

The Pennsylvania State University

The Graduate School

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**REVISITING THE POWER OF POSITIVE EMOTIONS: THE EFFECTS OF
AWE ON INFORMATION PROCESSING AND INFORMATION RECALL**

A Thesis in

Media Studies

by

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Submitted in Partial Fulfillment

of the Requirements

for the Degree of

Master of Arts

May 2019

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ABSTRACT

Emotion has been widely studied in the recent few decades. The power of emotions lies in the possibility that they can influence one's cognition and behavior. Findings from previous studies on emotion suggest that positive and negative emotions have different effects on cognition. Specifically, positive-valenced emotions are thought to inhibit message elaboration and facilitate heuristic processing while negative-valenced emotions have the opposite effects. Yet, recent studies on self-transcendent emotion awe revealed that there are questions remained to be answered regarding the nature and the effects of discrete emotions. The purpose of this study is to examine the psychological effects of awe on information processing and information recall, which in turn influence the persuasion process. The current study found that happiness and awe had opposite psychological effects. Consistent with hypotheses, awe was found to facilitate information processing and information recall while happiness showed inhibiting effects. Specifically, when participants felt higher level of awe, they tend to generate more thoughts and those thoughts were more in-depth and relevant. They also reported being more easily to allocate their cognitive resources. What's more, when feeling awe, participants showed more message recall. On the other hand, a higher level of happiness was associated with less relevant thoughts, more difficulty of allocating cognitive resources, and lower message recall. Implications of these findings for both happiness and awe are discussed.

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Acknowledgements

Throughout my graduate experience and my thesis research, I've received a great deal of support from my committee, my college, my fellow students, my friends, my boyfriend, and my family. I would first like to express my appreciation to my committee members, Dr. Mike Schmierbach, Dr. Mary Beth Oliver, and Dr. Jessica Myrick, for their patience and insightful feedbacks in overcoming obstacles I have been facing during my thesis research.

I would like to thank the faculty, staff members, and my cohort members in the College of Communications for their cooperation and friendship. It has been an honor to work with you.

My sincere thanks also goes to my friends: Xuan Zheng, Hang Li, and Bin Guo. You are always there when I needed help. I sincerely wish you all the best in the future.

I would like to express my special thanks to my boyfriend Yifei Wu. You are my inspiration and motivation. I enjoyed the past five years with you and I'm ready to spend my rest of life with you.

Finally, I dedicate this thesis to my family: my mom, dad, and two cats Taro and Mochi. Thanks to my mom and dad for being so loving, respectful, open-minded, and supportive. Thanks for encouraging me to make my own decision and chase my dream. Thanks to my cats, especially Mochi, for being such a great emotional companion. You always make me laugh when I'm down.

Chapter 1

Introduction and Literature Review

Awe is a potent emotion, which is often elicited when one is exposed to vastness and induced with a need for accommodation (Keltner & Haidt, 2003). A panoramic view of a beautiful garden, the moment of a volcanic eruption, or simply a masterpiece of artwork can all trigger this feeling. Although philosophers and religious people have acknowledged the power of awe for a very long time, social scientists still haven't examined this emotion in depth. This is partially because, unlike other emotions that have been studied extensively (e.g., happiness, anger, disgust), the elicitors of awe vary too much and the function of it remained unclear (Lazarus, 1991; Keltner & Haidt, 2003). A group of researchers, led by psychologist Dacher Keltner, began a series of studies in the early 2000s, and have identified elicitors and outcomes of awe (Keltner & Haidt, 2003; Shiota, Keltner, & Mossman, 2007). Based on an evolutionary and functional perspective, Keltner and Haidt (2003) propose a conceptualization of awe, which considers perceived vastness and need for accommodation as the two key features. Vastness refers to something that is perceived as much larger or powerful than oneself, which is not limited to physical size and can also refer to things like social impact (e.g. a huge historical event), or explanatory power (e.g. a mathematical equation). Need for accommodation means that the experience challenges one's accustomed frame of reference, therefore requiring one to update his or her existing knowledge structure to accommodate it (Keltner & Haidt, 2003).

Despite the recent development of awe theory in academia, awe elicitors can be often found in entertainment content. For example, the escape scene from *Shawshank's Redemption* where Andy took his shirt off and raised arms to the sky in a thunderstorm, or the scene of Pandora forest at night from *Avatar*, where the teeny-tiny glowing plants gradually landed on Jake, all carried us away with awe. In addition to movies, music also has the power to evoke awe, and is able to transport listeners to spiritual places (Pilgrim, Norris, & Hackathorn, 2017). Why are these media content so different and impressive? In line with Keltner and Haidt's (2003) conceptualization of awe, this is because this sort of content "breaks" our mental reality and encourages us to comprehend what just happened, which causes the content to be more impressive and memorable.

Acknowledging the power of awe, advertisers frequently incorporate awe elicitors in advertisements to impress and persuade consumers. For example, car commercials often feature sublime sunsets, legendary mountains, or beautiful waterfalls to map the experience consumers will get if they purchase the car. Although inducing awe is considered as a powerful boost for the effectiveness of persuasion (McEleny, 2017), the data from the advertising industry are largely descriptive and lack theoretical support. Plenty of questions can be raised regarding the mechanism of how induction of awe affects the effectiveness of a persuasive message. For example, does awe influence the way consumers process the information in the ads? Does it make people believe the argument more easily? Or does it simply make the ads more impressive without changing one's attitude toward the product or the brand? To answer these questions, the current study will particularly examine how awe influences one's information processing strategy and memory, thus affecting their acceptance of a persuasive message.

The Elaboration Likelihood Model (ELM) of persuasion explains attitude change through changes in cognition (Petty & Cacioppo, 1981). The ELM proposes that there are two routes through which people process information: central route (i.e., one is motivated and able to process information) and peripheral route (i.e., one lacks motivation or ability to process information). Previous studies on emotion and persuasion suggested that emotion influences which information processing route one's going to choose, thus affecting the effectiveness of persuasion (Cacioppo, Petty, Chuan, & Rodriguez, 1986; Eagly & Chaiken, 1993; Schwarz, Bless, & Bohner, 1991). That is, positive emotion inhibits message elaboration, thus facilitating peripheral-route processing, while negative emotion increases the likelihood of message elaboration, thus encouraging central-route processing (e.g. Schwarz & Strack, 1990; Bohner, Crow, & Schwarz, 1992). This is because positive emotions are thought to inhibit one's capacity and/or motivation to systematically process information while negative emotions are thought to do the opposite. Another way by which emotion may influence persuasion is through information encoding into memory. Scholars suggest that positive emotions typically reduce the accuracy of information encoded while negative emotions facilitate more accurate information encoding (Yegiyan & Yonelinas, 2011). This is because, based on the assumption that emotions are adaptive mechanisms that help the organism to survive, positive emotions help people to acquire information faster while negative emotions help people to be focused on the present threat or problem.

