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ATTAINING AND MAINTAINING CLARITY AS SELF-REGULATORY GOALS: THE UNDERLYING EFFECTS OF UNCERTAINTY ORIENTATION AND EGO-DEPLETION

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Abstract

According to the theory of uncertainty orientation, individuals differ in the ways in which they resolve uncertainty. Specifically, uncertainty-oriented individuals (UOs) prefer to attain clarity while certainty-oriented individuals (COs) prefer to maintain clarity. To investigate the roles cognitive resources may play in the connection between one's uncertainty orientation and information processing style, the present study showed that active self-regulation (i.e., systematic processing) lead to impaired performances on a subsequent executive attentional task. In this experiment, participants read a counterattitudinal article which varied in personal relevance and argument strength. Following this manipulation, participants' performances on the Stroop colour-naming task were examined. As predicted, UOs who read the strong arguments under high personal relevance performed worse on the task than COs in the same conditions. COs who read the strong arguments processed more systematically as personal relevance decreased. Unexpected and interesting results were also obtained among those who processed the weak arguments.

Keywords: uncertainty orientation, self-regulation, ego-depletion, persuasion, systematic and heuristic processing, motivation, cognition, individual differences.

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CHAPTER 1

INTRODUCTION

The more intensely we feel about an idea or a goal, the more assuredly the idea, buried deep in our subconscious, will direct us along the path to its fulfillment.

Earl Nightingale

As Earl Nightingale stated, individuals have the desires to seek and pursue goals. The action of goal seeking is commonly observed in people's daily lives. Athletes put themselves through rigorous training in order to achieve optimal performance and win the desired gold metal. Similarly, students put themselves through difficult examinations in order to attain the desired degree. One could argue that these goal seeking behaviours require the crucial role of self-regulation. That is, it is necessary for people to regulate and direct their own behaviours in order to fulfill their self-regulatory goals. According to Kruglanski, Thompson, Higgins, Atash, Pierro, Shah and Spiegel (2000), there appears to be two dimensions of self-regulation. On the one hand, "assessment" involves critical evaluation of the goals and means in self-regulation. "Locomotion", on the other hand, involves goal-related movement that is continuous, and is unaffected by distractions. It is argued that the combination of assessment and locomotion is necessary when an individual engages in self-regulation. Although one may make comparisons and choose the best means that will lead to the achievement of the desired end-states, one also needs to "commit the mental and physical resources required to initiate and maintain action that will reduce the discrepancy between one's current state and the desired end-state" (p. 794).

Sorrentino and Roney (2000) have stated that the mere possibility of not reaching one's desired self may elicit feelings of uncertainty. This is an indication that the self and

self-regulation also play important roles in uncertainty orientation. It has been found that individual differences in uncertainty orientation will provoke people to reduce uncertainty through different means. Furthermore, it is possible that uncertainty-oriented (UOs) and certainty-oriented individuals (COs) will also differ in their self-regulation styles. Perhaps some will rely more on a style that is similar to the dimension of assessment while others will rely more on a style that is similar to the dimension of locomotion. These differences in locomotion and assessment should emerge depending on whether the situation would allow the individual to find out new information about the self (UOs) or maintain clarity about the self (COs). From the perspective of self-regulation, resolution of uncertainty may be presented as a focal self-regulatory goal one aims to achieve. Therefore, attaining clarity and maintaining clarity could be presented as sub self-regulatory goals to the focal goal. In turn, the ways in which relative uncertainty is resolved could be seen as means by which these goals are achieved (B. Gawronski, personal communication, October 26, 2006). For example, some individuals may process incongruent information systematically to attain clarity while other individuals may process the same incongruent information heuristically to maintain clarity (Shuper & Sorrentino, 2004; Hodson & Sorrentino, 2003). Hence, an impediment that prevents the individual from utilizing the means for goal attainment may prevent the uncertainty-oriented individual from resolving uncertainty.

In order to investigate the self-regulatory styles of uncertainty-oriented and certainty-oriented individuals, it is important to review the goal seeking process of these individuals. Therefore, the present paper will first review research in goal systems theory and self-regulation. Second, it will review the applications of research in self-regulation

and ego-depletion to social information processing and attitude change. Third, it will apply previous research results in uncertainty orientation to recent research findings in goal pursuit, self-regulation, and ego-depletion. Finally, the experiment will investigate the components which may be the driving forces behind the linkage between the goals and means of uncertainty orientation. Specifically, the key interest is to examine the potential cognitive costs which may be associated with the pursuit of the self-regulatory goal of resolving uncertainty.

Process and Nature of Goals and Goal Pursuit

Reviews of the literature in goals and goal pursuit have shown that goals have both conscious and nonconscious components. According to Austin and Vancouver (1996), goals are defined as "internal representations of desired states" (p. 338) and "define the pursuits of individuals" (p. 339). Through these definitions, one may argue that the desired states and pursuits of individuals are innate motives which existed since birth. In their article, Schultheiss and Brunstein (1999) identified two motivational systems. The "implicit motivational system", on the one hand, included "nonconscious motives" such as need for achievement, need for affiliation and need for power. The "explicit motivational system", on the other hand, included "consciously accessible goals" that could only be accomplished when appropriate "cognitive strategies and plans" (p. 3) are utilized. Some of the distinctive features of goal constructs are the dimensions included within each goal. For example, dimensions such as commitment, attainability, and perceived progress in goal achievement are often important determinants in one's decision in goal pursuit. Additionally, implementation problems can in certain situations, obstruct a goal from being implemented or planned even if the individual had the mindset

to perform the contrary (Gollwitzer, Fujita, & Oettingen, 2004). According to the Model of Action Phases (Gollwitzer, 1996), four phases (predecisional, preactional, actional, and postactional) need to take place before an individual could fulfill his or her wishes and desires. Additionally, the individual's wishes and desires need to be specified before the course of fulfillment can take place.

Goal-mean associations. Cognition is an important component in goals and motivation. Theorists in this area have generally examined motivation and cognition in two approaches. In one approach, these entities have been viewed as two separate entities (Miller & Ross, 1975). In another approach, researchers such as Kunda (1990) have investigated how motivation and cognition may influence each other. Kunda's discussion of motivated reasoning, for example, describes how directional goals and the motivation to self-affirm could lead to "biased memory search and belief construction mechanisms" (p. 483). Researchers such as Sorrentino and Higgins (1986) have also adopted a "warm look" to motivation and cognition. That is, motivation and cognition are "synergistic" (p. 8) because they work together to achieve the desired end result. Additionally, Kruglanski, Shah, Fishbach, Friedman, Chun, and Sleeth-Keppler (2002) also abandoned the "motivation versus cognition" approach and have instead favoured the "motivation as cognition" (p. 331) approach. That is, like our goal systems, the cognitive system is also in constant motion. Therefore, the cognitions themselves represent the means that are associated with people's innate goals and these associations between goals and means allow goal attainment to succeed. Goals are defined by Kruglanski (1996) as "knowledge structures" (p. 599) that can be changed and activated. In reference to the goal systems theory, goal systems are defined as "mental

representations of motivational networks composed of interconnected goals and means" (Kruglanski et al., 2002, p. 333). According to Fishbach, Shah and Kruglanski (2004), goals have cognitive and motivational aspects. That is, goals have a cognitive aspect so they could associate with other entities with cognitive aspects. Also, goals have a motivational aspect because individuals will be motivated to pursue them when a goal-discrepant situation is undesirable. This motivation to pursue goals is especially salient when an individual is personally committed to the goals.

Due to its cognitive basis, Shah and Kruglanski (2003) have also shown that goals can be "primed". That is, a focus on the means associated with a goal may allow the goal to be activated more easily. Recent studies by Custers and Aarts (2007) have gone beyond the idea "priming" and proposed that for individuals who pursue a given goal frequently, (hence, are easily accessible) the "mere perception of a goal-discrepant situation can automatically facilitate access to mental representations of actions that are instrumental in resolving the discrepancy" (p. 630). That is, a discrepancy between the desired state (e.g. "looking well groomed") and the actual state (e.g. "having dirty shoes") may "trigger" the means (e.g. "polish shoes") that would allow the desired goals to be reached successfully. The authors found that for goals that are chronically accessible, the goal pursuit process does not need to include conscious intent. Therefore, the authors proposed that goal pursuit may be a nonconscious process that takes place implicitly. Ferguson, Hassin, and Bargh's (2008) chapter also supports this view of nonconscious goal pursuit. The authors stated that "goals can indeed be activated nonconsciously, and can then operate without conscious choice or guidance" (p. 153). It was also proposed in the chapter that automatic goal pursuit may be more flexible than

conscious goal pursuit because it is not as restricted by cognitive resources. In his discussion of the role conscious thought plays in motivation and cognition, Sorrentino (1996) also acknowledged that "conscious thought may amplify a process already implicit in the conditions of the moment" (p. 622).

In order for a goal to be achieved or for it to be pursued in the first place, the means associated with the goal need to be considered more closely. Although abstract goals could progress down to concrete means (Carver & Scheier, 1998) in a top-down fashion, the means themselves may also increase one's commitment to the achievement of the goal in a bottom-up fashion. Additionally, while people may choose the appropriate goals to pursue, they may also prioritize numerous pursuits at one time in order to maximize the number of goals that are achieved (Shah, 2005; Shah & Kruglanski, 2002). In his Theory of Planned Behavior, Ajzen (1991) stated that the actor's intention is the antecedent to the fulfillment of the behavior. Therefore, one's innate need (i.e. intention) may drive the actor to find means to carry out the goal (i.e. behavior). In their discussion of the mindset theory, Fujita, Gollwitzer, and Oettingen (2007) distinguished between "deliberative mindset" and "implemental mindset". Deliberative mindset is characterized by "open minded processing" and should be more prominent when an individual is choosing the appropriate goal to pursue. Implemental mindset, in contrast, is characterized by "closed minded information processing" (p. 49) and should be more useful when the individual is pursuing the chosen goal. Because closed minded processing involves filtering out information that is unrelated to the goal, this mindset could be considered the means which allow the desired goals to be reached. Bagozzi (1992) proposed that commitment and effort are also necessary for the proper

translation from intention to behavior. Furthermore, Shah and Kruglanski (2000) found that "if one's choice and commitment to a means is dependent on both its connection to the focal goal and its connection to background goals, then the association between these goals could become a strong determinant of means choice" (p. 97).

Individual differences in goal pursuit. Just as the means associated with a given goal could determine how the goal will be initiated and pursued, individual differences may also have important influences in how people pursue goals (Atkinson & Raynor, 1974). These individual differences, may in turn lead to different emotional reactions when the goal is attained or unattained (Roney, Higgins & Shah, 1995). One individual difference that could affect goal pursuit is the need for cognitive closure. According to Webster and Kruglanski (1994), people who score highly on this measure would be more likely to prefer "definite order and structure in their lives and abhor unconstrained chaos and disorder" (p. 1050). Therefore, these individuals will pursue structure through the ways they process information (e.g. stereotype others by categories; conduct social comparison with those who are similar) and interact with others (e.g. reject opinions of those who cause disorder).

Another relevant individual difference is from the theory of regulatory focus (Higgins, 1997). According to the theory, individuals with a promotion focus have an "ideal self-regulation" and individuals with a prevention focus have an "ought self-regulation" (p. 1281). Furthermore, Higgins (2000) proposed that individuals experience a "regulatory fit" when there is a match between one's chronic regulatory focus and the regulatory focus of the social context. Because a promotion focus stems from the idea of a "nurturance" social focus, a regulatory fit occurs when the focus of the social context is

on the presence and absence of positive outcomes. In contrast, because a prevention focus stems from the idea of a "security" (p. 1219) social focus, regulatory fit occurs when focus of the social context is on the presence and absence of negative outcomes. Along the same lines, Jostmann and Koole (2006) also identified individuals who are "action oriented" as ones who tend to take initiative and are decisive and "state oriented" as ones who tend to be hesitant and indecisive. Additionally, when faced with increased situational demands, action-oriented individuals tended to "mobilize their self-regulatory resources" (p. 1718) more efficiently so they could deal with the increased demands and reach their desired goals with greater ease.

Nature and Process of Self Regulation and Ego-Depletion

Nature of self-regulation. Self-regulation is often described as a tool that allows for an individual to control his or her impulses or desires. Just as goals are referred to as knowledge structures (Kruglanski, 1996), researchers have also indicated that self-regulation may be a process based on knowledge structure which includes "information about how to control the self and manage its responses" (Muraven, Tice & Baumeister, 1998, p. 775). According to Muraven and Baumeister (2000), the operation of self-regulation has also been referred to as a "muscle" that entails the usage of resources ("muscular energy") and continuous usage of these resources will lead to a depletion of the resources ("muscular fatigue") (p. 249). Fatigue of the muscle will prevent the individual from reaching the desired goal, and this "muscle", the authors stated, could also strengthen with practice. That is, the self-control process could improve if it was practiced repeatedly. In their discussion of self-regulatory issues in goal pursuit, Gollwitzer and Brandstatter (1997) additionally found that "implementation intentions"

and goal commitment are also important "self-regulatory tools" (p. 186) that would allow individuals to overcome any obstacles that may prevent them from accomplishing their goals successfully. According to Baumeister and Vohs (2007), there are traditionally three main "ingredients" of self-regulation. First, self-regulation is activated by certain "standards" the actors imposed on themselves. Second, self-regulation requires self "monitoring" and third, successful self-regulation requires "willpower". Most recently, the authors have acknowledged that "motivation" (p. 117) should be added as an additional ingredient. Without a motivation to self-regulate, human beings, the authors argued, would not have the desire to reach their self-regulatory goals in the first place.

Although most views of self-regulation frame this process as conscious and effortful, it is important to note that other researchers have proposed an alternative view. In extension to Bargh's (1990) auto-motive model, Fitzsimons and Bargh (2004) proposed an auto-motive model to self-regulation. That is, the procedures of selecting a self-regulatory goal to pursue and using means to fulfill the goal all operate under automatic, nonconscious, and unintentional processes. From this perspective, the progress of automatic self-regulation should be more flexible and should not be affected by variables such as cognitive resources.

Ego-depletion. A limitation or temporary obstruction in the resources required for self-regulation may result in one's failure to self-regulate (Vohs & Heatherton, 2000). According to Baumeister, Bratslavsky, Muraven, and Tice (1998), ego-depletion may be associated with physical fatigue and individuals are more likely to be acquiescent after they have gone through ego-depletion. Self-regulation is defined as successful when the desired changes related to the self are attained. This success, however, may only be

possible when one has cognitive and emotional resources available. For example, Vohs, Baumeister, and Ciarocco (2005) found that when people's regulatory resources are depleted, they are not as effective in self-presentation. Similarly, Hofmann, Rauch, and Gawronski (2007) found that a depletion of self-regulatory resources, through emotional suppression, led to a failure in dietary restraint. Furthermore, these researchers found that this failure in dietary restraint was associated with people's automatic attitudes about food. In their research, Govorun and Payne (2006) similarly found that ego-depletion decreased the "controlled component of stereotype-based responses" (p. 111) because these responses require the presence of "intentional control and cognitive resources" (p. 113). They found that, however, a decrease in one's cognitive resources did not influence the "automatic component of stereotype-based responses" (p. 111). Because depleted individuals are more likely to behave on their automatic associations, "stereotypical errors [will] result more frequently among participants who have a strong automatic bias and *are* depleted" (p. 128). Through applications of their Reflective-Impulsive Model (RIM), Strack, Werth and Deutsch (2006) indicated that impulsive buying behavior may be the result of both the reflective mechanisms (controlled) and the impulsive mechanisms (automatic). Although self-regulation may be associated with automatic processes, Vohs (2006) argued that because of the "complex nature" of the schemata in the reflective system, these mechanisms will not be activated unless self-regulatory resources were available to assist them. Therefore, "a reduction in self-regulatory resources, which power the reflective system, should severely impair reasoning, rational thought, and intelligent decision making" (p. 219). According to Jostmann and Koole (2006), when faced with multiple incongruent goals or situations

where the activation of behavioral intention is difficult, people's working memory capacities decreased due to the demanding nature of these activities. Similarly, activities such as ego-depletion may also have negative effects on self-control because they lessen the efficiency of people's working memory. Muraven and Slessareva (2003) stated that "a cognitive load or a shortfall in working memory is not easily overcome" (p. 895); hence, activities which require conscious cognitive effort will not execute as effectively when cognitive resources are not there to accompany them. If self-regulatory resources were essential components for the "means" in goal-mean associations, this supports the idea that not only is the intention to pursue a goal is important, the resources associated with the goal are also crucial.

