The sixth and final component contained five questions relating to interpersonal processing self-efficacy and accounted for 2.73% of the variance with a Cronbach's alpha of .823. Consequently, overall search self-efficacy divided on two components and explained a total of 46.86% of the variance. The overall processing self-efficacy component divided into four components accounting for 17.82% of the variance. The final scale containing 47 items. See Table 2 for details.

Table 2 – Search and Processing Self-efficacy Components

Table 2				
	Subscale	**Number of Items**	**% Variance Explained**	**Cronbach's Alpha**
1	Personal Search Self-efficacy	10	42.63	0.945
2	Logical Processing Self-efficacy	8	6.24	0.920
3	Verbal Processing Self-efficacy	9	5.35	0.919
4	Interpersonal Search Self-efficacy	9	4.23	0.895
5	Spatial Processing Self-Efficacy	6	3.50	0.895
6	Interpersonal Processing Self-Efficacy	5	2.73	0.823
7	Total Search Self-efficacy	19	46.86	0.949
8	Total Processing Self-efficacy	28	17.82	0.946
	Total	**47**	**64.68**	**----**

STUDY TWO-PHASE ONE DISCUSSION

Search self-efficacy was hypothesized to break down into four subcategories based on search modality. However, it actually broke down into the two subcategories of personal search and interpersonal search self-efficacy. This shows that contrary to previous hypotheses, when people search information, they differentiate their confidence in obtaining information by dividing information into that which they can get themselves and that which they must obtain from others. Explanations of these subcategories and subcategory items are below. All items begin with, "I can." All final questions can be viewed in Appendix 2. In addition, items were eliminated if the correlation between them and a component with an Eigen Value greater than one was not greater than .40.

Processing self-efficacy was hypothesized to break down into subcategories based on task characteristics. This hypothesis proved to be correct; however one additional category was needed to explain possible characteristics of a task. In addition to verbal, logic and spatial characteristics, tasks containing interpersonal characteristics also were differentiated from personal verbal characteristics by participants. Processing subcategory explanations are self-explanatory in light of the items within each subcategory. Subcategory items are below. All items also begin with, "I can" and can be found in Appendix 2.

STUDY TWO – PHASE TWO

Participants

173 students from a large northeastern university participated in this study in exchange for course credit and for a chance at one of two $50.00 cash prizes. Participants were 73% female and 74% white. 9% of the sample was freshman, 36% was sophomores, 28% was juniors, 22% was seniors and 5% was graduate students.

Materials

Participants were given an online survey. This survey was delivered in three main sections. The first section consisted of three demographic questions and asked for information about participant's gender, ethnicity and education level. The second section consisted of the 47 item search and processing self-efficacy questionnaire developed in study two, phase one. These items were randomized per participant by surveymonkey.com, to minimize fatigue and other ordering effects.

The third section consisted of twelve heuristics questions based on Kahneman and Tversky's work (1974). These questions were divided into the three categories of availability questions, representativeness questions, and anchoring and adjustment questions. These questions were intermixed. There were five availability questions. The first three were obtained from Plous (1993).The first asked participants which was a more likely cause of death in America, falling airplane parts or shark attacks. The correct answer is falling airplane parts. The second question asked participants which was a more likely cause of death in America, homicide and car accidents or diabetes and stomach cancer. The correct answer is diabetes and stomach cancer. The third question asked participants whether lightening or tornadoes cause more deaths in America. The correct answer is lightening. The final two availability questions came directly from Kahneman and Tversky (1974). The first of these questions asked if there are more six letter words that have the letter "n" in the fifth position, that have the letters "ing" in the fourth, fifth and sixth positions, or if there are about the same in each category. There are more words that have n in the fifth position because six letter words that end in i-n-g also have n in the fifth position. The second of these questions asked if more words begin with r, have r in the third position, or if these categories are about equal. The correct answer is there are more words that have r in the third position. The purpose of all these questions is that if someone uses his or her first

instinct he or she will choose the answer of which they can recall more members within the category of the answer, although it is wrong.