Although awe is often categorized as a positive emotion (Shiota et al. 2007; Shiota et al. 2011; Van Cappellen and Saroglou, 2012; Campos et al., 2013), scholars have documented effects of awe that are opposite to what are assumed about positive

emotions (e.g. Griskevicius, Shiota, & Neufeld, 2010). As discussed earlier, experiencing awe evokes a need for accommodation, therefore it's reasonable to speculate that awe contributes to knowledge acquisition. In line with this notion, awe should reduce one's reliance on existing schemas (e.g. stereotypes) when processing new information. Also, awe should encourage people to adopt a more systematic, bottom-up processing strategy. Following this theoretical rationale, awe clearly complicates the traditional theoretical framework of emotion and persuasion, which is based mostly on the hedonic attribute of an emotion. In addition, so far only one study documented the effects of awe on memory (Danvers & Shiota, 2017), and the results were not consistent. Further examination is needed.

Although scholars have attempted to define and test awe, there's still little known about this emotion and how and why it's different from other positive emotions. The current study will specifically adopt a classic ELM model, and examine how awe influences one's processing strategy and memory, which in turn influences persuasion. In the following sections, I will first discuss the definition of emotion, the definition and function of awe, the ELM model, and the theoretical linkage between emotion and persuasion.

Literature Review

In the past two decades, the link between emotions and various domains of cognition, including information processing, attention, memory, and reasoning, has been drawing increasingly more attention from researchers (e.g. Lench, Flores, & Bench, 2011). Much research has categorized emotions as either positive (e.g. happiness or joy)

or negative (e.g. sadness or anger) and found a distinctive pattern in their effects on cognitive processes (e.g. Fredrickson & Branigan, 2005; Bless, Bohner, Schwarz, & Strack, 1990). Yet, the results of recent studies on awe contradicted previous predictions (Griskevicius, Shiota, & Neufeld, 2010), suggesting other potential mediators in the relationship between emotion and cognition. Moreover, it's still unclear how awe, which generally is considered as a positive emotion, is different from other positive emotions to begin with. I now turn to the literature on emotion and cognition to specify what is known about the effects of emotion on persuasion, and how awe fits in the theoretical framework.

What's Emotion

Emotion is a complex psychological process that consists of “neural circuits, response systems, and a feeling state/process that motivates and organizes cognition and action” (Izard, 2010, p.367). However, within the field of social science, there's still not a consensus on the nature of emotion. The controversy in the emotion research concerns whether emotion should be conceptualized in terms of discrete categories (e.g., fear, happiness, anger), or dimensions (e.g., valence or arousal).

The discrete view of emotion proposes that there is a limited list of primary and distinctive emotions defined as specific automatic and correlated psychological, physiological, and behavioral response tendencies that address different evolutionary needs (Ekman, 1994; Izard, 2007). For example, fear heightens one's alertness and keeps the body and brain focused to serve the purpose of survival. The core of the discrete view is that each emotion has a specific corresponding subjective experience (e.g., affect),

behavior (e.g., facial expression), and physiology (e.g., blood pressure), which are triggered by a set of specific antecedents (Ekman, 1992; Ekman, 1999). In other words, each emotion has its own elicitor and response, which functions as a whole. A large body of studies suggest that discrete emotions do exist, and we should carefully examine them individually. For instance, Vytal and Hamann (2010) reviewed 30 studies regarding emotion and brain activity and found consistent and discriminable regional brain activation corresponding to each basic emotion. Also, Ekman and Wallace (1971) showed a group of people in New Guinea, who had nearly no exposure to Westerners or Western culture, pictures of Westerners portraying six different emotions. New Guinea people were able to associate the same facial expression with the same emotion, which suggests that emotions are universal and biologically inherent.

Discrete emotion theorists have linked specific action tendencies with specific functions of each emotion (Frijda, 1986; Lazarus, 1991; Levenson, 1994). Negative emotions (e.g. fear, anger, disgust) are thought to narrow people's thought-action repertoires. For example, fear is associated with the urge to escape and disgust is associated with the urge to expel, because these actions, from an evolutionary perspective, work best in surviving the life-or-death situation. On the other hand, positive emotions (e.g. joy, pride, happiness) are believed to broaden the thought-action repertoires, which allow people to enhance personal and social resources (Fredrickson, 2001). In summary, the discrete view of emotion emphasizes the adaptive functions of each emotion.

Another group of theorists argue for the dimensional view of emotion, which puts more emphasis on empirical criteria rather than theoretical criteria in understanding the

nature of emotions. According to this perspective, emotion is considered to be the result of a person's appraisal of his/her environment along several psychological dimensions (Barrett, Lindquist, Bliss-Moreau, Duncan, Gendron, Mize, & Brennan, 2007; Russell, 1980). In contrast to the discrete view of emotion that considers each emotion to have a corresponding neural system, the dimensional view proposes that all emotions are cognitive interpretations of neural sensations resulting from the two independent neurophysiological systems (Posner, Russell, & Peterson, 2005). Therefore, there's no need to study emotions discretely. Rather, emotions can be accurately represented by a combination of dimensions.

The most recognized dimensions are valence (pleasantness), arousal (emotion strength/intensity), and motivational direction (approach or withdrawal) (for a review of dimensions of emotion, see Smith & Ellsworth, 1985). Fear, for instance, is considered as the combination of negative valence, high arousal, and withdrawal. Support for this perspective has been found that each dimension (i.e. valence, arousal, and motivation) covaries with measurable states of the organism. For example, amygdala activity is associated with high-arousal emotions regardless of valence (e.g. Garavan, Pendergrass, Ross, Stein, & Risinger, 2001; Hamann & Mao, 2002), and the prefrontal cortex is mainly affected by valence (e.g. Anders, Lotze, Erb, Grodd, & Girbaumer, 2004). In sum, core to this view is that it focuses more on how people experience the emotion rather than conceptual distinctions among different emotions.

Although dimensions provide scholars a useful and parsimonious way to study the global features of emotion and relationship between each dimension, they can't fully explain each discrete emotion (for a review of two approaches, see Harmon-Jones,

Harmon-Jones, & Summerell, 2017). For example, many scholars agreed that all negative (i.e., valence) emotions are associated with the tendency to avoid or withdraw, but anger is documented to be linked with approach motivation (Harmon-Jones, Harmon-Jones, & Price, 2013). Also while the dimensional view of emotion often assumes that arousal, valence of subjective feelings, or motivation mediate the cognitive or behavioral effects, the discrete view of emotion considers psychological (e.g., activation of certain cognitive mechanism), physiological, and behavioral changes as a whole to pursue a particular goal.