Self-Regulation and Cognition

Effects of ego-depletion on self-regulation. As mentioned previously, lowering regulatory resources that are necessary for goal pursuit will slow down or stop one's progression towards the goal. In a series of studies, Schmeichel, Vohs, and Baumeister (2003) tested the effects of ego-depletion on cognition. Specifically, they investigated the role of the self and self-regulation in intelligent thought. The researchers found that participants performed worse on tasks which required "high-level cognitive control" when their self-regulatory sources were depleted. In contrast, performances were unaffected by ego-depletion when a high-level of cognitive control was not required by the task. A task was considered to involve a high level of cognitive control if it required "using logic to draw conclusions and implications from ideas, extrapolating from known facts to make estimates about unknowns, and generating novel ideas" (p. 33). The authors also distinguished between two types of intelligence that may be affected by ego-

depletion in different ways. On the one hand, fluid intelligence involves reasoning, manipulating abstractions, and making logical associations (Cattell, 1987). This type of intelligence is assumed to rely on regulatory resources due to its high level of cognitive control. Crystallized intelligence, on the other hand, involves knowledge that is learned through school and general experience. Because this type of intelligence is not assumed to rely on regulatory resources, it should not be affected by ego-depletion tasks.

To test these hypotheses, Schmeichel et al. (2003, Experiment 2) provided participants with a task which varied in ego-depletion, and then measured their performances on two different cognitive tasks. Participants were first shown a ten minute movie clip which included emotionally charged scenes. For the ego-depletion manipulation, participants in the emotion-regulation condition were asked to suppress any internal and external emotions they may feel during the viewing of the movie. In the no regulation condition, participants were free to express any natural emotions they felt during the viewing of the movie. Following the movie clip, participants completed the Positive and Negative Affect Schedule (PANAS), and then were instructed to complete two cognitive tests. The first test included multiple choice questions from the Graduate Management Admission Test (GMAT), which tested for general spatial, mathematical, and verbal knowledge. Good performance on these questions were achievable through simple, lower level information processing. The second test included open-ended questions from the Common Entrance Test (CET), which included questions that were ambiguous and tested for analytical ability. The questions required creative answers, and higher level information processing was necessary for the completion of the task. As predicted, an interaction was found between ego-depletion and performances on the

cognitive tests. That is, while emotional regulation led to inferior performance on the CET questions, it did not affect performance on the GMAT questions. These results provided support for the idea that depletion of one's cognitive resources may only impair tasks that require systematic and elaborate information processing. It is important to note that because the order of the tests were not counterbalanced in Experiment 2, the authors conducted an additional experiment in which they counterbalanced the order of two cognitive tasks following an ego-depletion manipulation. The same patterns results were obtained in the additional experiment thus confirming that order effects were not significant contributors to the results in the previous experiment.

Cognitive costs of self-regulation. Although most research in self-regulation and ego-depletion have focused on how an ego-depletion task could hinder people's attainment of their self-regulatory goals, recent studies have also found that merely engaging in the process of self-regulation could be depleting. As a result, this process could impair people's performances on an unrelated cognitive task. In one of their studies, Richeson and Shelton (2003) examined the cognitive costs of self-regulation by looking at the performances of white individuals on an executive attentional task (Stroop colour-naming task) after they had interacted with either a black or white confederate. It was found that in comparison to high-prejudice individuals who interacted with a white confederate and low-prejudice individuals, high-prejudice individuals who interacted with a black confederate performed the worst on the Stroop task. According to the researchers, because interracial interaction required the high-prejudice individuals to exert control on their behaviours (i.e., *not* to appear prejudice), this process of self-regulation depleted their cognitive resources. Consequently, the depletion of cognitive

resources prevented them from performing optimally on the Stroop task. In his discussion of the relation between working memory (WM) capacity and executive attention, Engle (2002) stated that "WM-capacity tasks measure a construct fundamentally important to higher-order cognition" and is related to "general fluid intelligence and executive attention". Furthermore, "performance on the Stroop task should rely on executive attention to maintain the goal of naming the color of the letters even when the word elicits a stronger response tendency to say the word" (p.22). This is further indication that poor Stroop task performance by the participants in Richeson and Shelton's (2003) study could have resulted from a decrease in working memory capacity, which resulted from the exertion of self-regulation efforts. This description of working memory and executive attention is also consistent with the earlier described relation between working memory capacity and ego-depletion (Jostmann & Koole, 2006).

Models of Persuasion

Because forming counterarguments against persuasive messages is similar to the higher level information processing task used by Schmeichel et al. (2003), it is important to examine some of the findings in this line of research. Research in persuasion has found that people typically use one of two processes or routes when they encounter persuasive arguments. In their elaboration likelihood model (ELM), Petty and Cacioppo (1986) identified the "central" and "peripheral" (p. 126) routes to persuasion. According to the authors, people tend to use the central route when they have the motivation or ability to process information thoughtfully. This style of processing is likely to occur when the situation is high in personal relevance, and when the individual has a high need for cognition. On the contrary, people tend to use the peripheral route when they do not

have the motivation or ability to process information thoughtfully. This type of processing is likely to occur when the situation is low in personal relevance and when the individual considering the arguments has a low need for cognition. Similar to the ELM, Chaiken (1980) also identified "systematic" versus "heuristic" (p. 753) processing in persuasion. Systematic processing is analogous to the central route to persuasion because they both involve careful evaluation of the information presented. Heuristic processing is analogous to the peripheral route to persuasion because it involves the usage of mental shortcuts.

Ego Depletion and Persuasion

Research in self-regulation and ego-depletion has normally been applied to examine negative behaviours such as impulsive eating, gambling and spending. However, as Schmeichel et al. (2003) showed, this process could also be applied to other activities such as intelligent thought. In their experiment, Wheeler, Briñol and Hermann (2007) expanded this research by examining resistance to persuasion as a self-regulatory process. Just as gaining control over one's eating habits could be important, resisting persuasion may also be motivating to individuals. That is, resisting and arguing against counterattitudinal messages may allow individuals to feel a sense of self-freedom and control. According to the authors, counterarguing requires "active control processes" (p. 150) because successful counterarguing includes careful processing of the persuasive message so contradictory arguments could be formed and used. Consistent with other behaviours that require active control processes, cognitive resources are also required for the successful resistance to persuasive messages. Therefore, the authors proposed that a depletion of one's self-regulatory resources should prevent individuals from reaching

their desired self-regulatory state (i.e. resisting counterattitudinal information). In other words, "ego-depleted participants could report acquiescent attitudes reflective of the types of agreement and 'going along' shown in other self-regulation breakdowns" (p. 151). It was further predicted that the reflection of the acquiescence should be shown through equal attitude ratings toward strong and weak arguments.

In this experiment, participants were assigned to either the low or high ego-depletion condition. In the first part of the ego-depletion task, all participants were asked to cross out every "e" they saw in a written passage. In the second part of the task, those in the low ego-depletion condition were asked to repeat the rule they had learned in the first part by crossing out every "e" in the passage. Participants in the high ego-depletion condition were asked to cross out every "e" they saw, but not if the "e" was followed by another vowel. Additionally, they were not to cross out an "e" if a vowel was present two letters before or after it. These rules in the high ego-depletion condition made the task cognitively taxing and depleting because participants had to learn new rules. A counterattitudinal appeal (implementation of mandatory comprehensive examinations) was then presented. Argument quality was manipulated by asking one group of participants to read weak arguments while asking another group of participants to read strong arguments. After the arguments were reviewed, the participants reported their attitudes toward the topic, listed their thoughts, and rated the amount of effort and attention they devoted to the task. As predicted, the results showed significant main effects for argument quality and ego-depletion. That is, participants were overall more persuaded by the strong arguments and participants in the depleted condition were also more persuaded by the counterattitudinal message. A significant interaction effect

between ego-depletion x argument strength was also found. That is, in comparison to those who were not depleted of their self-regulatory resources, depleted participants gave higher attitude ratings to weak arguments. Similarly, results from the thought listing task showed that the same participants generated more positive thoughts toward weak arguments. Furthermore, the authors found that depleted participants exerted the same amount of processing effort as non-depleted participants. This experiment made important contributions to the areas of self-regulation and attitude change because it showed that cognitive resources and self-regulatory goals may affect the ways in which people process counterattitudinal information. If defined through the goal systems theory, one could argue that the formation and application of counterarguments may be representations of the "means" that would lead to the fulfillment of the "goal" (i.e. resisting persuasion). It is also probable that the desire to resist persuasion may stem from an innate motive to resolve situational uncertainty. Therefore, individual differences, such as uncertainty orientation, may also affect the means that are used to achieve the goal of uncertainty reduction.

Uncertainty Orientation, Self-Regulation, and Goal Systems Theory

Even though uncertainty and unpredictability may sometimes bring forth excitement into one's life, human beings still have the innate tendency to reduce uncertainty. That is, it is important for people to be able to understand, control and predict their environment (Bandura, 1997). The theory of uncertainty orientation (Sorrentino & Roney, 2000; Sorrentino, Short & Raynor, 1984) is a general theory of motivation and self-regulation. According to the theory, although people may have the innate desire to reduce uncertainty, individual differences in uncertainty orientation will

determine how and when people will handle the uncertainty. Specifically, uncertainty-oriented individuals (UOs) are motivated by uncertain situations and view these as opportunities to learn new information about themselves and the environments around them. Certainty-oriented individuals (COs), on the other hand, are motivated by certain situations and desire to maintain clarity and avoid uncertain situations. Furthermore, UOs seek to *attain* clarity while COs seek to *maintain* clarity. "In essence, uncertainty orientation may be viewed as a cognitive individual difference variable related to information value. It serves as a situational screening device that, when identifying a relevant situation, arouses appropriate sources of motivation" (Sorrentino & Short, 1986, p. 393). Consistent with this view, Heine, Proulx and Vohs (2006) recently indicated need for certainty as one of the components of their Meaning Maintenance Model. According to the authors, "from birth onwards, people innately and automatically seek out, construct, and apply mental representations of expected relations to incoming information" (p. 91). This motivation to assign meaning to one's environment, the authors proposed, could be classified as an important personality dimension that directs individuals to either approach or avoid the situations around them.

In terms of self-regulation, the goal of resolving uncertainty could be represented as the focal goal for both UOs and COs. It may be the different ways in which these individuals resolve the uncertainty, or the means used to reach the self-regulatory goal, that distinguishes UOs from COs. If explained through the concept of equifinality, in which multiple means are associated with a common goal (Shah, Kruglanski & Friedman, 2003), one could conceptualize the need to resolve uncertainty as the common goal for UOs and COs and the usage of different information processing styles under different

conditions as the means associated with this common goal. Higgins (as cited in Sorrentino and Roney, 2000) also echoed this sentiment in his discussion of uncertainty orientation and self-regulation. He suggested that individual differences in uncertainty orientation are found because people share "different styles of self-regulation". That is, UOs may have been taught at an early age to resolve uncertainty around them by "learn[ing] everything that they could in order to master it". In contrast, COs may have been taught to resolve uncertainty by "stick[ing] to a few guiding principles and ignore the mass of confusion" (p. 157). Likewise, Brodscholl, Kober and Higgins (2007) mentioned in their description of the different strategies in self-regulation that while goal attainment concentrates on "bringing about additions" so individuals would be likely to use an eager approach during goal pursuit, goal maintenance concentrates on "stopping subtractions" (p. 629) so individuals would be likely to use a vigilant approach during goal pursuit.

Uncertainty Orientation and Persuasion: Differences in Information Processing

Past and present research have shown that uncertainty orientation may affect how an individual processes information. According to Sorrentino (1996), "uncertainty-oriented persons are motivated to process information in situations where uncertainty concerns are activated. Certainty-oriented persons, [in contrast], are motivated to process information in situations where concerns about certainty are activated" (p. 626). A number of studies have provided support to this idea that UOs and COs tend to have different processing styles. In a study that examined the interaction between uncertainty orientation, self-efficacy, and threat, Brouwers and Sorrentino (1993) found that when faced with health information that was high in threat, COs were less willing to attain

information about the health threat even when they had the efficacy to do so. In another study, Hodson and Sorrentino (2003) examined the information processing styles of UOs and COs when they were faced with either incongruent (i.e. ingroup disagreement, outgroup agreement) or congruent conditions (i.e. ingroup agreement, outgroup disagreement). The researchers found that UOs engaged in systematic processing when the persuasive message was incongruent with expectations and COs only engaged in systematic processing when the persuasive message was congruent with expectations. It was speculated that the distinguishing processing styles were found because UOs were motivated to process information carefully under incongruent conditions due to the uncertainty associated with the situation. COs, in comparison, were motivated to process information carefully under congruent conditions because of the certainty associated with the situation. According to the theory, as the decision-making situation becomes more important to the individual, UOs should be more likely to rely on controlled processing and COs in the same situation should be more likely to rely on automatic processing (Sorrentino, 1996; Sorrentino & Short, 1986).

In one of the original studies that showed evidence for different processing styles among UOs and COs, Sorrentino, Bobocel, Gitta, Olson and Hewitt (1988, Study 2) examined people's attitudes and information processing strategies toward persuasive messages. The participants were told that their university was considering implementing comprehensive exams as an additional requirement for graduation. This was considered to be a counterattitudinal message because most students had negative attitudes toward the idea of taking a major exam. Participants were also told that the proposed implementation of the exam would take place within one to two (high personal relevance)

or five to ten (low personal relevance) years. Furthermore, the message was either written by Dr. M. G. Richardson, professor of education and chairperson of the Ontario Commission of Higher Education (expert source) or by M. G. Richardson, a grade 13 student (nonexpert source). Because the implementation was a proposed policy change, this created a sense of ambiguity or uncertainty for the participants. Results showed that UOs resolved uncertainty more systematically when the issue was high in personal relevance. Because UOs preferred to approach counterattitudinal information that is personally important in more thoughtful ways, they gave arguments by the expert and nonexpert equal consideration; therefore, source expertise did not have a significant effect on their attitude ratings. COs, in contrast, resolved uncertainty less systematically when the issue was high in personal relevance; therefore, they rated the arguments more positively when they were presented by the expert. This pattern was a representation of their heuristic processing style and reliance on others to resolve uncertainty for them. When the issue was low in personal relevance, UOs were more persuaded by the expert source and COs were more persuaded by the nonexpert source. Under this condition, the COs were more persuaded by strength of arguments than the UOs. Therefore, the COs were more likely to engage in systematic processing when there was no uncertainty related to the self.