There were also five questions testing the use of the representativeness heuristic. All of these questions were obtained from Kahneman and Tversky (1974). The first of these questions is the famous "Linda" question in which participants are given a description of an outspoken and bright woman and asked whether it is more likely that she is a librarian or a librarian and a feminist. It is more likely that she is only a librarian because being both a librarian and a feminist fits within the category. The second question gives two urns, one contained 2/3 red balls and one containing 2/3 white balls. Participants are then asked whether an individual with 3 red balls and 1 white ball or an individual with 12 red balls and 8 white balls should feel more confident that he or she is drawing from the urn that is mostly red. The second individual should. The third question was a probability question which read "A cab was involved in a hit and run accident at night. Two cab companies, the Green and the Blue, operate in the city. 85% of the cabs in the city are Green and 15% are Blue. A witness identified the cab as Blue. The court tested the reliability of the witness under the same circumstances that existed on the night of the accident and concluded that the witness correctly identified each one of the two colors 80% of the time and failed 20% of the time. What is the probability that the cab involved in the accident was Blue rather than Green?" The correct answer is 41%, but many people respond with 80%. The fourth question is similar to the Linda problem, but it tells of a town where 80% of the citizens are farmers and 20% are librarians. It then gives a description of a quiet and shy man and asks what the probability is that he is a librarian. The answer is 20%. The final representativeness question asks whether it is more likely that 60% of the babies born are female in a small hospital, a large hospital, or about the same. It is more likely in the smaller hospital.

The final set of questions assessed whether participants were likely to use the anchoring and adjustment heuristic. There were three questions all taking the same form prescribed by Kahneman and Tversky (1974). The first asked whether the Nile River is longer or shorter than 500 miles. It then asked how long it actually is. The second asked whether Mount Kilimanjaro is taller or shorter than 8,000 feet and then how tall it is. And the third asked whether Saturn is closer or farther than 2 billion miles away from the sun and how far away it is. These natural entities were chosen because it was believed students would not know their exact distances, but could reference known distances such as that of the Mississippi River, Mount Everest, or the Earth or Pluto's mean distance. As the survey was administered online, participants were asked to please not use the internet to answer these questions. No one answered any of these questions exactly correct.

Procedure

As stated, the survey was administered online in three portions. Participants were recruited online through a database of the psychology department at the university where the experiment took place. Participants merely signed onto the website, completed the survey and were thanked. After all participants completed the study, the two $50.00 prizes were awarded.

Coding

All questions that had a correct choice and one or two incorrect choices were coded with a 0 if the participant answered with a choice that did not indicate heuristic use and a 1 if the participant answered with a choice that indicated use of a heuristic. This coding scheme covers all of the availability questions and the Linda, balls, and hospital representativeness questions. The taxicab problem was coded using the

formula (1/(.80-.41))*(.41-answer given). Therefore, this created a (0, 1) scale where 0 meant the correct answer was given and a 1 indicated the heuristic was completely used. This also created a situation where answers that fell in between were graded between these two numbers with those closer to 80% receiving a score closer to 1. The fictional town question was coded similarly. Scores were then aggregated creating an availability and representativeness scoring system where everyone scored between 0 and 5. The anchoring and adjustment questions were coded by subtracting the given answer from the actual answer and taking the absolute value of this number. Scores were then reduced so that all scores were on the scale of the Nile River question. Scores were then divided by 1000 so that all scores fell on a scale between 4.25 and 17.89 where 1 point was about equal to anchoring 100 feet based on the Nile River question.

Self-efficacy component scores were measured by aggregating the responses to the individual questions within each component and dividing by the total number of questions within that component. For example, total logical processing self-efficacy was calculated by adding together the eight questions within the category and dividing by eight.

STUDY TWO-PHASE TWO RESULTS

Gender did not have a significant effect on the use of the availability, t (173) = 1.518, p = .ns, the representativeness, t (173) = -.371, p = .ns, or the anchoring and adjustment heuristic, t (173) = .668, p = .ns. Next, a correlation matrix was created with all components of search and processing efficacy and search and processing efficacy totals. It can be viewed in Table 3. No parts of search and processing self-efficacy were negatively related to heuristic use, thus no support was found for hypotheses 2a or 2b.

However, specifically, search self-efficacy was not related to use of the availability heuristic, r (173) = .142, p = 063, meaning that if critical alpha is set to .1 instead of .05 search self-efficacy would actually have the opposite effect on use of the availability heuristic than was hypothesized. This would support the expertise literature. To specifically address hypothesis 2b processing self-efficacy was significantly positively related to the use of the representativeness heuristic, r (173) = .161, p <.05, and unrelated to use of the anchoring and adjustment heuristic, r (173) = -.022, p = .ns. This again supports the expertise literature for the relationship between processing self-efficacy and the use of the representativeness heuristic.