The study reported in this paper reflects the discrete view of emotion. Over the past few decades, few negative discrete emotions have been thoroughly tested and theorized, such as fear (Boster & Mongeau, 1984; Mongeau, 1998) and sadness (Nabi, 1998; Bohner, Chaiken, & Hunyadi, 1994). In line with the discrete model of emotion, a few studies have shown that emotions with same negative valence can have opposite effects on cognitive processes (e.g., DeSteno, Petty, Wegener, & Rucker, 2000; Lerner & Keltner, 2001). Despite the growth of negative discrete emotion theories, positive discrete emotions only gained scholars' interests recently. With an increasing number of scholars devoted to studying positive emotions, several studies have documented differences among positive emotions (e.g., Shiota, Nuefeld, Danvers, Osborne, Sng, & Yee, 2014). Although most of the positive emotions, such as happiness or joy, are very similar in terms of their effects on cognition, one specific emotion, awe, stands out in that its impact on cognition almost mimics the influence of a negative emotion (Griskevicius et al., 2010).

Awe

Awe is a complex but not uncommon emotion, especially in religious and artistic experience, yet it has been studied little compared with other emotions. Incorporating religious, social, philosophical, and psychological perspectives, Keltner and Haidt (2003) proposed an evolutionary conceptualization of awe. They suggested that awe is the reaction when a person experiences something vast that requires him/her to accommodate the new experience. This perspective originated largely from the discrete view of emotion by Ekman (1992) and Lazarus (1991). Ekman (1992) identified awe as a basic emotion that combines wonder and fear. Similarly, Lazarus (1991) agreed that awe is a multifaceted emotion.

The prototypical model of awe proposed by Keltner and Haidt (2003) views awe as an emotion with stable, central appraisal dimensions and “fuzzy” boundaries. Following this conceptualization, the two central dimensions are vastness and need for accommodation. The vastness appraisal dimension addresses perception. Vastness implies that the stimulus is larger than the self and challenges one’s accustomed frame of reference (Shiota, Keltner, & Mossman, 2007). Vastness not only refers to physical size, but can also be conveyed by social impact (e.g., a huge historical event), explanatory power (e.g. a mathematical equation), fame (e.g., a celebrity), or sensory detail (e.g., a complex art work) (Keltner & Haidt, 2003; Shiota, Thrash, Danvers, & Dombrowski, 2017). The need for accommodation dimension refers to altering one’s mental frames to accommodate new information. That is, because the stimulus may be hard to understand or explain using one’s existing schemas, it requires cognitive accommodation — a

process where the person updates his/her schemas in order to make sense of the world (Keltner & Haidt, 2003).

To validate Keltner and Haidt's (2003) argument that the perceived vastness and need for accommodation are the two central appraisal dimensions, Shiota, Keltner, and Mossman (2007) conducted an experiment to examine the features of elicitors of awe. Based on their data, awe elicitors are considered to be information-rich and much more significant compared to oneself (e.g., a view of nature or work of art), which supports the perceived vastness dimension. In addition, the awe-evoking natural events and the social events that are reported by participants often trigger changes in participants' self-concepts. For instance, a panoramic nature view makes participants think they are insignificant. A major social event such as marriage makes participants think of life transition. The results of this study are consistent with the need for accommodation dimension, which suggests that events that challenge one's frame of reference are able to evoke awe (Keltner & Haidt, 2003).

In addition to the two major appraisal dimensions, Keltner and Haidt (2003) identified five themes that account for variations regarding the awe experience. The first theme is threat. When threat or danger is a component of the awe elicitor, a feeling of fear may be added to awe. Under this circumstance, awe is more close to the feeling of sublimity. Some examples of threat are scenes of natural disaster (e.g., thunderstorm) or charismatic leaders (e.g., Hitler). The second theme is beauty. Beautiful and aesthetically appealing stimuli can add aesthetic pleasure to the awe experience. An example of this type of elicitor is architectural wonder such as the Roman Colosseum. The third theme is ability. That is, when people perceive someone to have exceptional ability or talent,

admiration often comes along with feeling of awe. The fourth theme is virtue. In addition to ability, the theme of virtue is related to exceptional morality, which turns awe closer to elevation. The fifth theme is supernatural causality. This theme is usually associated with a religious or spiritual factor (e.g., “seeing” God or a ghost), which adds a “flavor” of uncanny to the awe experience. In sum, these five themes are thought to be variations of awe (Lench, 2018), but if the elicitor failed to meet the two major appraisal requirements (i.e., vastness and need for accommodation) then this experience shouldn’t be considered as awe any longer. For instance, elevation is very similar to awe, but since the elevation experience usually doesn’t involve perceived vastness, these experiences shouldn’t be labelled as awe.

Keltner and Haidt’s (2003) view of awe builds, at least partially, on the functional and evolutionary view of emotion, which emphasizes the relationship between emotion and adaptive behaviors. As discussed earlier, the functional view of emotion considers emotion as a set of psychological, physiological and behavioral responses that help the organism achieve a particular goal (see Keltner & Gross, 1999 for a review). To fully explain the nature and function of awe, Keltner and Haidt (2003) first distinguished the current “elaborated” forms awe and “primordial” awe. Primordial awe is thought to be a set of relatively hard-wired and pre-cultural responses resulting from changes in the central and peripheral nervous systems. Primordial awe refers to the emotional responses to displays of power (e.g., higher-status person). It is thought to solidify social hierarchies, facilitate subordinate-leader relationship, and reinforce social identities, which are important to human survival (Keltner & Haidt, 2003; Keltner & Haidt, 1999). The fear or negative component is more relevant to this primordial awe. Following this

reasoning, awe responses should reflect the action tendency of a subordinate, including heightened attention, imitation, and passivity. Elaborated awe concerns additional culture-specific factors such as norms, language, or practices that culture and society add to primordial awe (Keltner & Haidt, 2003). For example, the responses to primordial awe that are elicited by social dominance can be generalized to other stimuli, such as music or spiritual figures, as long as these stimuli have the characteristic of power.

Partially contrary to Keltner and Haidt's (2003) view of the function of awe, Lench (2018) offered an alternative viewpoint. He argued that awe is originally a response to natural scenery, which was later generalized to social entities. Natural disasters, such as a thunderstorm or tornado, create life threatening situations, which encourages people to find a safe shelter. Scholars in the field of geography suggested that an ideal environment that makes people feel secure, which meets the basic psychological needs, should provide people the ability to see without being seen (see Appleton, 1996, for a review). A location like this is usually on higher land and provides people with a sweeping view of the surroundings, which matches some elicitors of awe. This is a rather new perspective that doesn't address the need for accommodation appraisal dimension of awe at all, nor does it explain the social influences of awe. Yet, it still offers some valuable insights into the nature and function of awe. The "social-first" view seems to be more predominant while the "nature-first" view raises new questions (Lench, 2018). So far, few scholars have attempted to theorize the foundation of awe. Further investigations are needed.