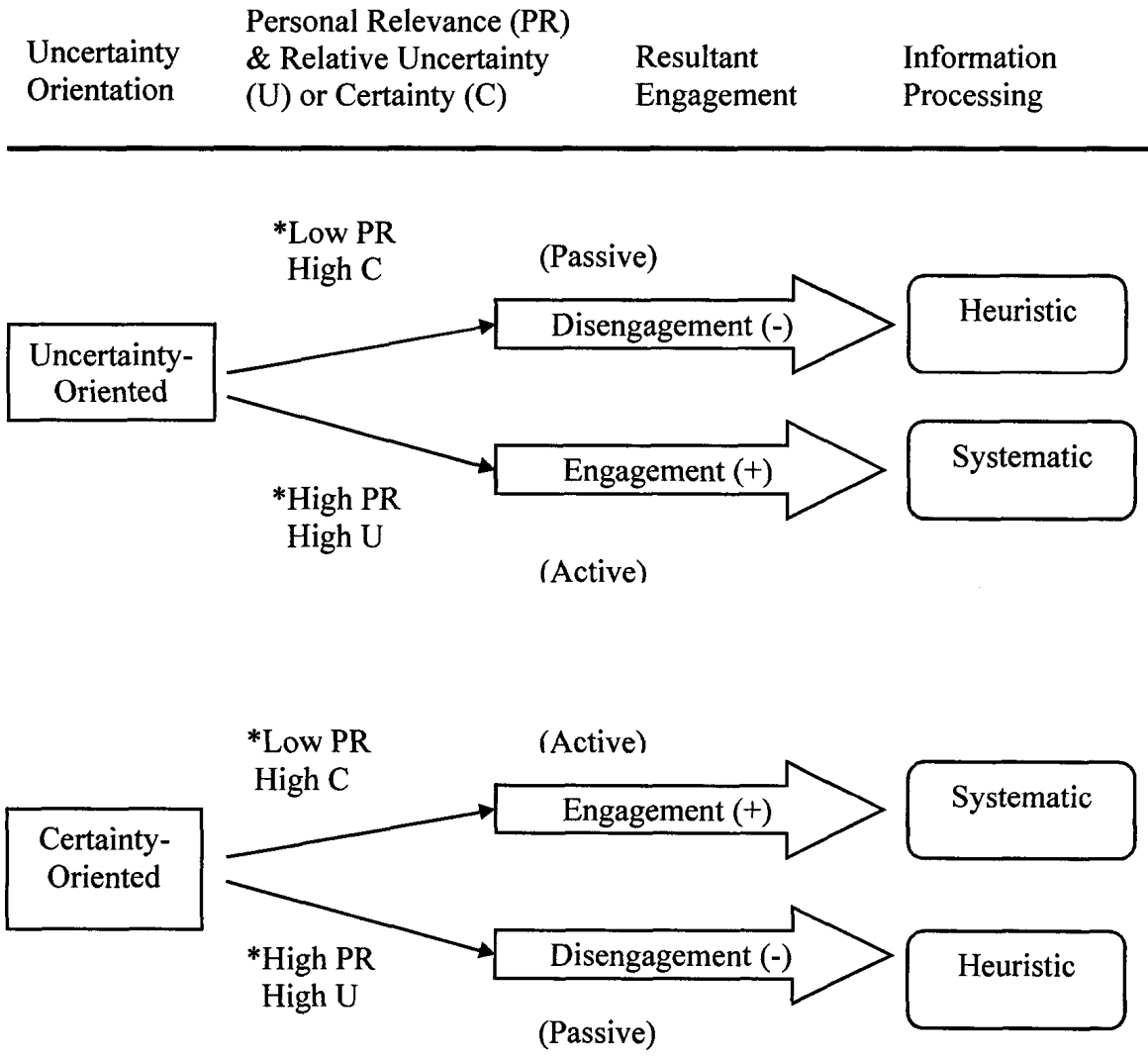
In their new mathematical reformulation of the theory of uncertainty orientation, Sorrentino, Smithson, Hodson, Roney and Walker, (2003) pointed out that the manipulation used in the 1988 research may have confounded personal relevance and situational uncertainty. Because the implementation of comprehensive exams may bring about diagnostic information regarding the self, it is important to emphasize that personal

relevance and situational uncertainty are independent from each other. According to the authors, this distinction is important because not only is personal relevance an important component to the theory, the level of perceived uncertainty or certainty and how that may relate to the self is also a crucial determinant of how individuals will ultimately process information.

The Present Study

As Wheeler et al. (2007) showed, resisting persuasion may be a self-regulatory process due to people's desires to "restore freedom or maintain psychological consistency and sense of self control" (p. 150). If this statement was applied to the theory of uncertainty orientation, one may argue that UOs and COs both have the desires to resolve uncertainty and restore freedom but they will achieve these goals through different ways. Hence, presentation of counterattitudinal messages could motivate individuals to resolve uncertainty through counterarguing. As mentioned above, one key distinguishing variable between UOs and COs would be the mean (or different style of information processing) used to accomplish this goal and another distinction is when the different style of information processing would take place. Specifically, personal relevance and perceived relative uncertainty or certainty of the situation will influence the degree of engagement in the situation and the amount of systematic processing (i.e., counterarguing). As illustrated in Figure 1, an increase in personal relevance and perceived uncertainty of the situation for the UOs would lead to active engagement and systematic processing. When the situation is low in personal relevance and the relative certainty is high, this results in disengagement and heuristic processing. For the COs, a decrease in personal relevance and increased relative certainty result in active

Figure 1. Illustration of the Model of Uncertainty Orientation in an Uncertain Situation



engagement in the situation and systematic processing. In contrast, an increase in personal relevance and increased relative uncertainty would lead to disengagement and heuristic processing.

In compliance with the findings found by Wheeler et al. (2007), depletion of one's cognitive resources should prevent the individual from processing information systematically. Uncertainty in the situation is the key determinant to whether the desire to resolve uncertainty would be triggered. Subsequently, personal relevance of the situation will activate the self-regulatory strategies people choose to use. When the argument is high in personal relevance, resolution of uncertainty may have important personal consequences. Therefore, gaining clarity and resolving uncertainty could be beneficial to the individual. In other words, *not* resolving uncertainty could be costly to the individual. For the UOs, the desire to attain clarity should be activated and they should process the counterattitudinal argument systematically. For the COs, the desire to maintain clarity should be activated and they should process the counterattitudinal argument less systematically because the situation is threatening to them. When the argument is low in personal relevance, resolution of uncertainty may not have important personal consequences. Therefore, gaining clarity and resolving uncertainty may not be as beneficial. Stated another way, *not* gaining clarity and resolving uncertainty may not be as costly to the individual. Similarly to the style adopted by UOs in the high personal relevance situation, COs may maintain clarity by processing the counterattitudinal argument rationally. In contrast, this type of situation should lead to less careful processing in UOs. The different types of processing styles under different situations reflect the conditions under which people are motivated to counterargue. Additionally,

they represent the means that are used to achieve the ultimate focal goal of uncertainty reduction.

Since previous research has consistently found that cognitive resources are necessary in self-regulatory operations, it is possible that cognitive resources are also involved in the self-regulatory processes of UOs and COs. From the perspective of Richeson and Shelton's (2003) findings, the mere act of processing counterattitudinal messages systematically (i.e. exertion of self-regulatory effort) should also be depleting. As a result, this depletion should impair the individual's subsequent performances on an executive attentional task.

The purpose of the present study is to investigate whether UOs and COs show different styles of information processing due to variations in their (1) self-regulation styles and (2) usage of means to achieve the goal of uncertainty reduction. Additionally, it aims to investigate the role cognitive resources may play in the linkage between uncertainty orientation and one's information processing style. Therefore, it will investigate whether (3) depletion of their cognitive resources (through active self-regulation and counterarguing) would be reflected in their performances on a subsequent task which requires executive attention and control.

Answers to the questions above will provide further insight into the underlying mechanisms and processes of uncertainty orientation. Previous research in uncertainty orientation has offered a wealth of evidence that UOs and COs differ in their information processing styles. This line of research is important because it showed the association between motivation and cognition. What the previous research has yet to examine, however, is whether there are other "components" that would allow this association to

occur successfully. Borrowing the statement from Vohs (2006), past studies in this area have not looked at what "greases the wheels" (p. 217) between uncertainty orientation and information processing. In other words, the resources that may allow the means to fulfill the focal goal have not been investigated fully. Because UOs and COs processed information systematically under different circumstances, it has been assumed that cognitive resources are present in these processes. By investigating the association between uncertainty orientation and ego-depletion, the present study will test whether this assumption is correct. The main objective is to further understand the conditions under which UOs and COs will exert self-regulatory resources and the possible cognitive costs associated with this exertion.

Lastly, application of other self-regulatory and goal pursuit theories to the uncertainty orientation model also allows the processes within uncertainty orientation to be examined from an alternative perspective. Although previous studies had already outlined the processes in uncertainty orientation through various mathematical models (Sorrentino et al., 2003), looking at the same processes through other theoretical frameworks and methodologies can strengthen the validity of the model and provide future directions in testing the model.

Hypotheses

As previous research findings suggest, active control of one's self-regulatory goals requires the operation of cognitive resources; therefore, it is predicted that making a self-regulatory effort (i.e. processing counterattitudinal messages systematically) should lead to a depletion of UOs' and COs' self-regulatory resources. Evidence of this resource depletion should be reflected in impaired performances on a subsequent executive

attentional task (i.e., Stroop task). Due to the importance of personal relevance, UOs should show the greatest impairment on the task after they have read the personally relevant and strong arguments. That is, they should pay more attention to the strong arguments as personal relevance increases. The amount of attention paid to the weak arguments should be relatively low across the different levels of personal relevance because it would not be worthwhile for the individuals to spend cognitive effort on arguing against these messages. In contrast, the performances of COs on the Stroop task should worsen after they have read the personally irrelevant and strong arguments. Because this situation is relatively certain, these individuals should pay more attention to the strong arguments in this low personally relevant (and nondiagnostic) condition. Similarly to the UOs, COs should also show relatively little attention to the weak arguments under low and high personal relevance.

In order to remain consistent with the research by Wheeler et al. (2007) and Sorrentino et al. (1988), additional attitude, thought listing and argument recall measures were also taken in the current experiment. The main purpose of these measures was to investigate how they may be influenced by the prior administration of an executive attentional task. It was anticipated that a majority of the results from these measures could be diluted by the effects of the Stroop task.

CHAPTER 2

METHOD

Participants

A total of 202 undergraduate psychology students from The University of Western Ontario participated in the experiment. Students participated in this study as part of their introductory psychology course requirement. Out of the 202 individuals who participated in the experiment, data from 17 participants were lost because computer and audio equipment problems failed to record their data. Additionally, 5 participants were excluded because they failed to follow the instructions and did not complete all parts of the experiment. Therefore, data from 180 participants were included in the analyses.

Design

The design was a 2 (personal relevance: high vs. low) x 2 (strength of argument: strong vs. weak) factorial, with uncertainty orientation as a continuous variable. The overall design and procedures were adopted from a combination of the methodologies used by Sorrentino et al. (1988, Study 2) and Richeson and Shelton (2003).

Materials

Uncertainty orientation was assessed by a revised version of the Thematic Apperception Test (TAT; Sorrentino, Hanna & Roney, 1992) and the F-Scale (acquiescent-free measure of authoritarianism; Cherry & Byrne, 1977). After the presentation of the counterattitudinal persuasive message, participants completed the Stroop colour-naming task. Finally, the participants completed an attitude questionnaire, an effectiveness questionnaire, a thought listing form, an argument recall form, a demographics questionnaire, a manipulation check, and a suspicion check.

Counterattitudinal persuasive message. The implementation of comprehensive exams was chosen as the persuasive topic for this study. Pilot testing with undergraduate

students (n = 78) from a previous year asked them to rate their favorability (1 = *very unfavorable*, 7 = *very favorable*) toward social topics such as "not implementing a tuition hike in exchange for two years of community service", "making abortion an illegal practice in Canada" and "implementing comprehensive exams as an additional requirement for graduation". Results showed that the proposal of implementing comprehensive exams was rated to be the least favorable (M = 2.50, SD = 1.70). The topic was also used in the studies by Sorrentino et al. (1988) and Wheeler et al. (2007).

Independent Measures

Personality assessment: Uncertainty-orientation versus certainty-orientation. The hypothesis posits that an individual's information processing style will be a function of one's dimension of uncertainty orientation; therefore, this measure was one of the predictor variables in the study. A person's dimension of uncertainty orientation was determined through the TAT and the F-Scale. The TAT included four sentences: (a) "Two people are working in a laboratory on a piece of equipment", (b) "A person is sitting, wondering about what may happen", (c) "A person is seated at a desk with a computer and books", and (d) "A person is thinking: An image of a crossroads is in the person's mind". The four questions which assisted the participants in writing their stories were: (a) "What is happening? Who is (are) the person(s)", (b) "What has led up to this situation? That is, what has happened in the past?", (c) "What is being thought? What is wanted? By whom?", and (d) "What will happen? What will be done?". The F-Scale was a self-report questionnaire that measured for authoritarianism. It asked the participants to rate their opinions on 21 items on 6-point scales (1 = *I Disagree Very Much*, 6 = *I Agree Very Much*), and some of the items included: "people ought to pay

more attention to new ideas, even if they seem to go against the Canadian way of life", "the findings of science may someday show that many of our most cherished beliefs are wrong", and "an insult to our honour should always be punished".

The need for uncertainty (*n*Uncertainty) and authoritarianism scores from the TAT and the F-Scale were used to determine the resultant uncertainty orientation score. *n*Uncertainty was a measure of the degree to which one had the need to resolve uncertainty about the self or the environment. Based on the scoring manual of *n*Uncertainty (Sorrentino et al., 1992), uncertainty imageries in the stories were scored and a *n*Uncertainty measure was obtained. The stories were scored by an expert scorer who had established above .90 correlation with practice materials from the scoring manual. To score for "need for uncertainty imagery", the stories written needed to contain "references to the goal of resolving or approaching uncertainty" (Sorrentino et al., 1992, p. 428). Once this criterion was scored, scores from additional subcategories such as "stated need to master uncertainty", "affective states associated with goal", and "instrumental activities taken to reach goal taken" could be added to the total *n*Uncertainty score. Below is an example of a story that had been scored for "need for uncertainty imagery" as well as other subcategories:

> "Joe has an image of a crossroads in his mind. He is sitting on his couch wondering where he should go in his life. He needs to make a major decision. One that will impact his life forever. In the past Joe had bad friendships, friendships that had a bad influence on him. He knew he needed to change. So he needed to make the choice to find new friends eventhough he knew it would be hard at first. Joe takes one day at a time to stay away from his old friends, he

avoids them when they bug him and devotes each day to finding something good about the new path he is willing to take. Joe finds friends that love him for who he is without even trying because he found confidence in himself. He found out the life and happiness and encouragement he always wanted and needed. He found this himself. Now Joe is living a liberating life."

Authoritarianism was a measure of the degree in which one had a need to maintain clarity about the self or the environment. To assess individual differences in uncertainty orientation, the total scores from the TAT and the F-Scale were each transformed into standardized z-scores. The resultant uncertainty orientation score was then determined by averaging one's standardized TAT score and the reversed coded standardized F-Scale score[1]. Taking the average score from the two measures allowed one to interpret the internal consistency of the resultant uncertainty orientation score.

Personal relevance: High versus low. Personal relevance was manipulated by advising the participants that the proposed change to the academic policy may take place in the next one to two years (high personal relevance) or in the next five to ten years (low personal relevance). Rephrasing the instructions used in the study by Sorrentino et al. (1988), the following statement was shown to the participants:

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[1] Calculating the resultant uncertainty orientation score by averaging the standardized TAT score and the reversed coded (i.e., multiplied by minus 1) standardized score from the F-Scale (i.e., [z-TAT + (-1)(z - FScale)] /2) is statistically equivalent (r = 1.00) to the traditional method of subtracting the standardized F-Scale score from the standardized TAT score (i.e., z-TAT - z-FScale). Averaging the scores, however, allows one to calculate and interpret the internal consistency of the resultant uncertainty orientation score (using Cronbach's alpha).

"The University of Western Ontario is currently considering making a number of changes to its graduation policy. One of the changes proposed to take place within one to two (or five to ten) years is the implementation of mandatory comprehensive exams as a requirement for graduation. The article you will be reading outlines the major reasons why the exam policy should begin in one to two (or five to ten) years from now. Because the university is interested in getting reactions from students on this issue, you will be asked to fill out several brief questionnaires after you have reviewed the article."

Strength of argument: Strong versus weak. Participants were asked to read an article which outlined the arguments that supported the change to the academic policy. The article contained either strong or weak arguments in favour of the change to policy (Petty & Cacioppo, 1986). Arguments from the strong arguments condition included: implementation of comprehensive exams will lead to an overall increase in GPA; final exams for senior undergraduate students will be eliminated in their final semester so students could prepare for the comprehensive exam; students from schools with the policy are viewed more favourably and are more likely to get into graduate schools; there is usually an overall increase in satisfaction with one's undergraduate education after the students have taken the comprehensive exams; graduates from schools with this policy are more likely to get good jobs and are likely to earn higher salaries. Arguments from the weak arguments condition included: UWO should implement this policy because various other universities have done so; the comprehensive

exam would provide a standard measure for comparing achievement across universities nationwide; anxiety leads to motivation in students, so good performances on the comprehensive exams are due to motivation; comprehensive exams are required for graduate degrees, so a comparable exam should be required for bachelor's degrees; ancient Greek philosophers thought comprehensive exams were the best measurement of intelligence, so this is a tradition worth following.