Table 3 – Effects of Search and Processing Self-efficacy on Judgmental Heuristics

Table 3

	Availibility	Representativeness	Anchoring & Adjustment
Personal Search	.164**	0.129	-0.021
Interpersonal Search	0.105	0.138	0.018
Verbal Processing	0.123	0.130	-0.020
Logical Processing	0.133	0.117	-0.052
Spatial Processing	.207**	.236**	0.007
Interpersonal Processing	0.104	0.128	-0.015
Total Search	0.142	0.143	-0.001
Total Processing	.161*	.174*	-0.022
	* significant at .05 level	** significant at .01 level	

In addition to correlation analysis a series of t-tests were conducted in order to test differences in self-efficacy means between those with high heuristic use and low heuristic use. In order to do this, heuristic use was divided into low and high groups by a mean split. Those that were equal to or higher than the mean were put into the high use group and those that were lower than the mean were put into the low use group. A mean split was used instead of a median split because many variables were coded

binomially so the medians held a large number of cases. As further support for the explanations provided in the current study, there was no difference in search efficacy between the low availability use (M = 6.96, SD = 1.00) and the high availability use (M = 7.20, SD = 1.18), t (173) = 1.395, p = .165. Additional support for the similarity in processing self-efficacy between those in the low representativeness group (M = 6.98, SD = 1.01) and those in the high representativeness group (M = 7.26, SD = 1.18), t (173) = 1.592, p = .113 was found. Similar, but more extreme similarities in processing self-efficacy between those in the low anchoring and adjustment group (M = 7.14, SD = 1.07) and those in the high anchoring and adjustment group (M = 7.13, SD = 1.07), t (173) = .082, p = .935, was also found.

STUDY TWO-PHASE TWO DISCUSSION

Overall no support was found for hypothesis 2a or 2b. Increases in search and processing self-efficacy can not be said to lower the use of judgmental heuristics in cognitive processing. Thus, preliminary support for the hypothesis of the current study, that fairly static cognitive limitations cause people to change the nature of heuristic use instead of limiting use of the heuristics themselves, has been found. For example, as someone is exposed to more information about mathematics, he or she will better be able to judge the difficulty of a specific test based on the first few questions. However, that person will not cease to make judgments. In addition, mild support was found in favor of the expertise literature which states that as someone becomes as expert in an area, preliminarily system two responses become system one heuristic responses. Search self-efficacy was found to relate to use of the availability heuristic if the critical alpha level is set to .1 and processing self-efficacy was found to relate to use of the representativeness heuristic at the .05 level.

OVERALL DISCUSSION

This research project was begun in order to answer two specific questions related to self-efficacy use, underlying motivational processes, performance and mental structures. The first question was how does self-efficacy affect performance? By manipulating both task type and self-efficacy it was found that self-efficacy operates as a strictly motivational construct as it affected performance on an effort task significantly more than performance on a skill task. Support was found for process theory that begins with self-efficacy affecting effort and continues with effort affecting performance. In addition, the question of whether this motivational effect on performance occurs through the pathways theorized in Control Theory or those theorized in Social Cognitive Theory was investigated. It was found that the difference between expected performance and actual performance was related to future performance, thus supporting Social Cognitive Theory. The effects hypothesized (Powers, 1991) and found (Vancouver et al., 2001; 2002) by control theorists were also replicated in the current study. However, these effects did not differentiate between task type and therefore could not be said to be due to a motivational effect. Instead, it was found that results were an artifact of self-efficacy measurement containing a performance ceiling and conducting within-person analysis while controlling for performance. This combination ended up penalizing those with high initial performance instead of calculating true performance growth.

The second set of questions investigated were: How do people characterize the skills necessary for the searching out and processing of information, and how does confidence in these areas effect their use of judgmental heuristics? It was found that people categorize the searching out of information based on whether they are personally searching information or must interact with others in order to obtain it. It was also found that people differentiate the processing of information, in line with

predictions of Wood, Atkins, and Tabernero (2000), based on task characteristics. In the current study these occurred when a specific task differentiated logical, spatial, verbal or interpersonal skill. It was also found that having confidence in one's abilities to search out and process information does not affect one's use of basic judgmental heuristics. This supports expertise theory, which states that as someone becomes more proficient in an area, responses that were initially system two become sytem one. However, this finding was contrary to the hypotheses of Wood, Atkins, and Tabernero (2000). It is theorized that due to restricted mental capacity, people change and update heuristics based on familiarity with a task area, which will also increase task specific self-efficacy. However, they do not lessen heuristic use. And, in this case, the tasks in question were the searching out and processing of information.