Awe and the Media

In the entertainment and marketing industry, awe has been widely used in commercials and movies. One example of successful awe elicitation in media is Volvo's truck commercial *The Epic Split* (Volvo trucks, 2013). In the commercial, the action star Jean-Claude Van Damme performed an epic split between two reversing Volvo trucks. Behind him was a beautiful sunrise on an airstrip. The commercial was a huge success and, according to the brand's survey, nearly half of the truck owners or buyers who watched the commercial indicated that they are more likely to choose Volvo in the future (Grinder, 2014). The commercial was first released online in 2013, and it now has near 90 million views on YouTube (Volvo trucks, 2013). Other examples of awe elicitation include scenes in movies like *Avatar*, *Gladiator*, and *Lord of the Rings*.

The power of media lies in the possibility that objects being seen on media can be experienced as actual objects through the use of sensory elements (e.g., image or sound). While natural events such as a volcanic eruption or tornado are rarely experienced in our daily lives, media are capable of creating an experience that is close enough to a real one. Many studies have confirmed that films, TV programs, online videos, and still pictures can impact one's emotional experience (Lang, 1996; Bradley, Cuthbert, & Lang, 1996; Gross & Levenson, 1995).

In academia, scholars have been trying to find reliable and ethically acceptable means of eliciting emotion in the laboratory. As discussed earlier, because media are capable of displaying stimuli as if they are experienced firsthand, they are thought to be appropriate tools for inducing emotions in laboratory for research purposes. Most of the emotion-induction procedures are implemented through various forms of media (see

Coan & Allen, 2007, for a review). Among other media, films or video clips have been used to elicit a diversity of predictable emotions. Specifically, they are able to activate multiple response systems associated with a specific emotion (e.g., psychological, physiological, and behavioral) as well as doing little harm even when the intensity of emotion is high (Rottenberg, Ray, & Gross, 2007). Among the few studies involving media and awe, three procedures were commonly used: 1) experiencing remembered or imagined examples (e.g., recall/imagine when you see a particular panoramic view) (Griskevicius et al., 2010; Shiota et al., 2007), 2) video clip (e.g., a video depicting mentally overwhelming objects such as waterfalls) (Rudd, Vohs, & Aaker, 2012; Danvers & Shiota, 2017), and 3) images (e.g., panoramic nature view) (Yee & Shiota, 2013).

Elaboration Likelihood Model

Before turning to the discussion of how emotion affects persuasion, it's necessary to first clarify how people process information. Introduced by Petty and Cacioppo (1981), the elaboration likelihood model of persuasion (ELM) describes changes of attitudes through cognition (Petty & Cacioppo, 1986). Prior to the introduction and development of ELM, though there were a vast number of studies of persuasion, conceptual deficiencies and ambiguities still existed. The ELM was the first persuasion model that provided a framework of the persuasion process that can be applied to various factors, including source, message, message receiver, and context.

The ELM model is dual-process model, which proposes that there are two routes by which people process information: the central route and the peripheral route (Petty & Cacioppo, 1986). These two routes reflect the two ends on the continuum representing

how likely cognitive effort is to be spent on processing information. Depending on people's motivation (e.g., personal relevance) and ability (e.g., message comprehensibility, distraction), one is more or less likely to go through one of the two routes. When elaboration likelihood is high (i.e., high motivation and ability to process the message), persuasion is most likely to occur through the central route. Under the central route, people are expected to analyze the message in a systematic, "bottom up" style, and the persuasion results from one's careful and thoughtful consideration of the content of the persuasive message. On the other hand, when the elaboration likelihood is low (i.e., low motivation or ability to process message), persuasion is thought to happen through the peripheral route. Under the peripheral route, people are more likely to adopt a heuristic processing style, where they pay little attention to the content itself, but more attention to heuristic cues relevant to persuasion, such as source credibility or attractiveness.

The ELM model identified multiple variables that affect the persuasiveness of a message (Petty & Cacioppo, 1986). According to the ELM model, argument strength or quality is the primary driver of persuasive message acceptance. Argument strength is conceptualized as the receiver's subjective perception (i.e., favorable or unfavorable) of the argument in a persuasive message (Petty & Cacioppo, 1986). Specifically, strong arguments are expected to evoke predominantly favorable cognitive and affective reactions to the message, while weak arguments are thought to yield more unfavorable or negative responses to the message. In terms of the content of the argument, Petty, Cacioppo and Heesacker (1981) defined a strong argument to be "logically sound, defensive and compelling," and a weak argument to be "open to skepticism and easy

refutation” (p. 435). Though little attention is given to argument strength in the development of ELM (Arieni & Lutz, 1987), it’s certainly a key factor driving the effectiveness of persuasion.

The ELM distinguishes two different processing routes and how they interact with argument strength in the persuasion process (Petty & Cacioppo, 1986). The central route (i.e., systematic processing) signals that people have motivation and ability to elaborate a persuasive message. Such processing style will enhance persuasion when the arguments in the message are strong, and reduces persuasion when the arguments in the message are weak. On the other hand, when message elaboration is low, people tend to go through the peripheral route (i.e., heuristic processing), which encourages them to pay more attention to heuristic cues rather than argument strength in the message, therefore argument strength usually exerts much less impact on persuasion (Eagly & Chaiken, 1993).

In addition to argument strength, which is an important determinant of persuasion when elaboration likelihood (i.e., motivation and ability) is high, the ELM model proposes that when elaboration likelihood is low, peripheral cues or heuristics in the message become a more important determinant (Petty & Cacioppo, 1986). It’s noteworthy that these peripheral cues are generally unrelated to the argument in the message, but they are likely to be used as the reference of the merits of the advocated position when the recipient has low motivation or ability to process the message. Persuasion studies using ELM have identified various types of peripheral cues and their effects on persuasion. For example, source credibility can trigger the impression that “experts are trustworthy so their arguments are right.” Also, the length of the message may be considered as a length cue, which implies strength (Sundar, 2007). Empirical

studies have found that source credibility or expertise (Chaiken & Maheswaran, 1994), celebrity status (Petty, Cacioppo, & Schuman, 1983), source valence (Maheswaran, Mackie, & Chaiken, 1992), interactivity (Sundar & Kim, 2005) and animation (Zorn, Olaru, Veheim, Zhao, & Murphy, 2012) significantly influence the effectiveness of a persuasive message.

Emotion and Persuasion Based on ELM

Emotion is considered as an effective tool for advertisers. Various types of companies have used emotions to sell their products, ranging from tangible goods (e.g., dish soap, snacks), to intangible services (e.g., mobile service, life insurance). Emotional advertising not only makes the product and the brand more memorable, it also encourages consumers to make impulsive purchase decisions without rationalizing them (see Bagozzi, Gopinath, & Nyer, 1999, for a review). For example, if consumers believe that that sugary snacks and drinks and junk food are bad for health, then how should drink companies appeal to consumers? The answer is to shift the focus and induce emotions. Imagine two commercials for a diet soda. One portrays a man drinking a can of the diet soda, and the slogan goes: Same rich flavor, but half the calories. The other commercial features a man in the backyard, drinking a diet Coke, and a hot girl approaches him and asks if he can give her a diet soda. Then the slogan goes: (brand name), enjoy your life. The difference between two commercials is that the first one states the fact, which can be effective because it targets consumers' need for a low-calorie drink. The second one, on the other hand, relies heavily on induction of positive emotions (e.g., happiness, joy). Although rational ads are persuasive, emotional ads can be as persuasive and may also be

able to lead consumers to ignore the negative aspects of the product. For example, Pepsi ads often portray youth, good times, and fun. Similarly, Haagen-Dazs associates its ice cream with indulgence and luxury. These real-life examples all suggest that emotional responses may, at least partially, mediate acceptance of advertising.