Dependent Measure

Stroop interference scores. Performance on the Stroop (1935) task is the main dependent measure of this experiment. A coloured stimulus word ("blue", "red", "yellow", "green") or a string of x's ("XXXX") was shown in the middle of the computer screen and participants were instructed to verbally identify the colour of the stimulus, not the word itself. The participants submitted their responses as fast as they could by speaking into the provided microphone[2]. A fixation cross (+) appeared on the screen before the stimulus word or the control stimulus ("XXXX") was presented. The word or x's was presented one at a time, for 2000ms and the interval between each trial was 1500ms. The challenge of the task came from the incompatible trials, in which the colour of the stimulus word and the colour word were different from one another (e.g. the word "yellow" shown in the colour red). The control trials showed the x's in various colours and were not challenging to process. Performance on the task was determined by the

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[2] Although Richeson and Shelton (2003) used the key response Stroop task in their research, the audio version was utilized for this experiment because the interference effects have been found to have greater reliability when responses are provided verbally (Peterson, Kane, Alexander, Lacadie, Skudlarski, Leung, & Gore, 2002).

mean Stroop interference score (in ms). This score was calculated by subtracting the latencies of the control trials from the latencies of the incompatible trials. Therefore, the worse the performance, the higher the mean Stroop interference score would be.

Additional Measures

Attitude and effectiveness measures. The attitude measure asked the participants to respond to the phrase "making comprehensive exams an additional requirement to graduation" on six 9-point semantic differential scales (bad-good, foolish-wise, negative-positive, beneficial-harmful, effective-ineffective, and convincing-unconvincing). For the effectiveness measure, participants were also asked to rate on a scale (1= *not at all*, 9 = *very*), the extent to which the article they read was "informative", "understandable", "interesting", "direct (i.e., to the point)", "creative", and "effective".

Thought listing. The thought listing form asked the participants to list all the thoughts that they had about the comprehensive exam proposal while reading the article. They were instructed to write each thought on its own line, and the form instructed them to indicate whether the thought was positive (+), negative (-), or neutral (0). The total number of thoughts listed, the positive thought index and the number of negative thoughts listed served as additional measures.

Argument recall. The argument recall form asked the participants to write down as many arguments as they could remember from the article they read. This form measured whether the participants paid attention to details of the arguments.

Demographics questionnaire. The demographics questionnaire asked the participants for basic demographic information such as ethnicity, place of birth,

language(s) spoken at home, age, and gender. The age and gender data are reported in the description of the final sample.

Manipulation check. The manipulation check asked the participants if they could recall when the proposed policy change would take place. This check reaffirmed whether the personal relevance manipulation was effective.

Suspicion check. The suspicion check asked the participants if they knew what the hypothesis of the study was, if they could think of any alternative hypotheses, and if they were suspicious of anything in the experiment.

Procedure

The experiment took place in 90-minute sessions[3]. The purpose of the first half of the session was to measure the individual's dimension of uncertainty orientation. The purpose of the second half of the session was to examine the effects self-regulation may have on individuals' performances on a cognitive task.

Assessment of uncertainty orientation. The participants came to the lab individually and were greeted by an experimenter. The participants were tested individually in lab rooms with a computer and audio equipment, and were asked to review the letter of information form and to sign the consent form if they agreed to participate. Participants were then seated in front of a computer, keyboard, and a set of headphones with a microphone. When the experiment began, participants were told to put on the headphones provided and to follow the instructions on the screen and the pre-recorded instructions given through the headphones. The personality measures in the

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[3] The study was run in conjunction with another research project. The tasks of the other project were administered after the tasks for the current project were completed so care was taken to ensure that the obtained results would not be contaminated by tasks which were not of interest to the current hypotheses.

first part of the study included the TAT and the F-Scale (Authoritarianism). The TAT involved writing four short stories in response to an ambiguous sentence lead. The instruction indicated that participants had 20 seconds to look at each sentence lead and to think of a story they could write based on that sentence. After the 20 seconds had expired, they were provided with four questions to help them write their stories. They were given one minute to answer each question, for a total of four minutes for each sentence lead. The computer program kept time and the pre-recorded messages let the participant know when it was appropriate to move on to the next questions. After the TAT's were completed, the participants were asked to complete the Personal Opinions Questionnaire 1 (F-Scale). All above questionnaires were administered through the computer program, MediaLab (Jarvis, 2006).

Information processing and ego-depletion. The purpose of this part of the study was to examine how self-regulation may affect people's performances on an executive attention task. The predictor variables for this part of the study were personal relevance (i.e., high versus low personal relevance) and strength of argument (i.e., strong versus weak arguments). Before the participants arrived, they were randomly assigned to one of the four conditions. After they completed the TAT and F-Scale, the participants were told that they would move on to the second part of the study: evaluation of people attitudes toward various social topics. The participants were told that a recent proposal had been put forth by the university to implement comprehensive exams as an additional requirement for graduation. The university was interested in getting feedback from students on this issue so they will be asked to read an article which contained arguments in favour of the proposal. The participants were then shown one of the four versions of

the article (high personal relevance and strong arguments; high personal relevance and weak arguments; low personal relevance and strong arguments; low personal relevance and weak arguments) which outlined the arguments in favour of the implementation of comprehensive exams. The participants were asked to review the article very carefully and to inform the experimenter once they had finished reading it. After the participants reviewed the article, the experimenter told them that their assistance was needed on a task that was unrelated to the study. Results from the task, they were told, would be used as pilot testing data for a future study. The Stroop task was then administered on the computer through the program DirectRT (Jarvis, 2006) and the participants were asked to identify the colour of the stimulus shown on the screen by speaking into the microphone provided. The first block of the task included 20 practice trials. Following the practice trials, there were 7 more blocks with 12 trials in each block. After they completed the Stroop task, the participants were asked to complete the attitude and effectiveness measures, thought listing form, argument recall form, demographic questionnaire, manipulation check, and the suspicion check.

At the end of the experiment, the experimenter debriefed the participants on the purposes and deceptions used in the experiment. The participants then received a debriefing form, were thanked, and dismissed.

CHAPTER 3

RESULTS

Treatment of the Stroop Data and Final Sample

The audio Stroop responses were saved as sound files. Therefore, error rates were recorded by reviewing the sound files for each trial and comparing the participants' responses with the correct answers. Correct responses were coded as "1" and incorrect responses were coded as "0" and the percentage of correct responses was computed for each participant. Overall, the average percentage of correct responses was .98, or 97.89% (SD = .04) across the 180 participants. To control for outliers, participants who had accuracy rates less than 2.5 standard deviations from the mean (or 88.5%) were excluded from the final analysis (n = 8). Therefore, a total of 172 participants (138 females and 34 males) were included in the final sample (age ranged between 17 and 30 years; M = 18.62, SD = 1.86). The average Stroop accuracy rate for the final sample was .99 (SD = .02).

To ensure the argument strength and personal relevance manipulations had no direct influence on the error rates, a 2 (argument strength) x 2 (personal relevance) ANOVA was conducted with error rates as the dependent variable. The interaction effect was shown to be nonsignificant, $F(1, 168) = .90$, $p = .35$. The main effects for argument strength, $F(1, 168) = .22$, $p = .64$, and personal relevance, $F(1, 168) = 1.21$, $p = .27$, were also nonsignificant.

Stroop interference scores. Reaction times for all trials were recorded by DirectRT. Examination of the frequency distribution of reaction times across all trials suggests that a majority of the reaction times was in the range of 250ms and 1000ms. To exclude the outliers, latencies lower than 250ms (3.06% of all reaction times) were recoded as 250ms and latencies greater than 1000ms (10.99% of all reaction times) were

recoded as 1000ms prior to the calculation of the Stroop interference scores. After the latencies were recoded, the mean Stroop interference score (in ms) for each participant was calculated by subtracting the mean latency from the control trials from the mean latency from the incompatible trials. Therefore, an increase in the Stroop interference score represented higher latencies in the incompatible trials, thus *worse* Stroop performance. The interference scores ranged from -39.98ms to 251.84ms (M = 105.62ms, SD = 51.94).

Manipulation Check: High Versus Low Personal Relevance

The manipulation check asked the question: "when was the proposed change to the academic policy set to take place?". Incorrect responses were coded as "0" and correct responses were coded as "1". The overall correct rate was .87 (SD = .34). Therefore, this was an indication that the majority of the participants had awareness of the personal relevance manipulation.

Resultant Uncertainty Orientation Score

Using Cronbach's alpha, the internal consistency for the resultant uncertainty orientation was shown to be $\alpha = .11$.[4] To ensure the experimental manipulations were independent from the individual difference variable, a 2 (argument strength) x 2 (personal relevance) ANOVA was conducted with resultant uncertainty orientation as the dependent variable. The interaction was shown to be nonsignificant, $F(1, 168) = 1.58, p = .21$.

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[4] Separate reliability analyses were conducted for the four TAT's and the 21-item F-Scale. Internal consistency was shown to be $\alpha = .33$ for the four TAT's and $\alpha = .67$ for the F-Scale.

Principal Analysis

The section below includes results for the main dependent variable, the Stroop interference scores. Analysis showed a significant three-way interaction for the Stroop interference scores, and the regression coefficient table and figures for these results are presented in the tests of hypotheses section.

Tests of Hypotheses

The three-way interaction between uncertainty orientation x personal relevance x strength of argument was tested through multiple regression. In this analysis, personal relevance and strength of argument were dummy coded (0 = low relevance, 1 = high relevance; 0 = weak, 1 = strong) and the centered resultant uncertainty orientation scores were treated as the continuous variable. The dependent variable, Stroop interference scores, was then regressed to the three predictor variables and their possible interactions (see Table 1). The regression analysis (R^2 = .08) confirmed a significant three-way interaction, B = 65.39 (SE = 22.49), $t(164) = 2.91$, p = .004. As presented in Figures 2a and 2b, the hypothesis that UOs in the strong arguments and high personal relevance conditions would have higher Stroop interference scores than COs in the same conditions was confirmed. Reversed patterns were found among those who were in the weak arguments condition. That is, COs in the high personal relevance condition had higher Stroop interference scores than UOs. UOs in the low personal relevance condition had higher Stroop interference scores than the COs.

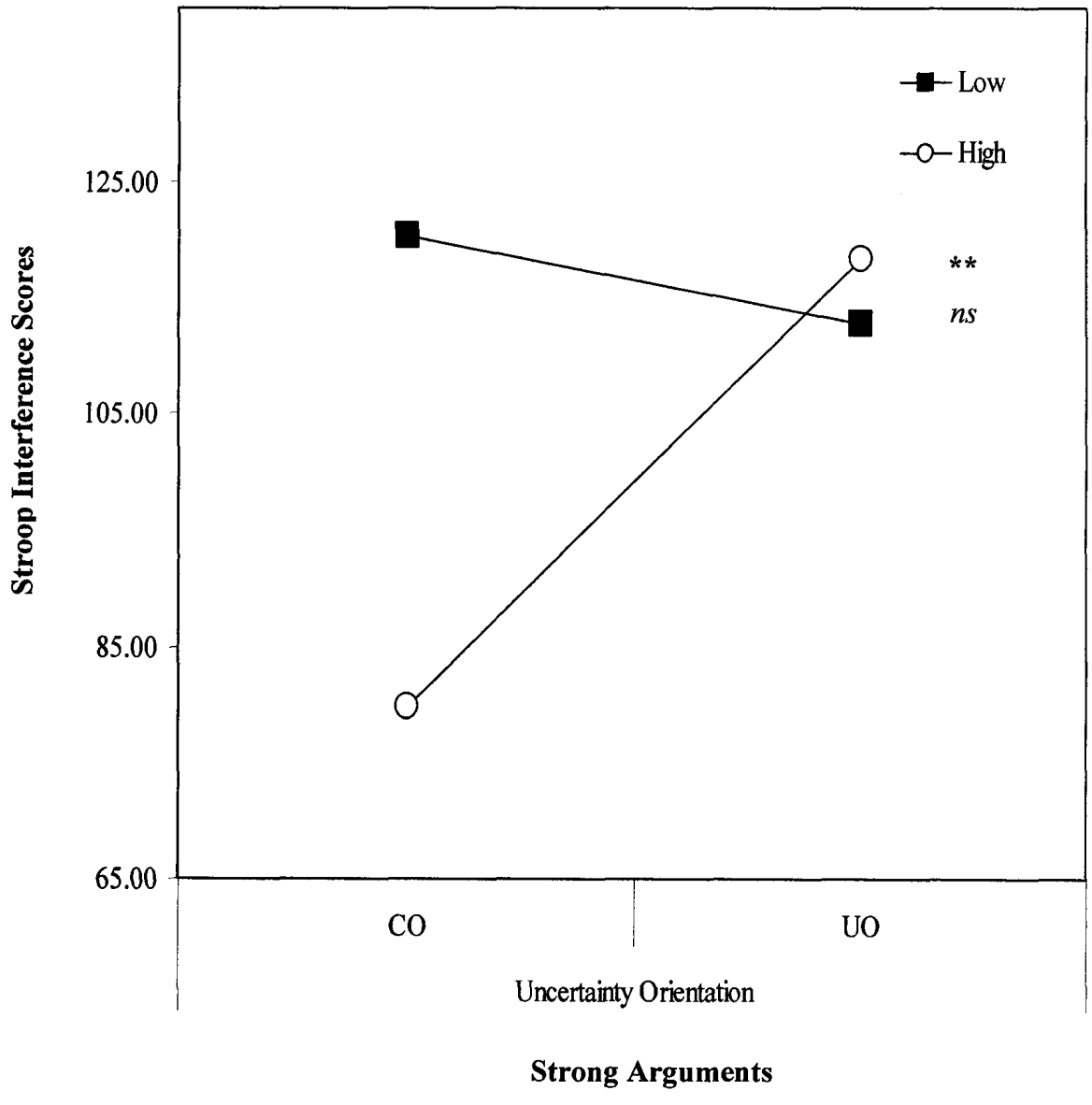
Table 1

Regression Coefficients for Stroop Interference Scores as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO), and Their Interactions (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	101.78	8.39		12.13	.00
ARG	14.85	11.44	.14	1.30	.00
PR	1.43	11.37	.01	.13	.90
UO	15.13	9.39	.21	1.61	.11
ARG X PR	-18.92	15.91	-.16	-1.19	.24
ARG X UO	-20.35	15.10	-.18	-1.35	.18
PR X UO	-33.61	14.51	-.31	-2.32	.02
ARG X PR X UO	65.39	22.49	.40	2.91	.004

Figure 2a. Significant three-way interaction between uncertainty orientation x strength of argument x personal relevance for Stroop interference scores.