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Study one has several implications for future research. First, only two tasks were used. This experiment should be repeated with intermediary tasks in order to create a true continuum where performance could be shown to increase with self-efficacy as effort becomes more prevalent. This would further validate self-efficacy as a motivational construct. Or, alternately, a task could be created that contains different levels of skill and effort so that other characteristics of the task would not be seen as confounds. In addition, results indicate that more analysis on the specific mechanisms that affect self-efficacy, and by which self-efficacy affects performance, should be done instead of focusing on supplementing the massive amount of research on the direct relationship between self-efficacy and performance. Only by doing this will the nature of the true relationship between self-efficacy and performance become understood.

Study two also has several research implications. First, the categorization of search and processing skills should continue to be investigated. There may be other ways that search self-efficacy differentiates within the categories of personal and interpersonal search. Further, other task characteristics may be investigated to see if the relationship that seems to hold between processing self-efficacy and categorization by task characteristic really exists and how many characteristics it differentiates between. In addition, results indicate that tactics to reduce system one processing may be in vain because as skills become better learned they become heuristic responses and people continue to have limited cognitive ability. Therefore, efforts to adjust the intake of information should be focused on making heuristics as accurate as possible. Also, research tracking the development of heuristic responses over the process becoming an expert in a specific area should be supplemented.

CONCLUSIONS

Overall results indicate that although much self-efficacy research has been conducted and analyzed, the study of mechanisms by which self-efficacy asserts its effects still need to be investigated. This has been shown in the areas of both motivation and heuristic use. Although the relationship between self-efficacy and performance seems to be well established, and was further supported by the current study when controlling for task type and self-efficacy level, this merely makes it more important to understand the mechanisms by which this relationship occurs. This is so that the relationships between self-efficacy and its outcomes, including established relationships like that with performance, and newly hypothesized relationships like those with judgmental heuristics, can truly be understood and therefore applied.

APPENDIX 1
Original Search and Processing Self-Efficacy Questionnaire

When faced with a question or task in everyday life, whether it is a research question or not, it is necessary to search out solutions to the problem. Inevitably, this search will result in information which will need to be processed in order to complete the task or problem encountered.

These questions will ask you to record how confident you feel about performing different tasks involved in obtaining information necessary to investigate a topic and processing that information. There are no right or wrong answers. Please be as honest as you can.

For each question, you are asked to make two responses:

*1. Can you perform the task? If your answer is **Yes**, please list a **Y** in the **CAN DO** column. If you **do not** believe you can, please list an **N** for **No** in this column.*

*2. For each task, you are also asked to indicate how confident you feel concerning your ability to perform the described task. Using the scale below as a guide, select the appropriate number and enter it in the **CONFIDENCE** column.*

I can:	*Yes/No*	*Confidence*
1. Answer this example question		

Interpersonal Questioning Self-Efficacy Scale:

1) Get another person to define difficult terms
2) Get another person to describe difficult concepts
3) Understand terms defined by another person
4) Get another person to summarize difficult concepts
5) Get another person to differentiate between similar terms
6) Understand the differences between similar terms in the search
7) Communicate with another person on how to apply the search topic
8) Communicate with another person on how to search for related topics
9) Understand how to search for related topics
10) Communicate with another person on how to explain the relevance of the search topic
11) Communicate with another person on how to arrange a topic within the context of a theory
12) Understand how concepts fit into the context of a theory
13) Combine a search with other similar topics
14) Discuss with another person how to combine search terms in order to answer an overall question
15) Discuss which search method is the best with another person
16) Accurately rank search techniques with another person
17) Get another person to clarify ambiguous search terms
18) Be able to evaluate advice given by another person
19) Be able to search further after a discussion with another person.
20) Identify, with another person, terms that need to be searched from results of preliminary search
21) Connect information from multiple theories to enhance search
22) Be able to get another person to give more in depth insight about a search topic than you currently have
23) Identify individuals who may be knowledgeable in your search area
24) Ask questions that elicit the information you are seeking.
25) Ask questions that get the other person to reflect accurately on what they need to do in order to complete the task.
26) Ask questions that get the other person to reflect accurately on himself or herself.
27) Ask questions that get the other person to evaluate strategies for change.
28) Ask questions that elicit focused responses
29) Identify ways to get more information from another person

30) Correct another's behaviors that hinder the information search
31) Provide instructions that help another person to clearly understand the task.