Although emotion may be less well-established in academia compared with other factors of persuasion (e.g., message design), emotion is certainly a significant factor that influences message effectiveness, making it worth further examination. The original ELM model accounts for the effects of affect in the peripheral route (Petty & Cacioppo, 1986). Specifically, positive affect leads to a more favorable attitude toward the argument and vice versa. However, at that time the role of emotion on cognition and persuasion was not clearly identified (Morris, Woo, & Singh, 2005). Given more recent findings on the importance of emotion on information processing in persuasion (Eagly & Chaiken, 1993; Schwarz, Bless, & Bohner, 1991), emotion is clearly a much more complex factor compared with other types of cues such as color use, visuals, and source credibility. The ELM model proposes that the central route deals with message content while the peripheral route deals with cues (e.g., affect, attractiveness, number of arguments, etc.). This proposition seems to assume that emotional processing is not a part of the central route. However, as discussed earlier, emotion is a set of affective, physiological and behavioral responses, which can influence one's cognition and subsequent behavior (Izard, 2010). It's reasonable to believe that emotion is important to both central and peripheral routes. Therefore, it's probably more appropriate to treat emotion as a moderator rather than simply a cue in the message.

Previous studies have explored the mechanism by which affective states influence persuasion (e.g., Eagly & Chaiken, 1993; Schwarz, Bless, & Bohner, 1991). The majority of the findings suggest the processing strategy to be the main mechanism underlying the relationship between emotion and persuasion. In general, positive emotions are thought to facilitate peripheral route (heuristic) processing, and people in such affective states are more likely to make judgements based on simple cues or rules of thumb (Worth & Mackie, 1987; Bless et al., 1990). In line with the ELM model, which suggests that peripheral route processing should decrease the effects of argument strength on persuasion, Schwarz and Strack (1990) found that, compared with those in neutral or sad moods, subjects in a positive mood were less persuaded by strong arguments regarding an increase in student service fees at the subject's university. Subjects were also asked to recommend how much should the student service fee increase. Again, while sad subjects recommended a higher fee after they read a strong argument instead of a weak argument (\$59.29 vs. \$45.63), the difference in the recommended fee was smaller for happy subjects (\$53.98 vs. \$47.78), which, again, supports the notion that positive emotions reduce the effects of argument strength. Bohner, Crow, and Schwarz (1992) found similar results using behavior reaction as the dependent variable to examine the effects of emotion on the persuasiveness of an argument. They induced either happiness or neutral emotion to the subject, who was waiting to use a public phone, and then coded whether the subject would comply with a confederate's request to advance in line and use the phone first. The confederate either told the subjects that "she had to contact her boss, who would only be in his office for another few minutes" (i.e., strong argument) (p. 517) or made the request without any reason (i.e., weak argument). They found that subjects in

the neutral condition were strongly influenced by the argument strength. Specifically, 92% of subjects complied in the strong argument condition and only 39% of subjects complied in the weak argument condition. On the other hand, the difference between compliance rates in the strong and weak argument conditions was much smaller for happy subjects (75% and 50% compliance rate for the strong and weak argument condition respectively). This result suggests that happy subjects were less likely to spot differences in argument strength. In addition, other studies have found that positive emotions increase people's reliance on general knowledge structures (Bless, Schwarz, Clore, & Golisano, 1996), encourage people to make decisions faster based on less information (Isen & Means, 1983), and usually lead people to make biased judgements (Sinclair & Mark, 1992).

Scholars generally agree on two major accounts that explain the effects of positive emotions on information processing strategy: the capacity account and the motivation account. According to the capacity account, people have a limited capacity of information-processing resources (Bless et al., 1996). Assuming that affective states prime thoughts in memory, then being in positive affective states, compared with being in negative affective states, should limit one's cognitive processing capacity more because positive information is considered to be more interrelated and people tend to store more positive than negative information in memory (Mackie & Warth, 1989). In other words, because positive emotions take up a larger amount of processing capacity, they encourage people to adopt a more effortless processing strategy when exposed to a stimulus and asked to analyze new information.

The motivation account, based on the feeling-as-information approach (Schwarz, 1990) and mood management (Isen, 1987), proposes motivation as the mediator in the relationship between emotion and cognition. Emotions are believed to “exist for the sake of signaling states of the world that have to be responded to, or that no longer need response and action” (Frijda, 1988, p. 354). Following this rationale, positive emotions are perceived as a cue that indicates everything’s going well and there’s no need for extra cognitive effort to change the current situation (Schwarz, 1990). In positive mental states, people are “loosening” (Fiedler, 1988), thus simplified heuristics are preferred to effortful processing strategies. By contrast, negative emotions signal the presence of problem or threat in the environment, and should motivate people to use a bottom-up, systematic processing strategy (Bless et al., 1996; Forgas & Koch, 2013; Forgas, 2013). Support for this account is rather voluminous. For example, Bless et al. (1990) found that participants in the sad condition discriminated between strong and weak arguments while participants in the happy condition didn’t, suggesting that emotions have an effect on information processing strategy. These effects of positive and negative emotions have been consistently replicated, which provides evidence that positive emotions reduce systematic processing.

Awe and Information Processing

Although awe is considered as a positive emotion by participants in the United States (Shiota et al. 2007) and by psychology researchers (Shiota et al. 2011; Van Cappellen and Saroglou, 2012; Campos et al., 2013), the conceptualization discussed above suggests that the awe experience is more complicated. As a matter of fact, previous

studies have found that some effects of awe on cognition are more similar to the effects of negative emotions. Specifically, awe was found to reduce one's tolerance for weak arguments (Griskevicius et al., 2010), to reduce one's reliance on stereotypes when participants were asked to rate personalities of people in fictional profiles (Yee & Shiota, 2013), and to decrease the reliance on scripts when asked to recall whether a certain piece of information was presented (Danvers & Shiota, 2017).

As noted earlier, the discrete model of emotion proposes that emotions are biologically fixed and inherited for the sake of species growth and continuation (see Levenson, 1999, for a discussion). Based on this notion, it's reasonable to argue that awe contributes to knowledge acquisition. According to Piaget's theory of cognition, when things happening don't make sense, people have two ways to adapt: assimilation and accommodation (Piaget, 1970). Assimilation refers to the process where people use their existing schemas to interpret the new information, whereas accommodation refers to the process where people create new schema or change their existing schema in order to cope with the new information that doesn't fit. Based on Keltner and Haidt's (2003) conceptualization, awe elicitors facilitate the accommodation process. If the conceptualization of awe is sound, there's reason to believe that awe should reduce one's reliance on existing schemas, stereotypes, heuristics, and other existing knowledge structures when processing new information. In addition, awe should facilitate people to adopt a more systematic processing strategy, which is opposite to the effects of positive emotions.