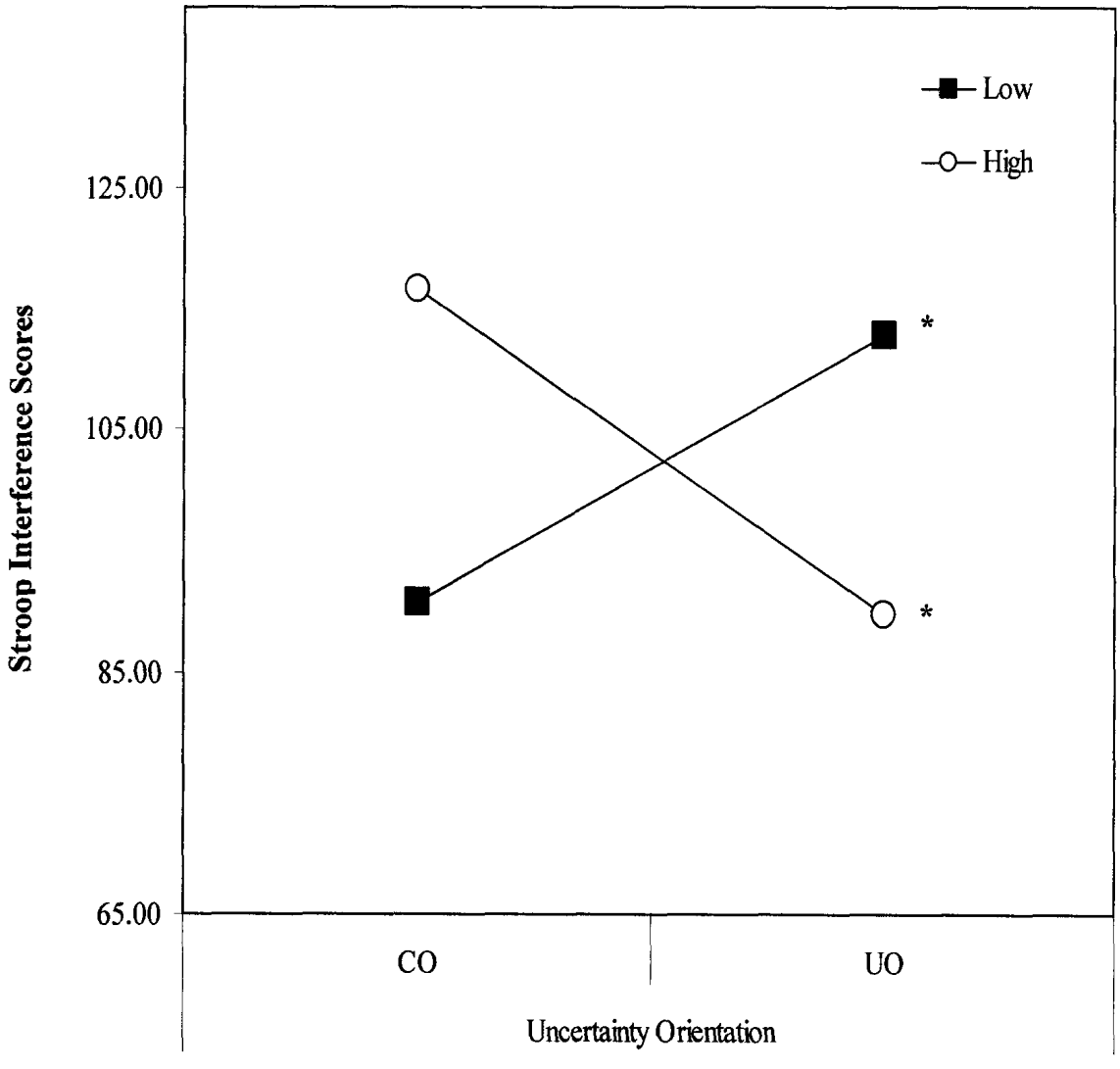
Among those who read the strong arguments, UOs who were in the high personal relevance condition performed worse on the Stroop task than COs in the same condition. For those in the low personal condition, performance on the Stroop task did not differ significantly among UOs and COs.



**$p < 0.01$, two-tailed.

Figure 2b. Significant three-way interaction between uncertainty orientation x strength of argument x personal relevance for Stroop interference scores.

Among those who read the weak arguments, COs who were in the high personal relevance condition performed worse on the Stroop task than UOs in the same condition. UOs in the low personal condition performed worse on the Stroop task than COs in the same condition



*$p < 0.05$, two-tailed.

When the means were estimated for individuals who were low (-1 SD) and high (+1 SD) in uncertainty orientation, the regression plots depicted in Figure 2a revealed that among those who read the strong arguments under high personal relevance, individuals who were high in uncertainty orientation (UOs) performed worse ($M = 118.45$) than individuals who were low in uncertainty orientation (COs) ($M = 79.82$). For those who read the strong arguments under low personal relevance, COs had higher Stroop interference scores ($M = 120.42$) than the UOs ($M = 112.83$). As shown in Figure 2b, among those who read the weak arguments under high personal relevance, COs performed worse on the task ($M = 116.65$) than UOs ($M = 89.77$). In contrast, UOs who read the weak arguments under low personal relevance performed worse on the Stroop task ($M = 112.78$) than COs in the same conditions ($M = 90.78$).

To test whether the patterns of the three-way interaction were significant, simple slopes analyses were performed (Aiken & West, 1991). Among those who read the strong arguments, the high personal relevance slope moving from COs to UOs was significant, $B = 19.31$, $t(164) = 3.41$, $p = .001$. The low personal relevance slope moving from COs to UOs, however, was nonsignificant, $B = -3.79$, $t(164) = .69$, $p = .49$. Difference in performance between high and low personal relevance was shown to be significant for the COs, $B = -20.30$, $t(164) = 12.84$, $p < .001$, but nonsignificant for the UOs, $B = 2.81$, $t(164) = .25$, $p = .62$. Among those who read the weak arguments, the high personal relevance slope moving from COs to UOs was significant, $B = -13.44$, $t(164) = 2.37$, $p = .02$ and the low personal relevance slope moving from COs to UOs was also significant, $B = 11.00$, $t(164) = 3.58$, $p < .05$. Difference in performance

between high and low personal relevance was significant for both COs, $B = 12.94$, $t(164) = 5.59$, $p = .02$ and UOs, $B = -11.51$, $t(164) = 4.42$, $p = .04$.

To decompose the interaction further, the significance of the two-way interaction between personal relevance and uncertainty orientation was tested when different levels of argument strength were controlled. Specifically, two separate regression equations were calculated for strong versus weak arguments and the significance of personal relevance x uncertainty orientation was then examined.[5] Multiple regression analysis for individuals who read the strong arguments showed the beta value for the two-way interaction between personal relevance and uncertainty orientation to be nonsignificant, $B = -.92$, $t(164) = -.08$, $p = .94$. Analysis for individuals who read the weak arguments showed the beta value for the two-way interaction to be significant, $B = -66.30$, $t(164) = -2.83$, $p = .005$.

Additional Measures

Participants' attitudes toward the proposal presented were scored from six 9-point semantic differential scales (bad-good, foolish-wise, negative-positive, beneficial-harmful, effective-ineffective, and convincing-unconvincing). Following the procedure by Baker and Petty (1994), the last three items were reverse coded and the average

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[5] To examine the two-way interactions at different levels of argument strength, it was necessary to calculate separate regression equations for strong and weak arguments. To control for argument strength among those who read the strong arguments (+ 1 SD), a new predictor (ARG_{Strong}) was calculated by subtracting 1 SD from argument strength predictor. This new predictor, the two other predictors (personal relevance and resultant uncertainty orientation scores), and their interaction terms then formed a new regression equation. To control for argument strength among those who read the weak arguments (- 1 SD), a new predictor (ARG_{weak}) was calculated by adding 1 SD to the argument strength predictor. This new predictor, the two other predictors (personal relevance and resultant uncertainty orientation scores), and their interaction terms then formed another regression equation. Significance of the two-way interactions was then tested by analyzing these equations separately through multiple regression.

attitude score for each participant was obtained by summing the scores from the items then dividing this sum by six. Higher scores represented more positive attitudes, and the average attitude rating was 5.95 (*SD* = 2.04).

Participants provided the effectiveness rating of the article by selecting on a scale (1= *not at all*, 9 = *very*), the extent to which the article they read was "informative", "understandable", "interesting", "direct (i.e., to the point)", "creative", and "effective". Similar to the treatment of the attitude ratings, the average effectiveness score for each participant was obtained by summing the scores from the items then dividing this sum by six. Higher scores indicated higher effectiveness and the average effectiveness ratings across all conditions was 6.22 (*SD* = 1.34).

In addition to recalling the arguments stated in the persuasive articles, participants were also asked to list any thoughts they had when they were reading the article about the comprehensive exam implementation. Following the procedure used by Baker and Petty (1994), participants were asked to code each thought they had as positive (+), neutral (0) or negative (-). Three main dependent measures considered during the analysis for the thought listing data were the total number of thoughts listed, positive thought index, and negative thoughts listed. The total number of thoughts listed was calculated by summing the positive, neutral, and negative thoughts for each participant. Overall, participants listed 4.50 (*SD* = 2.38) thoughts. There was an average of 2.08 (*SD* = 1.83) positive thoughts, 2.42 (*SD* = 1.88) negative thoughts, and .40 (*SD* = .70) neutral thoughts. The positive thought index was calculated by dividing the number of positive thoughts by the sum of the positive and negative thoughts. An increase in this score represented an

increase in the proportion of the number of positive thoughts listed. The overall positive thought index across conditions was .45 (SD = .29).

Each persuasive article presented included four main arguments in favor of the proposal for the implementation of the comprehensive exams in either one to two or five to ten years. Following the procedure by Baker and Petty (1994), arguments recalled by the participants were coded for correctness. The score of recall for each participant ranged from 0 to 4, in which 0 represented no correct arguments recalled and 4 represented four correct arguments recalled. Overall, participants recalled a mean of 2.56 (SD = 1.16) arguments.

Correlations

As presented in Table 2, a number of significant correlations among the measures were found. First, average attitude ratings correlated highly with average effectiveness ratings, $r = .56, p < .01$, positive thought index, $r = .63, p < .01$, and negatively with the number of negative thoughts, $r = -.44, p < .01$. Second, average effectiveness ratings correlated positively with positive thought index, $r = .38, p < .01$ and negatively with negative thoughts, $r = -.21, p < .01$. Third, argument recall correlated positively with total thoughts listed, $r = .26, p < .01$, negative thoughts, $r = .28, p < .01$ and negatively with positive thought index, $r = -.16, p < .05$. Fourth, total thoughts listed correlated positively with negative thoughts listed, $r = .65, p < .01$. Finally, positive thought index correlated negatively with negative thoughts, $r = -.57, p < .01$. The main dependent measure, the Stroop interference scores, did not correlate significantly with any of the additional measures.

Table 2

Correlations Between Average Attitude Ratings (ATT), Average Effectiveness Ratings (EFFECT), Argument Recall (RECALL), Total Thoughts Listed (THOUGHTS), Positive Thought Index (INDEX) and Negative Thoughts Listed (NEG) (n = 172)

	ATT	EFFECT	RECALL	THOUGHS	INDEX	NEG
ATT	---	.56**	-.03	.05	.63**	-.44**
EFFECT		---	.09	.14	.38**	-.21**
RECALL			---	.26**	-.16*	.28**
THOUGHS				---	.12	.65**
INDEX					---	-.57**
NEG						---

**$p < 0.01$, two-tailed.

*$p < 0.05$, two-tailed.

Secondary Analyses

Average attitude ratings. The three-way interaction between uncertainty orientation x strength of argument x personal relevance for average attitude rating was not a significant predictor, $B = -.57$ ($SE = .76$), $t(164) = -.75$, $p = .45$.[6] As per the recommendation by Aiken and West (1991), the significance of lower order effects in the three-way interaction were explored by conducting separate multiple regression analyses for the two-way interactions and main effects. First, the dependent measure was regressed to the predictors and their two-way interactions. The analyses showed that strength of argument x personal relevance, $B = .46$ ($SE = .54$), $t(164) = .85$, $p = .40$ and strength of argument x uncertainty orientation $B = -.29$ ($SE = .38$), $t(164) = -.77$, $p = .45$ interactions were nonsignificant predictors. However, the two-way interaction between personal relevance x uncertainty orientation was significant, $B = -1.19$ ($SE = .38$), $t(164) = -3.18$, $p = .002$. Specifically, for those who were in the low personal relevance condition, average attitude ratings increased as uncertainty orientation increased ($M = 6.60$ vs. $M = 5.46$). For those who were in the high personal relevance condition, average attitude ratings decreased as uncertainty orientation increased ($M = 5.42$ vs. $M = 6.01$). In the second regression analysis, tests of the main effects showed strength of argument to be a significant predictor of average attitude ratings, $B = 2.04$ ($SE = .28$), $t(164) = 7.39$, $p < .001$. The beta weights showed that strong arguments were rated more positively than weak arguments. Tests of main effects for personal relevance $B = -.32$ ($SE = .27$), $t(164) = -1.16$, $p = .25$ and uncertainty orientation $B = .31$ ($SE = .19$), $t(164) = 1.63$,

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[6] Regression coefficients tables for the additional dependent measure are summarized under Appendix L. Note the same regression models were used for all of the regression analyses listed.

p =.11 were not found to be significant.

Average effectiveness ratings. The three-way interaction between uncertainty orientation x strength of argument x personal relevance was nonsignificant for the average effectiveness ratings, B = -.20 (SE = .56), $t(164)$ = -.36, p = .72. None of the two-way interactions were found to be significant (argument strength x personal relevance: B = .50 (SE = .40), $t(164)$ = 1.25, p = .21; argument strength x uncertainty orientation: B = -.01 (SE = .28), $t(164)$ = -.05, p = .96; personal relevance x uncertainty orientation: B = -.35 (SE = .28), $t(164)$ = -1.27, p = .21). However, tests of main effects found that strength of argument, B = .89 (SE = .20), $t(164)$ = 4.51, $p < .001$, and uncertainty orientation, B = .34 (SE = .14), $t(164)$ = 2.49, p = .01 were both significant predictors for the average effectiveness ratings. Examination of the beta weights revealed that those who read the strong arguments found the arguments to be more effective than weak arguments. Additionally, individuals who scored higher on uncertainty orientation also rated the arguments as more effective. Personal relevance, on the other hand, was not a significant predictor, B = -.14 (SE = .20), $t(164)$ = -.71, p = .48.

Total thoughts listed (positive, neutral, and negative). Test of the three-way interaction between uncertainty orientation x strength of argument x personal relevance was found to be nonsignificant for the total number of thoughts listed (positive, neutral, negative), B = .32 (SE = 1.06), $t(164)$ = .30, p = .77. Tests of the two-way interactions did not find argument strength x personal relevance, B = .79 (SE = .74), $t(164)$ = 1.06, p = .29, argument strength x uncertainty orientation, B = .52 (SE = .52), $t(164)$ = 1.00, p = .32, and personal relevance x uncertainty orientation B = -.32 (SE = .52), $t(164)$ = -.61, of main effects showed that strength of argument, B = .43 (SE = .37), $t(164)$ = 1.16,

$p = .25$, personal relevance, $B = -.32$ ($SE = .37$), $t(164) = -.87$, $p = .38$ and uncertainty orientation, $B = .20$ ($SE = .26$), $t(164) = .77$, $p = .44$ were all nonsignificnat predictors.

Positive thought index. Test of the three-way interaction between uncertainty orientation x strength of argument x personal relevance was not significant, $B = -.07$ ($SE = .11$), $t(164) = -.64$, $p = .52$. Tests of the two-way interactions revealed that argument strength x personal relevance, $B = .07$ ($SE = .08$), $t(164) = .89$, $p = .38$, and argument strength x uncertainty orientation, $B = .09$ ($SE = .06$), $t(164) = 1.68$, $p = .10$ were nonsignificant predictors. However, personal relevance x uncertainty orientation, $B = -.13$ ($SE = .06$), $t(164) = -2.34$, $p = .02$ was a significant predictor. When the situation was low in personal relevance, UOs had a much higher positive thought index ($M = .55$) than CO's ($M = .35$). There was no difference in this measure among UOs ($M = .44$) and CO's ($M = .43$) when the situation was high in personal relevance. Tests of the main effects did not find personal relevance to be a significant predictor, $B = -.01$ ($SE = .04$), $t(164) = -.26$, $p = .80$. However, both argument strength, $B = .24$ ($SE = .04$), $t(164) = 5.94$, $p < .001$, and uncertainty orientation, $B = .08$ ($SE = .03$), $t(164) = 2.68$, $p = .01$ were found to be significant. The beta weights showed that strong arguments were associated with higher positive thought index. Additionally, those who scored higher on uncertainty orientation also had more positive thoughts.