Passive Study Self-Efficacy Scale:
32) Interpret what the author of an article means
33) Interpret the causes of a problem
34) Relate ideas from other topics to the search topic
35) Let one idea set off a long chain of thought
36) Find ways to understand confusing ideas from an article or book chapter.
37) Fully understand the details of an article or book chapter
38) Be able to understand the reasoning behind the authors point
39) Have an organized way to search the topic
40) Be able to find comfortable study conditions
41) Be able to motivate yourself to put appropriate effort into the search
42) Find a large number of appropriate search resources
43) Obtain resources relevant to the search topic
44) Generate unique ideas based on material read about the search topic
45) Create a strategy to obtain relevant resources
46) Generate multiple strategies to obtain relevant resources

Experimentation Self-Efficacy Scale:
47) Identify the most relevant information among many relevant sources
48) Identify relevant information among a group of irrelevant information
49) Recognize a recurring theme within a set of sources
50) Create a plan to investigate a topic
51) Identify important information about a topic
52) Formulate a search strategy that will yield appropriate results
53) Formulate multiple strategies that will yield your objective
54) Select the most appropriate strategy to yield your objective
55) Analyze the results of your chosen strategy
56) Use experimental outcomes to make appropriate generalizations
57) Use observations to draw appropriate conclusions
58) Use facts to draw logical conclusions
59) Identify a topic that needs to be investigated
60) Obtain information within a topic area
61) Identify topics that are linked to a search topic
62) Investigate multiple topics linked to a search term
63) Identify problems.
64) Choose the best solution to a problem.
65) Identify the causes of problems.
66) Generate effective solutions to a problem
67) Form appropriate conclusions from a set of facts.
68) Rationally compare opinions.

Domain Specific Electronic Search Self-Efficacy Scale
69) Use reference resources (i.e. dictionary, thesaurus…) to identify keywords for use in the search.
70) Determine the appropriate keywords to use in the literature search statement.
71) Identify the major requirements of the search from the initial statement of the topic.
72) Use connecting terms like "and" "or" and "not" when designing a search statement.
73) Develop a search strategy which will identify a large number of appropriate resources.
74) Evaluate the resulting list to monitor the success of your approach.
75) Devise a search which will result in a very small percentage of irrelevant items on my list.
76) Produce a list which does not include any irrelevant titles.
77) Identify a solution to a problem using literature search help guides.
78) Complete the search competently

79) Complete the search in an efficient amount of time
80) Evaluate the results of an electronic search to choose relevant items
81) Alter your electronic search to get results better associated with your search topic
82) Conduct additional electronic searches without achieving redundant results
83) Use a broad search term to get specific topics for further investigation
84) Identify logical relationships between search terms
85) Be able to restrict a search to yield a higher percentage of appropriate results
86) Be able to understand the database to conduct an electronic search
87) Be able to adjust search options to acquire the most relevant search results
88) Use multiple databases if one does not produce the desired results
89) Organize the search results for later access
90) Find alternate search terms if initial terms do not yield appropriate results
91) Realize when you have reached the limit of the search results
92) Create search terms that yield specific subtopics of the main search
93) Create search terms that yield background information on the main topic
94) Choose the database that will yield the most appropriate results

Spatial Processing Self-Efficacy
95) Make sense of unconnected information
96) Find a pattern in information
97) Find a visual pattern in a space
98) Recognize unique attributes among similar objects
99) Visualize driving directions between two points
100) Find your way back to a main road when lost
101) Visualize how pieces of a puzzle will fit together
102) Visualize how an object will move in space
103) Visualize how an object will look when it is rotating
104) Visualize a route shown on a map
105) Remember the location of objects after they are removed from view
106) Remember the details of a situation
107) Mentally break an object into its base components

Verbal Processing Self-Efficacy
108) Interpret the tone of a person's voice
109) Interpret the underlying meaning of a conversation
110) Make appropriate judgments based on the meaning of a conversation
111) Compare two written sources of information
112) Compare the viewpoints of two people after speaking with both
113) Integrate verbal information to explain a topic
114) Integrate written information to explain a topic
115) Interpret the tone of a written document
116) Interpret the meaning of a written passage
117) Create a plan of action based on written information
118) Create a plan of action based on verbal information
119) Revise a plan based on newfound verbal information
120) Revise a plan based on newfound written information
121) Tell someone your ideas clearly
122) Write your ideas in a manner understandable to others
123) Write steps to solve a problem that another can understand
124) Clearly explain how to solve a problem
125) Persuade someone to see an argument from your point of view
126) Remember something that you read
127) Reword another's argument to make it clearer