Another potential explanation for this opposing effect is the consideration of awe as a self-transcendent emotion. The term self-transcendent refers to "a sense of reduced

self-awareness and increased connectedness with others” (Van Cappellen, 2017, p.254). Regardless of its valence, emotions in general tend to turn one’s attention inward, while self-transcendent emotions (e.g., awe, elevation) shift one’s attention outwards (Haidt & Keltner, 2004). Scholars have examined the elicitors of self-transcendent emotions and have found that they tend to be irrelevant to one’s own interest or goal pursuit (Keltner & Haidt, 2003; Schindler, Zink, Windrich, & Menninghaus, 2013). For example, awe can be triggered by watching a flight takeoff, which does no benefit to the person. Although each self-transcendent emotion differs from the others in various ways (e.g., antecedents and consequences), they all challenge people’s expectations of the worlds. They have the ability to shift people’s attention outwards to something greater than the self, which needs to be understood (e.g., volcanic eruption) (Shiota, Keltner, & Mossman, 2007; Van Cappellen, 2017). Based on the discussion of two potential explanations of how awe affects cognition, there’s reason to believe that unlike what’s previously been found about positive emotions increasing the reliance on internal knowledge, awe should reduce one’s reliance on schema and facilitate a more systematic analysis of the stimulus.

Emotion and Recall

In addition to information processing, emotion also influences information recall, which in turn may influence the effects of persuasion (Chattopadhyay & Alba, 1988; Lynch, Marmorstein, & Weigold, 1988). As noted earlier, emotions can be considered as adaptive mechanisms that help the organism to survive (Lench, 2018); therefore, it’s possible that positive and negative emotions have different effects on memory. Following this rationale, positive emotions can help the organism to maintain its current status while

exploring the environment (Yegiyani & Yonelinas, 2011). In line with the functional view of emotions, positive emotions sacrifice accurate recall of details to help an organism gather more information faster. On the other hand, negative emotions would mobilize an organism to fight or avoid the aversive stimulus (Yegiyani & Yonelinas, 2011). Therefore, negative emotions should increase the accuracy of information gathering, especially for central details. Studies that documented this effect usually induce a certain emotion, then show participants a story or a message, and ask them to complete a subsequent recall task. For example, Bless, Clore, Schwarz, Golisano, Rabe, & Wölk (1996) found that when the participants were asked if a certain detail was presented in the story, happy participants were more likely to say yes if the detail matched their scripts even when this detail wasn't presented. On the other hand, sad participants remembered the details in the story better regardless of whether they matched the scripts. This study implies that, first, people who experience positive emotions encode information less accurately, and second, they are more likely to rely on scripts.

If the earlier discussion of the function of awe as well as the effects of awe on information processing was correct, then one should expect awe to increase the accuracy of recall of details. Until now, only one study has examined this effect. In Danvers and Shiota's (2017) study, they found that, in general, participants in an awe condition identified more script-inconsistent as well as script-irrelevant details. However, the effects of awe on recall of script-irrelevant details were not consistent across three studies. They argued that it may be due to the different methods used in evoking awe. Specifically, a novel awe stimulus may be better at increasing the recall of script-irrelevant details. Despite their argumentation, I think that these results didn't contradict

the conceptualization of awe. Rather, they may have found a boundary condition. It may be the case that awe only promotes recall of central details, which in Danvers and Siota's (2017) study was details that were relevant to the script (i.e., script-consistent and script-inconsistent details), but not peripheral details (i.e., script-irrelevant details). Nevertheless, with so few studies on awe, the mechanism underlying awe and memory is still not clear.

The Current Study

Awe has been frequently used in various media such as commercials and films, yet only a few academic studies have documented the effects of awe on cognition. More studies are needed to better understand this emotion. The current study is inspired by the previous findings that awe facilitates systematic processing in the process of persuasion, which contradicts the effects of most positive emotions (Griskevicius et al., 2010, Danvers & Shiota, 2017). Specifically, Griskevicius and his colleagues (2010) found that participants in the awe condition showed less tolerance of a weak message, which, based on the elaboration likelihood model, indicated that they were using central route processing. However, the mechanism by which awe affects persuasion still remains ambiguous. Firstly, the ELM model proposes that people who lack motivation or ability to elaborate information (i.e., peripheral route processing) will rely more on the heuristic cues in the message. Because Griskevicius et al. (2010) didn't include heuristics as an independent variable in their study, there could be other confounding variables that influence the effect of emotion on message acceptance. As a result, the support for the information-processing account is weakened. Alternatively, it could be the case that awe

facilitates recall of key information, which in turn helps people to make subsequent judgements, therefore increasing the effectiveness of argument strength. It's worth noting that this information-recall account, though compatible with, is different from the perspective that awe influences one's information processing strategy (Danvers & Shiota, 2017). In fact, Danvers and Shiota (2017) found that awe increases one's recall of script-inconsistent and script-irrelevant details in a story. Hence, it's reasonable to speculate that awe has the ability to influence both information-processing strategy and information recall, which can have a huge impact on the persuasiveness of a message. This study aims to extend the previous findings and further examine the proposition that an incidental feeling of awe influences persuasion through information processing strategy and/or recall by 1) using a thought-listing technique (Cacioppo, von Hippel, & Ernst, 1997) and adding a resource allocation measure (LaMarre, Landreville, Young, & Gilkerson, 2014) to analyze one's cognitive process, 2) manipulating the credibility of source in the persuasive message based on the ELM model, and 3) testing the effects of awe on one's memory to validate the information-recall account using open-ended question as well as multiple choice questions. A graphic depiction of the theoretical framework can be seen in figure 1. To fill the gap and better understand the nature and effects of awe, the primary and secondary research questions posit:

RQ1: How does awe affect persuasion process?

RQ2: Do awe and happiness affect persuasion process in the same way?