Negative thoughts listed. The three-way interaction between uncertainty orientation x strength of argument x personal relevance was not significant, $B = .49$ ($SE = .81$), $t(164) = .61$, $p = .55$. Tests of the two-way interactions were nonsignificant for strength x personal relevance, $B = .34$ ($SE = .57$), $t(164) = .60$, $p = .55$, argument strength x uncertainty orientation, $B = .07$ ($SE = .40$), $t(164) = .18$, $p = .86$ and personal relevance

x uncertainty orientation, $B = .03$ ($SE = .40$), $t(164) = .08$, $p = .94$. Tests of the main effects found argument strength to be a significant predictor, $B = -1.03$ ($SE = .28$), $t(164) = -3.66$, $p < .001$. The beta weights showed that strong arguments were negatively associated with the number of negative thoughts listed; therefore, strong arguments were associated with less negative thoughts. However, both personal relevance, $B = -.10$ ($SE = .28$), $t(164) = -.36$, $p = .72$, and uncertainty orientation, $B = -.26$ ($SE = .20$), $t(164) = -1.35$, $p = .18$ were found to be nonsignificant.

Argument recall. Test of a three-way interaction between uncertainty orientation x strength of argument x personal relevance was found to be nonsignificant for the number of arguments recalled, $B = .08$ ($SE = .51$), $t(164) = .15$, $p = .88$. A separate regression analysis the for the two-way interactions did not reveal any significant predictors (argument strength x personal relevance: $B = .01$ ($SE = .36$), $t(164) = .03$, $p = .98$; argument strength x uncertainty orientation: $B = .15$ ($SE = .25$), $t(164) = .57$, $p = .57$; personal relevance x uncertainty orientation: $B = -.33$ ($SE = .25$), $t(164) = -1.32$, $p = .19$). Similar results were found for the regression analysis of the main effects (argument strength: $B = -.30$ ($SE = .18$), $t(164) = -1.69$, $p = .09$; personal relevance: $\beta = -.17$ ($SE = .18$), $t(164) = -.96$, $p = .34$; uncertainty orientation: $B = -.20$ ($SE = .12$), $t(164) = -1.63$, $p = .11$).

CHAPTER 4

DISCUSSION

General Overview

Stroop performance. Overall, the main hypothesis of the experiment was partially supported. Among those who read the strong arguments, UOs had significantly worse Stroop performance (i.e., higher Stoop interference scores) than the COs under high personal relevance, whereas the COs showed marginally worse Stroop performance than the UOs under low personal relevance. In other words, the personal relevance effect only emerged significantly for the COs as the UOs had similar interference scores under high and low personal relevance. One anomalous result was the significant difference for the Stroop performances in the weak arguments conditions for UOs and COs. Contrary to expectations that UOs and COs should not have impaired Stroop performances after reading the weak arguments, UOs who read the weak arguments actually performed worse on the task as personal relevance decreased and the COs performed worse as personal relevance increased.

For uncertainty-oriented individuals who read the strong arguments, their performance on the Stroop task worsened as personal relevance increased. This finding is consistent with previous research that UOs tend to pay more attention and engage in more active counterarguing when the information is highly relevant to them. This fits with the idea that the self-regulatory goal of attaining clarity is activated for the UOs when not resolving the uncertainty has high costs to them. As a result, they will pursue the means (systematic processing) which will allow them to attain clarity, and resolve the uncertainty. Because the proposed policy would affect them personally, UOs were more motivated to think about the arguments made and gave more careful consideration to the sound arguments. Since performance between high and low personal relevance was not

significantly different, this may also be an indication that UOs have the tendency to be more curious and will pay attention to the situation even if it would not be diagnostic of the self.

The opposite pattern was shown for certainty-oriented individuals. That is, COs who read the strong arguments performed significantly worse on the Stroop task as they decreased in personal relevance, supporting the notion that they will not systematically process information when the situation may be diagnostic of the self, but they will when it is relatively certain and nondiagnostic. Although the patterns of these results were consistent with the predictions, the significant results for weak arguments were unexpected. That is, instead of processing weak arguments equally across personal relevance conditions, UOs appeared to pay significantly more attention to the weak arguments under low personal relevance than under high personal relevance. Because the weak arguments were quite unrealistic and counterattitudinal, it is possible that UOs were quicker at dismissing them when they were motivated to process the information carefully. Similar arguments can be made for the COs, who might be quick to dismiss these arguments when they were motivated to process counterattitudinal arguments. Therefore, impaired performance under high personal relevance and weak conditions may not be a reflection of active counterarguing. Rather, it may suggest a dismissive bias permitted by the weak arguments.

Recent research by Tormala, Rucker, and Seger (2008) on how confidence and doubt may influence people's information processing styles may lend support for why weak arguments would be dismissed more quickly under various conditions. While past research on confidence and doubt on information processing had found that people would

only think carefully when there was doubt or uncertainty in the situation, these authors showed in their research that confidence or certainty in the situation may also increase thinking under certain conditions. Specifically, it was shown that when participants were primed with confidence or certainty related terms *and* saw persuasive messages that were framed with confidence (i.e., "The Board of Trustees' message has been prepared with the specific intention of removing students' doubts and restoring confidence in the educational process at IU", p. 144), the persuasive messages were processed more carefully (i.e., strong arguments rated as more persuasive than weak arguments) because confidence-matching was induced. In contrast, participants who were primed with doubtful or uncertainty related terms only processed the information more carefully when the messages were presented without the confidence frame. If these findings were applied to the current results, one could argue that UOs and COs thought more carefully (i.e., thought about strong arguments more carefully and dismissed weak arguments more quickly) because they were in their respective "match" states (i.e., relative uncertainty for UOs and relative certainty for COs)

Regardless of the anomalous findings with the weak arguments conditions, the patterns described above lend support to previous findings that UOs and COs have the tendency to process information differently under different conditions. Not only did they differ in *how* they process information, they also differed in *when* they processed information. Furthermore, these different styles of information processing were associated with certain cognitive costs, such as depletion in one's executive attentional functioning. These findings shed light on some of the mechanisms underlying the linkage between one's uncertainty orientation and the different means used to pursue the

goal of attaining or maintaining clarity. It also provided evidence that resolving uncertainty may be an active self-regulatory process which requires the usage of cognitive resources.

Additional Measures

Attitudes and effectiveness. The results for the attitudes and effectiveness measures in the study (average attitude ratings, average effectiveness ratings) were not as clear as the participants' performances on the Stroop task. Specifically, the three-way interactions between uncertainty orientation, strength of argument, and personal relevance were not supported for these measures.

One could argue that the absence of three-way interactions for these measures is inconsistent with previous findings in uncertainty orientation and attitude change (presence of systematic or heuristic processing). Therefore, performance on the Stroop task alone may not be enough evidence for active self-regulation. However, as predicted above, the absence of three-way interactions for these additional measures should not be entirely surprising since these measures were administered following the Stroop task. Therefore, the administration of this cognitive task may have diluted the results of these subsequent measures.

Analyses with the lower-order predictors revealed a number of interesting findings. For the attitude ratings, the results showed a significant two-way interaction between personal relevance x uncertainty orientation. For those who were in the low personal relevance condition, their attitudes toward the policy change became more positive as they increased in uncertainty orientation. For those who were in the high personal relevance condition, their attitudes toward the policy change became more

negative as they increased in uncertainty orientation. This interaction may indicate that UOs were more prepared to counterargue under high personal relevance and COs were more prepared to counterargue under low personal relevance. The significant main effects found (strength of argument for attitude and effectiveness ratings) also reconfirmed that the participants were able to judge the strong arguments as more positive and effective.

Positive thought index. Similar to the attitudes ratings, personal relevance x uncertainty orientation interaction was found to be a significant predictor for positive thought index. Specifically, among those who were in the low personal relevance condition, the proportion of positive thoughts increased as uncertainty orientation increased. Additionally, argument strength and uncertainty orientation were also significant main predictors for this measure. That is, those who read the strong arguments listed more positive thoughts and individuals who were higher on uncertainty orientation also had higher positive index.

Argument recall, total thoughts, and negative thoughts listed. No significant effects were found for argument recall, and total thoughts listed. Because these measures were cognitively-based (i.e., memory based, required recall), the Stroop task could have had an impact on these results. For negative thoughts listed, argument strength was a significant predictor so participants listed less negative thoughts after they had read the strong arguments. Another interesting result worth pointing out is the significant positive correlation between arguments recalled and the number of negative thoughts listed. It is possible that the bad arguments were more salient and were therefore retained and recalled better by the participants.

Implications of the Present Study

The current results expanded previous research by Wheeler et al. (2007). Specifically, although it also showed that counterarguing and resisting persuasion requires cognitive resources, it additionally showed that consideration of individual difference variables, such as uncertainty orientation, is important. The results also replicated and expanded findings by Richeson and Shelton (2003). That is, not only did it find that active self-regulation leads to ego-depletion, it also showed that depletion (as result of active self-regulation) could apply to areas beyond prejudice suppression.

Another important implication of the current research is that it lends further support that motivation and cognition interact with each other in a synergistic manner. Importantly, cognitive resources were found to be the driving forces behind the connections between the self-regulatory goals of attaining and maintaining clarity and the different information processing styles that were linked to these goals.

Limitations

Low internal consistency of the resultant uncertainty orientation score may be one of the key criticisms of the current research. In his chapter which addressed some of the weaknesses of projective measures, Smith (1992) mentioned that the "amount of time spent imagining achievement in simulated storytelling was highly correlated with individual differences in input strength of achievement motive." (p. 131). Therefore, a motive score is not the sole determinant of the motive's strength so low internal consistency among the items does not necessarily reflect low validity. Additionally, low test-retest reliability of projective measures may be an indication that individuals simply

try to write different stories under different conditions. Hence, projective measures of motives could still be sound predictors of actual behaviours (Spangler, 1992).

Future Directions and Concluding Remarks

The findings from the current research add new insight into the theoretical model of uncertainty-orientation. That is, it offers evidence that the mechanisms underlying the linkage between one's uncertainty orientation and style of information processing are cognitively-based. The findings also add to the current literature on the relations between self-regulation, ego-depletion and information processing.

The results from some of the secondary measures provided evidence that the presence of the uncertain situation may have elicited certain emotions within participants. As Higgins (2000) mentioned in his discussion on regulatory fit, a fit between one's regulatory focus and the reward structures in the environment will influence the ways in which people process information. Regulatory fit, the author noted, increases people's engagement in the situation because people are in a state of "feeling right" (p. 210). This state of engagement should also be associated with various positive emotional states so emotions could be closely aligned to people's cognitions. Recent research by Sorrentino, Nezlek, Yasunaga, Kouhara, Otsubo, and Shuper (2008) also supports this notion. In a series of cross-cultural research, the authors found that a match or mismatch between an individual's uncertainty orientations and his or her culture's uncertainty orientation could have important emotional implications. Specifically, a match between an individual's uncertainty orientation and the uncertainty orientation of his or her culture will result in more active and positive emotions while those who are consistently in a mismatch state will experience more passive and negative emotions.

While the emotions that were activated during this study may have played a role in people's information processing styles, it is not clear whether the same emotions persisted in the face of ego-depletion. Without emotion measures, it is difficult to judge whether the participants felt the same emotions throughout the self-regulatory process. Equally important, it is difficult to determine whether the intensities of these emotions altered in any way throughout the experiment. For these reasons, one suggestion for future research is to measure participants' emotions before and after the administration of the executive attentional task in order to gain insight into the emotions that were felt during the experiment and whether these emotions may have played roles in people's thinking patterns.

Another suggestion for future directions is to further explore the roles cognitive resources play in the relation between uncertainty orientation and information processing by examining ego-depletion from another perspective. Specifically, instead of measuring ego-depletion as a dependent variable, future research could investigate how uncertainty orientation could influence information processing when ego-depletion is treated as an independent variable. That is, after the assessment of their uncertainty orientation, the participants would be asked to complete an ego-depletion task prior to reading the counterattitudinal messages. The amount of attitude change would then be measured following the presentation of the arguments. It is predicted that those in the high ego-depletion condition should show greater attitude change, though this would be evident at different levels of personal relevance for UOs and COs.

An additional idea for future study is to explore whether forming implementation intentions would allow one to overcome the impairing effects from counterarguing. As

Webb and Sheeran (2002) found in their research, participants who formed implementation intentions ahead of the ego-depleting task allowed them to overcome the effects from ego-depletion. Although systematic processing and counterarguing could be beneficial (especially when the situation is relevant to the self), the current research showed that this type of information processing may not be entirely optimal if an individual had to complete a subsequent task that required working memory capacity. Therefore, it would be interesting to investigate whether it is possible for an individual to actively alter his or her thinking tendencies (thus overcoming the impact of ego-depletion) when performance on a subsequent task bears greater importance.

Finally, due to the involvement of cognitive resources, the present study postulates that the link between uncertainty orientation and information processing operates on a controlled level. However, as Fitzsimons and Bargh (2004) mentioned in their auto-motive model of self-regulation, all steps of goal pursuit should operate on nonconscious and automatic levels; therefore, there are still questions to whether the initial *activation* of the present self-regulatory goals (i.e., attaining and maintaining clarity) occur on a conscious or nonconscious level. To answer these questions, future research could adopt methodologies commonly used in the nonconscious goal pursuit literature (e.g., priming people with of goal-related associations; Chartrand, Dalton, & Cheng, 2008) as a way to investigate whether activating these goals nonconciously and consciously would result in the same goal-directed behaviours. This idea for future research could expand current understanding of the underlying mechanisms and processes related to the regulation of uncertainty.

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Appendix A: Information Sheet and Consent From

Letter of Information

Everyday Attitudes and Actions

In today's session, we will be examining your attitudes and feelings toward an article you will be reading. Additionally, you will be asked to complete a number of questionnaires and tasks on the computer. There are five parts in today's session. In Part 1, you will be asked to write a number of short stories and complete two brief questionnaires. In Part 2, you will be reading an article. In part 3, you will complete a task on the computer. In part 4, you will be asked to complete a number of questionnaires based on the article you read. In part 5, you will complete another short task followed by a few short questionnaires. Participation will take approximately 60 minutes. All information that you provide will be kept strictly confidential, as only code numbers will be attached to your input, and will be used only for research purposes. You will receive one research credit for your participation in today's session. At the end of the session, you will receive a sheet describing the nature of the study and any questions you may have will be answered. Your participation in this research is voluntary. You can leave at any time or refuse to answer any question, without loss of promised research credit. If you have any questions or concerns about this study, please contact XXXXX in the Department of Psychology at XXX-XXXX ext. XXXXX, SSC Room XXXX, or at XXXXX.

Consent Form

Everyday Attitudes and Actions

I have read the Letter of Information, have had the nature of the study explained to me and I agree to participate. All questions have been answered to my satisfaction.

Name (print):_____ Student #:_____

Signature:_____ Date:_____

Researcher (print):_____

Researcher Signature:_____ Date:_____

Appendix B: Debriefing Form

Debriefing Sheet

Everyday Attitudes and Actions

Dear Research Participant:

Thank you for participating in our study. We would like to take a few moments to inform you of some of the information from our study and to explain our hypotheses.

In the first part of this study, you filled out a series of questionnaires, including one that asked you to write stories. The stories you filled out (a projective measure similar to a task called the Thematic Apperception Test, or TAT) actually assessed your motives, such as need to resolve uncertainty and need for achievement (Sorrentino & Short, 1986). According to the theory of uncertainty orientation, Uncertainty-oriented individuals (UOs) and Certainty-oriented individuals (COs) prefer to resolve uncertainty in different ways. This is often reflected in the ways they process counterattitudinal information. These stories and questionnaires, in addition to helping us determine your uncertainty orientation, also helps us determine your achievement motivation. In other words, it is used to identify those who are success-oriented (SOs) and those who are failure threatened (FTs). Past research has demonstrated that during achievement-related situations, SOs will feel pride in their successes while FTs will feel anxiety about the task they are performing. This leads SOs to outperform FTs in such situations.