Logical Processing Self-Efficacy

128) Make logical arguments
129) Think logically
130) Form appropriate conclusions from a set of facts
131) Analyze problems logically
132) Analyze alternative solutions to a problem
133) Create logical alternative solutions to a problem
134) Accurately evaluate the credibility of an information source
135) Logically evaluate ideas
136) Logically compare information
137) Create an overall picture from multiple sources of information
138) Revise ideas due to the discovery of new facts
139) Integrate new information into previous ideas
140) Perform complex calculations
141) Form logical conclusions from a set of already accepted premises
142) Find situations in which already known theories would also be applicable

APPENDIX 2
Final Search and Processing Self-Efficacy Questionnaire

When faced with a question or task in everyday life, whether it is a research question or not, it is necessary to search out solutions to the problem. Inevitably, this search will result in information which will need to be processed in order to complete the task or problem encountered.

These questions will ask you to record how confident you feel about performing different tasks involved in obtaining information necessary to investigate a topic and processing that information. There are no right or wrong answers. Please be as honest as you can.

For each question, you are asked to make two responses:

*1. Can you perform the task? If your answer is **Yes**, please list a **Y** in the **CAN DO** column. If you **do not** believe you can, please list an **N** for **No** in this column.*

*2. For each task, you are also asked to indicate how confident you feel concerning your ability to perform the described task. Using the scale below as a guide, select the appropriate number and enter it in the **CONFIDENCE** column.*

I can:	*Yes/No*	*Confidence*
1. Answer this example question		

Search and Processing Self-Efficacy Scale

Component 1: Personal Search Self-Efficacy
1) Evaluate the results of an electronic search to choose relevant items
2) Alter your electronic search to get results better associated with your search topic
3) Create a search strategy to obtain relevant resources
4) Select the most appropriate strategy to obtain your search objective
5) Be able to restrict a search to yield a higher percentage of appropriate results
6) Choose the electronic database that will yield the most appropriate search results
7) Find alternate electronic search terms if initial terms do not yield appropriate results
8) Understand how to search for topics related to a stated topic
9) Determine the appropriate keywords to use in a literature search statement
10) Develop a search strategy which will identify a large number of appropriate resources

Component 2: Logical Processing Self-Efficacy
11) Think logically
12) Generate effective solutions to a problem
13) Logically evaluate ideas
14) Make logical arguments
15) Identify problems
16) Analyze problems logically
17) Use facts to draw logical conclusions
18) Use observations to draw logical conclusions

Component 3: Verbal Processing Self-Efficacy
19) Be able to understand the reasoning behind an authors point
20) Interpret the meaning of a written passage
21) Integrate written information to explain a topic
22) Integrate verbal information to explain a topic
23) Find ways to understand confusing ideas from an article or book chapter
24) Interpret what the author of an article means

25) Interpret the tone of a written document
26) Generate unique ideas based on written material
27) Fully understand the details of an article or book chapter

Component 4 – Interpersonal Search Self-Efficacy
28) Ask questions that get another person to reflect accurately on himself or herself
29) Identify ways to get more information from another person
30) Ask questions that get another person to evaluate different strategies
31) Get another person to summarize difficult concepts
32) Ask questions that get the other person to reflect accurately on what they need to do in order to complete a task
33) Communicate with another person on how to explain the relevance of a topic to a third party
34) Get another person to differentiate between similar terms
35) Correct another's behaviors that hinder them giving appropriate information
36) Get another person to define difficult terms

Component 5 – Spatial Processing Self-Efficacy
37)Visualize how an object will look when it is rotating
38) Find a specific visual pattern in a space filled with patterns
39) Remember the location of objects after they are removed from view
40) Visualize driving directions between two points
41) Visualize how pieces of a puzzle will fit together
42) Visualize how an object will move in space

Component 6 – Interpersonal Processing Self-Efficacy
43) Discuss which search method is best with another person
44) Revise a plan based on newfound written information
45) Get another person to give more insight about a search topic than you currently have
46) Communicate with another person on how to search for topics related to a question
47) Get another person to describe difficult concepts

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