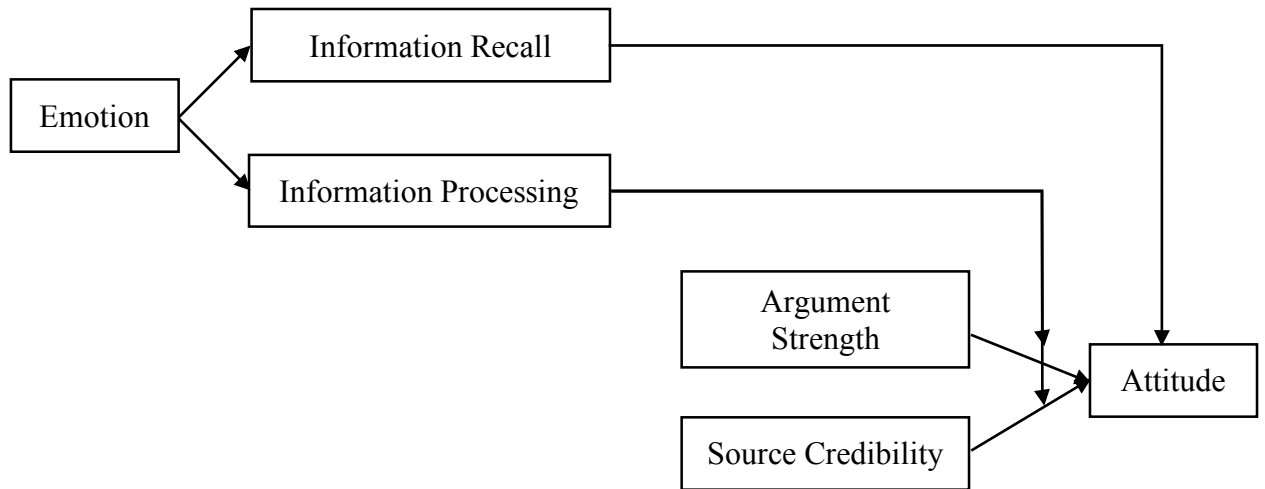


Figure 1. Conceptual framework

A 3 (emotion condition) X 2 (argument strength) X 2 (heuristic cue) between-subject experiment is designed to address the research question. In this experiment, participants will first be randomly assigned to watch one short video clip. These video clips are designed to induce one of three emotion conditions (happiness, awe, or control). Then they will be asked to read an argument about a proposal of a comprehensive senior exam in universities (Petty & Cacioppo, 1986). Once they finish reading the information, they will respond to questions regarding their attitudes toward the proposed comprehensive exam, depth of information processing, and recall of the details.

Based on the theoretical discussion and empirical evidence on the relationship between positive emotions and information processing strategy, I expect that when participants are happy, their ability and/or motivation to process the information they encounter is lower. Therefore, they are more likely to use a peripheral (heuristic) processing strategy. On the other hand, awe challenges one's existing mental representation of the world and creates a need for accommodation. I expect that awe would facilitate a central (systematic) processing strategy. In this study, I will use the

number of thoughts, the ratio of systematic thoughts to all thoughts, and difficulty of allocating cognitive resources as proxies of processing strategy. In line with previous studies, when people are using a more central (systematic) processing strategy, they are likely to find it's easy to allocate cognitive resources to process the information. They also tend to generate more thoughts regarding the message they read, and these thoughts will be more systematic (i.e., more relevant and in-depth). In contrast, when people are adopting a more peripheral (heuristic) processing strategy, they tend to behave cognitively in the opposite way. Based on this rationale, the following hypotheses therefore posit the following outcomes (relative to the control condition):

H1a: Watching happiness videos will have a negative effect on the number of thoughts generated while reading the argument.

H1b: Watching awe videos will have a positive effect on the number thoughts generated while reading the argument.

H2a: Watching happiness videos will have a negative effect on the quality of the thoughts, such that participants who watch happiness videos will have a lower ratio of systematic thoughts to all thoughts.

H2b: Watching awe videos will have a positive effect on the quality of the thoughts, such that participants who watch awe videos will have a higher ratio of systematic thoughts to all thoughts in the thought-listing question.

H3a: Watching happiness videos will make it harder for participants to allocate cognitive resources to process the message.

H3b: Watching awe videos will make it easier for participants to allocate cognitive resources to process the message.

H4a/b/c: The effects of happiness induction videos on the number of thoughts (a), the ratio of systematic thoughts to all thoughts (b), and difficulty of allocating cognitive resources to process the message (c) will be mediated by participants' level of happiness.

H5a/b/c: The effects of awe induction videos on number of thoughts (a), ratio of systematic thoughts to all thoughts (b), and difficulty of allocating cognitive resources to process the message (c) will be mediated by participants' level of awe.

In addition to information processing strategy, emotion can also affect the information recall process of memory, which in turn influences the persuasion process. Previous evidence supports the proposition that positive emotion decreases the accuracy of details recalled. On the other hand, though less explored in the literature, awe is expected to increase the accuracy of details recalled. In this study, recall is measured using an open-ended free recall question, and four multiple choice questions. The following hypotheses are proposed regarding the emotional induction conditions relative to the control condition:

H6a: Watching happiness videos will have a negative impact on the number of accurate recall of the details about the comprehensive exam.

H6b: Watching awe videos will have a positive impact on the number of accurate recall of the details about the comprehensive exam.

H7a: Watching happiness videos will have a negative effect on the score of the multiple choice questions that test one's recall of details about the proposed comprehensive exam.

H7b: Watching awe videos will have a positive effect on the score of the multiple choice questions that test one's recall of details about the proposed comprehensive exam.

H8a/b: The effects of happiness induction videos on the number of accurate recall (a) and score of multiple choice questions (b) will be mediated by participants' level of happiness.

H9a/b: The effects of awe induction videos on the number of accurate recall (a) and score of multiple choice questions (b) will be mediated by participants' level of awe.

In line with the ELM model, argument strength and heuristic cues are the two key factors in influencing the persuasiveness of a message. In other words, regardless of other factors, strong arguments and a credible source should make the message to be more persuasive. To reflect a classic experiment design utilizing ELM model, in this study, the argument strength will be manipulated to be either strong or weak, and the heuristic cues will be manipulated by varying the credibility of the source.

H10: All else being equal, strong arguments (vs. weak arguments) will lead to more favorable attitudes toward the proposed comprehensive exam.

H11: All else being equal, a credible source (vs. a non-credible source) will lead to more favorable attitudes toward the proposed comprehensive exam.

The literature on ELM typically focuses on the moderating role of individual's processing strategy. Specifically, when the likelihood of message elaboration is high, people pay more attention to the argument itself, and therefore argument strength is the dominant determinant of persuasion. In contrast, when the likelihood of message elaboration is low, heuristics become the more important determinants of persuasion.

Following the ELM framework, the following hypotheses are proposed:

H12: The relationship between argument strength and attitudes toward the proposed comprehensive exam will be moderated by participants' information processing

strategy, such that the positive effect of the strong-argument condition will be stronger for those who use a more central processing strategy.

H13: The relationship between source credibility and attitudes toward the proposed comprehensive exam will be moderated by participants' information processing strategy, such that the positive effect of a credible source will be stronger for those who use a more peripheral processing strategy.

Nevertheless, a group of researchers found that recall can predict attitudes (e.g. Chattopadhyay & Alba, 1988; Lynch, Marmorstein, & Weigold, 1988). It's noteworthy that recall and processing strategy may be correlated but they are not the same concepts. The original study that directly tested the effects of awe on attitudes only measured processing but not recall (Griskevicius et al., 2010). So it may be the case that both processing strategy and information recall independently influence attitudes in an ELM experiment. Therefore, to better explain awe, the third research question asks:

RQ3: How does information recall influence attitudes?