Studies have shown that active self-regulation (e.g. trying not to appear prejudice) may impair people's performances on a subsequent task (e.g. Stroop task) which requires working memory capacity (Richeson and Shelton, 2003). Since processing counterattitudinal messages could be considered a form of active self-regulation (Wheeler, Brinol & Hermann, 2007), the purpose of the first four parts of this study was to examine whether systematic processing of the counterattitudinal article would impair people's performances on the Stroop task. It is predicted that individuals' performances on the Stroop task will be impaired after they have processed counterattitudinal messages systematically. Therefore, the more carefully someone processed the arguments, the more he/she should be ego-depleted. Because UOs tend to process information more carefully under situations of high personal relevance, the more uncertainty-oriented someone is, the more he/she should have systematically processed the message. We did not reveal the real purpose of the task during the experiment because we needed an unbiased measure of working memory impairment. Thus, we had to make up a story about comprehensive exams and present some students with strong arguments and others with weak arguments, to see if they would make a difference. We also needed to make up a topic like comprehensive exams in order to make it sound important to some, but not to others. Some people in the study were told that the implementation of the comprehensive exams would take place in 1-2 years (high personal relevance) while others were told that it would take place in 5-10 years (low personal relevance). We chose the topic of comprehensive exams because it was relevant to students and it allowed us to alter the level of personal relevance.

The final task you performed (math task) was part of another study that examines uncertainty orientation. We believe that one's uncertainty orientation will interact with the situation and one's achievement motivations leading to specific levels of performance. Specifically, we predict that if one's uncertainty orientation is not matched with the situational uncertainty, then this will not lead to any performance differences as a function of achievement motivation. However, if one's uncertainty orientation is matched with the situational uncertainty then this will lead those who are motivated to succeed to outperform those who are motivated to avoid failure. The math task you completed is an indication of your performance, or how well you did, in that situation. Specifically, how well you can memorize the numbers in order to come up with the correct response. It is an indication of how motivated people are to perform the task. The marks you achieve in Psych 020 is another indication of performance. Without this then, we would not be able to examine performance within the classroom situation and compare it with the performance within this experimental setting. Moreover, everyone received the same math task and therefore the rates of success indicated for the math task were only used as a manipulation of the level of situational uncertainty. In other words, if you were told that your chances of success were 20% or 80%, then you were led to believe that you were certain of failure or certain of success on the task, respectively. If you were told that you had a 50% chance of success on the task, then you were led to believe that you were uncertainty of success or failure. The questions about how important you perceived introductory psychology were used as an index of perceived instrumentality or importance. This measure will be used to see if perceiving this course as more important will accentuate the performance differences discussed above. Finally, the second part of the present study (the math task) is currently being completed in Japan as well. We will be examining if cultures that have a different way of handling uncertainty will affect the pattern results.

Again, thank you for your participation. We ask, however, that you do not discuss the hypotheses of this study with anyone who might be a participant in the study before April 2008, when the experiment will end. If you have any questions regarding this study, please contact XXXXX at XXX-XXXX ext. XXXXX, or office XXXX SSC. If you have questions about you rights as a research subject, you should contact the Director of the Office of Research Ethics at XXXXX or XXX-XXXX.

Suggested Readings:

Richeson, J. A., & Shelton, J. N. (2003). When prejudice does not pay: Effects of interracial contact on executive function. *Psychological Science, 14*, 287-290.

Sorrentino, R. M. & Roney, C. J. (2000). *The uncertain mind: individual differences in facing the unknown.* Philadelphia: Psychology Press.

Wheeler, S. C., Brinol, P. & Hermann, A. D. (2007). Resistance to persuasion as self-regulation: Ego-depletion and its effects on attitude change processes. *Journal of Experimental Social Psychology, 43,* 150-156.

Appendix C: *n*Uncertainty Measure

SENTENCE INTERPRETATIONS

Instructions

You are going to see a series of sentences, and your task is to tell a story that is suggested to you by each sentence. Try to imagine what is going on. Then tell what the situation is, what led up to the situation, what the people are thinking and feeling, and what they will do.

In other words, write as complete a story as you can--a story with plot and characters.

You will have twenty (20) seconds to look at a sentence and then 4 minutes to write your story about it. Write your first impressions and work rapidly. I will keep time and tell you when it is time to finish your story and to get ready for the next sentence.

There are no right or wrong stories or kinds of stories, so you may feel free to write whatever story is suggested to you when you look at a sentence. Spelling, punctuation, and grammar are not important. What is important is to write out as fully and as quickly as possible the story that comes into your mind as you imagine what is going on.

1. TWO PEOPLE ARE WORKING IN A LABORATORY ON A PIECE OF EQUIPMENT.

1. What is happening? Who is (are) the person(s)

2. What has led up to this situation? That is, what has happened in the past?

3. What is being thought? What is wanted? By whom?

4. What will happen? What will be done?

2. A PERSON IS SITTING, WONDERING ABOUT WHAT MAY HAPPEN.

1. What is happening? Who is (are) the person(s)

2. What has led up to this situation? That is, what has happened in the past?

3. What is being thought? What is wanted? By whom?

4. What will happen? What will be done?

3. A PERSON IS SEATED AT A DESK WITH A COMPUTER AND BOOKS.

1. What is happening? Who is (are) the person(s)

2. What has led up to this situation? That is, what has happened in the past?

3. What is being thought? What is wanted? By whom?

4. What will happen? What will be done?

4. A PERSON IS THINKING: AN IMAGE OF A CROSSROADS IS IN THE PERSON'S MIND.

1. What is happening? Who is (are) the person(s)

2. What has led up to this situation? That is, what has happened in the past?

3. What is being thought? What is wanted? By whom?

4. What will happen? What will be done?

Appendix D: Authoritarianism Scale

PERSONAL OPINION QUESTIONNAIRE 1

The following is a study of what the general public thinks and feels about a number of important social and personal questions. The best answer to each statement below is your personal opinion. We have tried to cover many different and opposing points of view; you may find yourself agreeing strongly with some of the statements, disagreeing just as strongly with others, and perhaps uncertain about others; whether you agree or disagree with any statement, you can be sure that many people feel the same as you do.

Select 1, 2, 3 or 4, 5, 6, depending on how you feel in each case.

1: I AGREE A LITTLE	4: I DISAGREE A LITTLE
2: I AGREE SOMEWHAT	5: I DISAGREE SOMEWHAT
3: I AGREE VERY MUCH	6: I DISAGREE VERY MUCH

1. There is hardly anything lower than a person who does not feel a great love, gratitude and respect for his or her parents.

   1 2 3 4 5 6

2. An insult to our honour should always be punished.

   1 2 3 4 5 6

3. Books and movies ought not to deal so much with the unpleasant and seamy side of life; they ought to concentrate on themes that are entertaining or uplifting.

   1 2 3 4 5 6

4. What the youth needs most is strict discipline, rugged determination, and the will to work and fight for family and country.

   1 2 3 4 5 6

5. No sane, normal, decent person could ever think of hurting a close friend or relative.

1 2 3 4 5 6

6. Young people sometimes get rebellious ideas, but as they grow up they ought to get over them and settle down.

1 2 3 4 5 6

7. The findings of science may someday show that many of our most cherished beliefs are wrong.

1 2 3 4 5 6

8. People ought to pay more attention to new ideas, even if they seem to go against the Canadian way of life.

1 2 3 4 5 6

9. If people would talk less and work more everybody would be better off.

1 2 3 4 5 6

10. A person who has bad manners, habits, and breeding can hardly expect to get along with decent people.

1 2 3 4 5 6

11. Insults to our honour are not always important enough to bother about.

1 2 3 4 5 6

12. It is right for people to raise questions about even the most sacred matters.

1 2 3 4 5 6

13. Obedience and respect for authority are the most important virtues children should learn.

1 2 3 4 5 6

14. There is no reason to punish any crime with the death penalty.

1 2 3 4 5 6

15. Anyone who would interpret the Bible literally just doesn't know much about geology, biology, or history.

1 2 3 4 5 6

16. In this scientific age the need for a religious belief is more important than ever before.

1 2 3 4 5 6

17. When they are little, kids sometimes think about doing harm to one or both of their parents.

1 2 3 4 5 6

18. It is possible that creatures on other planets have founded a better society than ours.

1 2 3 4 5 6

19. The prisoners in our corrective institutions, regardless of the nature of their crimes should be treated humanely.

1 2 3 4 5 6

20. The sooner people realize that we must get rid of all traitors in the government, the better off we'll be.

1 2 3 4 5 6

21. Some of the greatest atrocities in history have been committed in the name of religion and morality.

1 2 3 4 5 6

Appendix E: Persuasive Message Articles

In the following order:

High Personal Relevance-Strong Arguments

High Personal Relevance-Weak Arguments

Low Personal Relevance-Strong Arguments

Low Personal Relevance-Weak Arguments

High Personal Relevance x Strong Arguments

Proposed Changes to the University Graduation Policy

by M. G. Richardson

The University Committee of Academic Policy has recently proposed several academic policy changes to be instituted at the University of Western Ontario in one to two years from now. The Committee functions as a primary advisory source to the President of Western on changes in academic policy that should be instituted at the University. One of the changes proposed to take place within one to two years is the imposition of a requirement that seniors take a comprehensive exam in their area of major prior to graduation. The exam would be a test of what the student had learned after completing the major, and a certain score would be required if the student was to graduate.

A thorough review of the academic policies at universities across North America has shown that this change in policy will have a number of important benefits for students at Western. This article will outline four points in support of the implementation of comprehensive exams.

First, the National Scholarship Achievement Board recently revealed the results of a five-year study conducted on the effectiveness of comprehensive exams at McGill University. The results of the study showed that since the comprehensive exam has been introduced at McGill, the grade point average of undergraduates has increased by 31%. At comparable schools without the exams, grades increased by only 8% over the same period. The prospect of a comprehensive exam clearly seems to be effective in challenging students to work harder and faculty to teach more effectively. It is likely that the benefits observed at McGill could also be observed at other universities that adopt the exam policy.

Second, one aspect of the comprehensive exam requirement that students at the schools where it has been tried seem to like is that all regular final examinations for seniors are typically eliminated. This elimination of final exams in all courses for seniors allows them to better integrate and think about the material in their major areas just prior to graduation rather than "wasting" a lot of time cramming to pass tests in courses in which they are really not interested. Students presently have to take too many courses in subjects that are irrelevant to their career plans. The comprehensive exam places somewhat greater emphasis on the student's major and allows greater concentration on the material that the student feels is most relevant.

Third, graduate schools and law and medical schools are beginning to show clear and significant preferences for students who received their undergraduate degrees from institutions with comprehensive exams. As the Dean of the Harvard Business School said: "Although Harvard has not and will not discriminate on the basis of race or sex, we do show a strong preference for applicants who have demonstrated their expertise in an area of study by passing a comprehensive exam at the undergraduate level". Admissions officers of law, medical, and graduate schools have also endorsed the comprehensive exam policy and indicated that students at schools without the exams would be at a significant disadvantage in the very near future. Thus, the institution of comprehensive exams will be an aid to those who seek admission to graduate and professional schools after graduation.

Finally, data from Queens University, where comprehensive exams were recently instituted, indicate that the average starting salary of graduates increased over $4000 over the two-year period in which the exams were begun. At comparable universities without comprehensive exams, salaries increased only $850 over the same period. As Saul Siegel, a vice-president of IBM put it in *Business Week* recently, "We are much quicker to offer the large salaries and executive positions to these kids because by passing their area exam, they have proven to us that they have expertise in their area rather than being people who may or may not be dependable and reliable". Another benefit is that universities with the exams attract larger and more well-known corporations to campus to recruit students for their open positions. The end result is that students at schools with comprehensive exams have a 55% greater chance of landing a good job than students at schools without the exams.

High Personal Relevance x Weak Arguments

Proposed Changes to the University Graduation Policy

by M. G. Richardson

The University Committee of Academic Policy has recently proposed several academic policy changes to be instituted at the University of Western Ontario in one to two years from now. The Committee functions as a primary advisory source to the President of Western on changes in academic policy that should be instituted at the University. One of the changes proposed to take place within one to two years is the imposition of a requirement that seniors take a comprehensive exam in their area of major prior to graduation. The exam would be a test of what the student had learned after completing the major, and a certain score would be required if the student was to graduate.

A thorough review of the academic policies at universities across North America has shown that this change in policy will have a number of important benefits for students at Western. This article will outline four points in support of the implementation of comprehensive exams.

First, the National Scholarship Achievement Board recently revealed the results of a study they conducted on the effectiveness of comprehensive exams at McGill University. One major finding was that student anxiety had increased by 31%. At comparable schools without the exam, anxiety increased by only 8%. The Board reasoned that anxiety over the exams, or fear of failure, would motivate students to study more in their courses while they were taking them. It is likely that this increase in anxiety observed at McGill would also be observed and be of benefit at other universities that adopt the exam policy.

Second, graduate students have always had to take a comprehensive exam in their major area before receiving their degrees, and it is only fair that undergraduates should have to take them also. As the Dean of the Harvard Business School said, "If a comprehensive exam is considered necessary to demonstrate competence for a masters or doctoral degree, by what logic is it excluded as a requirement for the bachelors degree? What administrators don't realize is that this is discrimination just like discrimination against persons of a certain gender. There would be a lot of trouble if universities required only men to take comprehensive exams but not women. Yet universities all over the country are getting away with the same thing by requiring graduate students but not undergraduates to take the exams". Thus, the institution of comprehensive exams could be as useful for undergraduates as they have been for graduate students.

Third, an interesting and important feature of the comprehensive exam requirement is that if the exams were instituted nationwide, students across the country could use the exam to compare their achievements with those of students at other schools. Data from the Educational Testing Service confirm that students are eager to compare their grades in a particular course with those of other students. Just imagine how exciting it would be for students in the Eastern provinces to be able to compare their scores with those of students at the University of British Columbia, for example. This possibility for comparison would provide an incentive for students to study and achieve as high a score as possible so they would not be embarrassed when comparing scores with their friends.

Finally, data from Queens University show that some students favor the senior comprehensive exam policy. For example, one faculty member asked his son to survey his fellow students at the school since it recently instituted the exams. Over 55% of his son's friends agreed that in principle, the exams would be beneficial. Of course, they didn't all agree but the fact that most did proves that undergraduates want the exams. As Saul Siegel, a student whose father is a vice-president of IBM wrote in the school newspaper: "The history of the exams can be traced to the ancient Greeks. If comprehensive exams were to be instituted, we could feel pleasure at following traditions begun by Plato and Aristotle. Even if there were no other benefits of the exams, it would be worth it just to follow tradition".

Low Personal Relevance x Strong Arguments

Proposed Changes to the University Graduation Policy

by M. G. Richardson

The University Committee of Academic Policy has recently proposed several academic policy changes to be instituted at the University of Western Ontario in five to ten years from now. The Committee functions as a primary advisory source to the President of Western on changes in academic policy that should be instituted at the University. One of the changes proposed to take place within five to ten years is the imposition of a requirement that seniors take a comprehensive exam in their area of major prior to graduation. The exam would be a test of what the student had learned after completing the major, and a certain score would be required if the student was to graduate.

A thorough review of the academic policies at universities across North America has shown that this change in policy will have a number of important benefits for students at Western. This article will outline four points in support of the implementation of comprehensive exams.

First, the National Scholarship Achievement Board recently revealed the results of a five-year study conducted on the effectiveness of comprehensive exams at McGill University. The results of the study showed that since the comprehensive exam has been introduced at McGill, the grade point average of undergraduates has increased by 31%. At comparable schools without the exams, grades increased by only 8% over the same period. The prospect of a comprehensive exam clearly seems to be effective in challenging students to work harder and faculty to teach more effectively. It is likely that the benefits observed at McGill could also be observed at other universities that adopt the exam policy.

Second, one aspect of the comprehensive exam requirement that students at the schools where it has been tried seem to like is that all regular final examinations for seniors are typically eliminated. This elimination of final exams in all courses for seniors allows them to better integrate and think about the material in their major areas just prior to graduation rather than "wasting" a lot of time cramming to pass tests in courses in which they are really not interested. Students presently have to take too many courses in subjects that are irrelevant to their career plans. The comprehensive exam places somewhat greater emphasis on the student's major and allows greater concentration on the material that the student feels is most relevant.

Third, graduate schools and law and medical schools are beginning to show clear and significant preferences for students who received their undergraduate degrees from institutions with comprehensive exams. As the Dean of the Harvard Business School said: "Although Harvard has not and will not discriminate on the basis of race or sex, we do show a strong preference for applicants who have demonstrated their expertise in an area of study by passing a comprehensive exam at the undergraduate level". Admissions officers of law, medical, and graduate schools have also endorsed the comprehensive exam policy and indicated that students at schools without the exams would be at a significant disadvantage in the very near future. Thus, the institution of comprehensive exams will be an aid to those who seek admission to graduate and professional schools after graduation.

Finally, data from Queens University, where comprehensive exams were recently instituted, indicate that the average starting salary of graduates increased over $4000 over the two-year period in which the exams were begun. At comparable universities without comprehensive exams, salaries increased only $850 over the same period. As Saul Siegel, a vice-president of IBM put it in *Business Week* recently, "We are much quicker to offer the large salaries and executive positions to these kids because by passing their area exam, they have proven to us that they have expertise in their area rather than being people who may or may not be dependable and reliable". Another benefit is that universities with the exams attract larger and more well-known corporations to campus to recruit students for their open positions. The end result is that students at schools with comprehensive exams have a 55% greater chance of landing a good job than students at schools without the exams.

Low Personal Relevance x Weak Arguments

Proposed Changes to the University Graduation Policy

by M. G. Richardson

The University Committee of Academic Policy has recently proposed several academic policy changes to be instituted at the University of Western Ontario in five to ten years from now. The Committee functions as a primary advisory source to the President of Western on changes in academic policy that should be instituted at the University. One of the changes proposed to take place within five to ten years is the imposition of a requirement that seniors take a comprehensive exam in their area of major prior to graduation. The exam would be a test of what the student had learned after completing the major, and a certain score would be required if the student was to graduate.

A thorough review of the academic policies at universities across North America has shown that this change in policy will have a number of important benefits for students at Western. This article will outline four points in support of the implementation of comprehensive exams.

First, the National Scholarship Achievement Board recently revealed the results of a study they conducted on the effectiveness of comprehensive exams at McGill University. One major finding was that student anxiety had increased by 31%. At comparable schools without the exam, anxiety increased by only 8%. The Board reasoned that anxiety over the exams, or fear of failure, would motivate students to study more in their courses while they were taking them. It is likely that this increase in anxiety observed at McGill would also be observed and be of benefit at other universities that adopt the exam policy.

Second, graduate students have always had to take a comprehensive exam in their major area before receiving their degrees, and it is only fair that undergraduates should have to take them also. As the Dean of the Harvard Business School said, "If a comprehensive exam is considered necessary to demonstrate competence for a masters or doctoral degree, by what logic is it excluded as a requirement for the bachelors degree? What administrators don't realize is that this is discrimination just like discrimination against persons of a certain gender. There would be a lot of trouble if universities required only men to take comprehensive exams but not women. Yet universities all over the country are getting away with the same thing by requiring graduate students but not undergraduates to take the exams". Thus, the institution of comprehensive exams could be as useful for undergraduates as they have been for graduate students.

Third, an interesting and important feature of the comprehensive exam requirement is that if the exams were instituted nationwide, students across the country could use the exam to compare their achievements with those of students at other schools. Data from the Educational Testing Service confirm that students are eager to compare their grades in a particular course with those of other students. Just imagine how exciting it would be for students in the Eastern provinces to be able to compare their scores with those of students at the University of British Columbia, for example. This possibility for comparison would provide an incentive for students to study and achieve as high a score as possible so they would not be embarrassed when comparing scores with their friends.

Finally, data from Queens University show that some students favor the senior comprehensive exam policy. For example, one faculty member asked his son to survey his fellow students at the school since it recently instituted the exams. Over 55% of his son's friends agreed that in principle, the exams would be beneficial. Of course, they didn't all agree but the fact that most did proves that undergraduates want the exams. As Saul Siegel, a student whose father is a vice-president of IBM wrote in the school newspaper: "The history of the exams can be traced to the ancient Greeks. If comprehensive exams were to be instituted, we could feel pleasure at following traditions begun by Plato and Aristotle. Even if there were no other benefits of the exams, it would be worth it just to follow tradition".

Appendix F: Attitude Measure

To evaluate the effectiveness of the article presented, it is important to first assess your attitude toward the issue, because your opinion about the issue raised by the article may influence your evaluation.

On the following scales, please rate the proposal of "making comprehensive exams an additional requirement to graduation" *(Select the number that corresponds with your answer)*

1	2	3	4	5	6	7	8	9
BAD								GOOD
1	2	3	4	5	6	7	8	9
FOOLISH								WISE
1	2	3	4	5	6	7	8	9
NEGATIVE								POSITIVE
1	2	3	4	5	6	7	8	9
BENEFICIAL								HARMFUL
1	2	3	4	5	6	7	8	9
EFFECTIVE								INEFFECTIVE
1	2	3	4	5	6	7	8	9
CONVINCING								UNCONVINCING

Appendix G: Effectiveness Measure

Please answer the following questions regarding the article you received.

(Select the number that corresponds with your answer)

1. How informative was the article?

1	2	3	4	5	6	7	8	9
NOT AT ALL								VERY

2. How understandable was the article?

1	2	3	4	5	6	7	8	9
NOT AT ALL								VERY

3. How interesting was the article?

1	2	3	4	5	6	7	8	9
NOT AT ALL								VERY

4. How direct (i.e., to the point) was the article?

1	2	3	4	5	6	7	8	9
NOT AT ALL								VERY

5. How creative was the article?

1	2	3	4	5	6	7	8	9
NOT AT ALL								VERY

6. In general, how effective was the article?

1	2	3	4	5	6	7	8	9
NOT AT ALL								VERY

Appendix H: Thought Listing Form

Please list all the thoughts that you had about the comprehensive exam proposal while reading the article. Please type each thought on its own line. Next to each line where you listed a thought, indicate whether your thought was positive (+), negative (-), or neutral (0) toward the proposal.

Appendix I: Argument Recall

Write down as many arguments as you can remember that were described in the newspaper article that discussed the comprehensive exam proposal. Please type each argument on its own line.

Appendix J: Demographic Questionnaire

Please answer the following questions:

1) Ethnicity (select one)

a) Asian; Asian-Canadian (please specify: _____)

b) Black; African-Canadian

c) Native-Canadian

d) White; Caucasian

e) Other (please specify: _____)

2) Place of Birth: _____

3) Language(s) spoken at home: _____

4) Age: _____

5) Sex: _____

Appendix K: Manipulation and Suspicion Check

1. When was the proposed changed to the academic policy set to take place?

2. What do you think the hypothesis (purpose) of the study was?

3. Can you think of any alternative hypotheses? If so, please specify.

4. Were you at all suspicious of anything in the experiment? If so, please specify.

Appendix L: Multiple Regression Coefficient Tables

Table L-1

Regression Coefficients for Average Attitude Ratings as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO), and Their Two-Way and Three-Way Interactions (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	5.14	.29		18.02	.00
ARG	1.84	.39	.45	4.74	.00
PR	-.57	.39	-.14	-1.49	.14
UO	.83	.32	.30	2.60	.01
ARG X PR	.44	.54	.10	.82	.41
ARG X UO	-.03	.51	-.01	-.06	.95
PR X UO	-.96	.49	-.22	-1.94	.05
ARG X PR X UO	-.57	.76	-.09	-.75	.45

Table L-2

Regression Coefficients for Average Attitude Ratings as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO), and Their Two-Way Interactions (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	5.11	.28		18.11	.00
ARG	1.85	.39	.46	4.78	.00
PR	-.55	.38	-.14	-1.43	.16
UO	.93	.29	.33	3.22	.00
ARG X PR	.46	.54	.10	.85	.40
ARG X UO	-.29	.38	-.07	-.77	.45
PR X UO	-1.19	.38	-.28	-3.18	.00

Table L-3

Regression Coefficients for Average Attitude Ratings as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO) (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	5.08	.24		20.99	.00
ARG	2.04	.28	.50	7.39	.00
PR	-.32	.27	-.08	-1.16	.25
UO	.31	.19	.11	1.63	.11

Table L-4

Regression Coefficients for Average Effectiveness Ratings as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO), and Their Two-Way and Three-Way Interactions (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	5.96	.21		28.54	.00
ARG	.64	.29	.24	2.26	.03
PR	-.40	.28	-.15	-1.42	.16
UO	.44	.23	.24	1.90	.06
ARG X PR	.49	.40	.16	1.24	.22
ARG X UO	.08	.38	.03	.20	.84
PR X UO	-.27	.36	-.09	-.74	.46
ARG X PR X UO	-.20	.56	-.05	-.36	.72

Table L-5

Regression Coefficients for Average Effectiveness Ratings as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO), and Their Two-Way Interactions (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	5.95	.21		28.82	.00
ARG	.65	.28	.24	2.28	.02
PR	-.39	.28	-.15	-1.40	.16
UO	.48	.21	.26	2.26	.03
ARG X PR	.50	.40	.16	1.25	.21
ARG X UO	-.01	.28	-.01	-.05	.96
PR X UO	-.35	.28	-.12	-1.27	.21

Table L-6

Regression Coefficients for Average Effectiveness Ratings as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO) (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	5.84	.17		33.86	.00
ARG	.89	.20	.33	4.51	.00
PR	-.14	.20	-.05	-.71	.48
UO	.34	.14	.18	2.49	.01

Table L-7

Regression Coefficients for Total Thoughts Listed as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO), and Their Two-Way and Three-Way Interactions (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	4.66	.39		11.85	.00
ARG	.05	.54	.01	.10	.92
PR	-.74	.53	-.16	-1.38	.17
UO	.15	.44	.05	.34	.73
ARG X PR	.80	.75	.15	1.07	.29
ARG X UO	.38	.71	.07	.54	.59
PR X UO	-.45	.68	-.09	-.66	.51
ARG X PR X UO	.32	1.06	.04	.30	.77

Table L-8

Regression Coefficients Total Thoughts Listed as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO), and Their Two-Way Interactions (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	4.68	.39		12.03	.00
ARG	.05	.54	.01	.09	.93
PR	-.75	.53	-.16	-1.42	.16
UO	.10	.40	.03	.24	.81
ARG X PR	.79	.74	.14	1.06	.29
ARG X UO	.52	.52	.10	1.00	.32
PR X UO	-.32	.52	-.06	-.61	.54

Table L-9

Regression Coefficients for Total Thoughts Listed as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO) (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	4.45	.32		13.73	.00
ARG	.43	.37	.09	1.16	.25
PR	-.32	.37	-.07	-.87	.38
UO	.20	.26	.06	.77	.44

Table L-10

Regression Coefficients for Positive Thought Index as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO), and Their Two-Way and Three-Way Interactions

(n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	.35	.04		8.30	.00
ARG	.21	.06	.37	3.65	.00
PR	-.06	.06	-.10	-.98	.33
UO	.08	.05	.20	.86	.39
ARG X PR	.07	.08	.10	.86	.39
ARG X UO	.13	.08	.20	1.67	.10
PR X UO	-.10	.07	-.17	-1.37	.17
ARG X PR X UO	-.07	.11	-.08	-.64	.52

Table L-11

Regression Coefficients for Positive Thought Index as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO), and Their Two-Way Interactions (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	.35	.04		8.31	.00
ARG	.21	.06	.37	3.68	.00
PR	-.05	.06	-.09	-.93	.36
UO	.09	.04	.23	2.12	.04
ARG X PR	.07	.08	.11	.89	.38
ARG X UO	.09	.06	.15	1.68	.10
PR X UO	-.13	.06	-.22	-2.34	.02

Table L-12

Regression Coefficients for Positive Thought Index as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO) (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	.33	.04		9.27	.00
ARG	.24	.04	.42	5.94	.00
PR	-.01	.04	-.02	-.26	.80
UO	.08	.03	.19	2.68	.01

Table L-13

Regression Coefficients for Negative Thoughts Listed as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO), and Their Two-Way and Three-Way Interactions (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	3.07	.30		10.13	.00
ARG	-1.20	.41	-.32	-2.90	.00
PR	-.26	.41	-.07	-.62	.53
UO	-.23	.34	-.09	-.68	.50
ARG X PR	.36	.57	.08	.62	.54
ARG X UO	-.15	.55	-.04	-.27	.78
PR X UO	-.17	.52	-.04	-.33	.74
ARG X PR X UO	.49	.81	.08	.61	.55

Table L-14

Regression Coefficients for Negative Thoughts Listed as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO), and Their Two-Way Interactions (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	3.09	.30		10.32	.00
ARG	-1.21	.41	-.32	-2.93	.00
PR	-.28	.41	-.07	-.68	.50
UO	-.32	.31	-.12	-1.03	.30
ARG X PR	.34	.57	.08	.60	.55
ARG X UO	.07	.40	.02	.18	.86
PR X UO	.03	.40	.01	.08	.94

Table L-15

Regression Coefficients for Negative Thoughts Listed as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO) (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	2.99	.25		12.08	.00
ARG	-1.03	.28	-.28	-3.66	.00
PR	-.10	.28	-.03	-.36	.72
UO	-.26	.20	-.10	-1.35	.18

Table L-16

Regression Coefficients for Arguments Recalled as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO), and Their Two-Way and Three-Way Interactions (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	2.79	.19		14.63	.00
ARG	-.29	.26	-.12	-1.10	.27
PR	-.18	.26	-.08	-.70	.48
UO	-.10	.21	-.07	-.49	.63
ARG X PR	.01	.36	.01	.04	.97
ARG X UO	.11	.34	.04	.33	.75
PR X UO	-.36	.33	-.15	-1.10	.27
ARG X PR X UO	.08	.51	.02	.15	.88

Table L-17

Regression Coefficients for Arguments Recalled as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO), and Their Two-Way Interactions (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	2.79	.19		14.83	.00
ARG	-.29	.26	-.12	-1.11	.27
PR	-.19	.26	-.08	-.72	.47
UO	-.12	.19	-.07	-.60	.55
ARG X PR	.01	.36	.00	.03	.98
ARG X UO	.15	.25	.06	.57	.57
PR X UO	-.33	.25	-.13	-1.32	.19

Table L-18

Regression Coefficients for Arguments Recalled as Predicted by Argument Strength (ARG), Personal Relevance (PR), Uncertainty Orientation (UO) (n = 172)

	B	*SE B*	*β*	*t*	*p*
Intercept	2.80	.16		17.88	.00
ARG	-.30	.18	-.13	-1.69	.09
PR	-.17	.18	-.07	-.96	.34
UO	-.20	.12	-.13	-1.63	.11

Appendix M: Ethics Approval Form

Department of Psychology The University of Western Ontario
Room 7418 Social Sciences Centre,
London, ON, Canada N6A 5C1
Telephone: (519) 661-2067Fax: (519) 661-3961

Use of Human Subjects - Ethics Approval Notice

Review Number	**07 09 04**	**Approval Date**	**07 09 04**
Principal Investigator	**Dick Sorrentino/Andrew Szeto**	**End Date**	**08 04 30**
Protocol Title	**Everyday attitudes and actions**		
Sponsor	**n/a**		

This is to notify you that The University of Western Ontario Department of Psychology Research Ethics Board (PREB) has granted expedited ethics approval to the above named research study on the date noted above.

The PREB is a sub-REB of The University of Western Ontario's Research Ethics Board for Non-Medical Research Involving Human Subjects (NMREB) which is organized and operates according to the Tri-Council Policy Statement and the applicable laws and regulations of Ontario. (See Office of Research Ethics web site: http://www.uwo.ca/research/ethics/)

This approval shall remain valid until end date noted above assuming timely and acceptable responses to the University's periodic requests for surveillance and monitoring information.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the PREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of research assistant, telephone number etc). Subjects must receive a copy of the information/consent documentation.

Investigators must promptly also report to the PREB:
a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to the PREB for approval.

Members of the PREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the PREB.

[redacted]

Clive Seligman Ph.D.

Chair, Psychology Expedited Research Ethics Board (PREB)

The other members of the 2007-2008 PREB are: Mike Atkinson, David Dozois, Bill Fisher and Matthew Maxwell-Smith

CC: UWO Office of Research Ethics

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