Chapter 2

Methods

Participants

Participants were recruited from undergraduate communication classes at a large university in the northeast United States. Participants received course extra credit in exchange for their participation. A total of 635 students participated in the study. Fourteen cases were eliminated because they only finished half of the experiment, and 19 cases were eliminated because they didn't answer the questions related to dependent variables. The data cleaning process left a valid sample of 602 cases in total. This sample ($N = 602$) was composed of 43.5% males ($n = 262$), 55.1% females ($n = 332$), 0.3% others ($n = 2$), and six didn't answer. Participants' ages ranged from 18 to 32 ($M = 19.54$, $SD = 1.30$). A large majority of the participants were White (76.4%), followed by Asian (11.1%), Black or African American (7.0%), other (4.3%), American Indian or Alaska Native (0.2%), and six refused to answer. In terms of academic standing, 28.7% were Freshmen ($n = 173$), 31.6% were Sophomores ($n = 190$), 25.6% were Juniors ($n = 154$), 13.0% were Seniors ($n = 78$), and seven students refused to answer.

Study Design

This study employed a 3 (emotion condition) x 2 (argument strength) x 2 (source credibility) factorial experiment through the Qualtrics online survey platform (Qualtrics, 2018). To mask the purpose of the study, the participants were told that there were two separate tasks. After indicating consent, participants were asked to finish task one, where

each participant was randomly assigned to watch a 3-minute video clip intended to induce neutral, happy or awe feelings. After watching the video clip, participants were asked to rate their current emotions. They then turned to task two. The second task asked participants to evaluate a hypothesized proposal of a senior comprehensive exam (Petty & Cacioppo, 1986). To do so, they first all read a general introduction of the proposal, which included the description of the senior comprehensive exam, when the decision of proposal would be made, and when the comprehensive exam would be instituted if the proposal were approved. After reading the introduction of the proposal, participants were then randomly assigned to read a Facebook post that was posted by either a credible or non-credible source and contained either a strong or weak argument in favor of the proposal. Participants then rated their attitudes toward the comprehensive exam, indicated how difficult it was for them to allocate cognitive resources, listed thoughts they had while reading the Facebook post, listed details they remembered about the exam, and finally completed four multiple choice questions regarding the information presented in the introduction of the comprehensive exam.

Manipulation Materials

Emotion induction video clips. A pretest with 94 participants was conducted to ensure that the video clips chosen elicited neutral, happy, and awe emotions; 12 video clips were assessed (4 for each emotion). In the pretest, participants watched one video clip from each emotion condition, and rated how they felt. The results indicated that in general, the happy videos successfully induced happiness and awe videos successfully induced awe (see table 1).

Table 1*EM Means of Each Emotion by Videos on Scales of 1 (lowest) -7 (highest)*

Emotion	Neutral				Happy				Awe			
	v1	v2	v3	v4	v1	v2	v3	v4	v1	v2	v3	v4
Anger	1.90	1.37	2.15	1.46	1.55	1.66	1.54	-.37	1.41	1.54	1.58	1.21
Sadness	1.89	1.26	1.63	1.15	1.57	1.60	1.33	1.48	1.4	1.45	1.58	1.34
Fear	1.57	1.24	1.47	1.1	1.51	1.78	1.16	1.57	1.38	1.96	1.45	1.49
Gratitude	2.68	2.39	2.58	2.60	2.50	2.79	2.41	3.39	3.78	3.33	3.46	3.60
Interest	3.71	3.89	3.03	3.38	3.14	3.25	2.7	3.83	3.58	3.51	3.75	3.99
Love	2.67	2.27	2.37	2.44	2.29	3.38	2.48	2.63	3.55	2.71	2.65	2.81
Amusement	3.01	2.86	2.17	2.68	4.32	4.50	3.91	3.43	2.83	2.44	2.30	2.70
Happiness	3.37	3.01	2.56	3.18	4.70	4.53	4.33	5.22	4.12	3.41	3.38	3.80
Awe	3.22	3.03	2.80	2.78	3.17	2.83	2.56	3.63	4.93	4.70	4.59	5.16
Sympathy	2.24	1.64	2.04	1.46	2.32	3.49	1.88	1.75	2.40	2.97	2.01	2.76
Surprise	3.08	3.00	2.56	3.20	3.04	2.45	2.39	2.36	3.82	3.58	4.07	4.08

Two video clips from each condition were chosen as the stimuli in the main study because they elicited more of intended emotions without eliciting too much of the unintended emotions (video 1 & 4 in the neutral condition, video 1 & 2 in the happy condition, and video 1 & 4 in the awe condition). Neutral video 1 is a tutorial on how to grow passion fruit. In the video, the instructor shows how to get seeds from the passion fruit and grow them in the soil. Neutral video 4 is a tutorial on how to make a Murphy desk. In the video, the instructor demonstrates how to build a Murphy desk using standard wood boards. Happy video 1 is a compilation of funny videos, including scenes such as a girl falling from a skateboard, monkeys' reactions to a man's card tricks, etc. Happy video 2 is a compilation of funny animal videos, including scenes such as cat stealing a bag of bread, a cat preventing his owner from reaching the computer, etc. Awe video 1 is a promotional video from the World Wide Fund for Nature (WWF) which

depicts the natural sceneries in Romania (e.g. forest, waterfall, clear lakes, etc.). Awe video 4 is a short clip from BBC Earth, which films the beauty of nature using a time-lapse technique.

Argument strength. Argument strength was manipulated to be either strong or weak. Arguments were selected from Petty and Cacioppo’s (1986) list of strong and weak arguments. Each argument was around 150 words long and was in favor of the comprehensive exam. Two strong arguments and two weak arguments were pretested. Participants were asked to rate the extent to which the argument was strong/weak, good/bad, and effective/ineffective on a 7-point semantic differential scale where 7 represented positive items and 1 represented negative items. These three variables were then coded into an index that indicates the perceived strength of the argument ($\alpha = .84$). A one-way ANOVA with Bonferroni post-hoc comparisons was performed (see Table 2). The results revealed that strong argument 1 ($M = 4.36, SD = 1.13$) and strong argument 2 ($M = 4.29, SD = .87$) were both perceived as significantly stronger than weak argument 1 ($M = 3.29, SD = 1.38$), but two strong arguments were not significantly different from each other. Based on the results, strong argument 1 and weak argument 1 were chosen to be used in the main study (see Appendix A for specific text).

Table 2
Argument Strength Ratings

	Strong Argument 1	Strong Argument 2	Weak Argument 1	Weak Argument 2
<i>M</i>	4.36 _a	4.29 _a	3.29 _b	3.71 _{ab}
<i>SD</i>	1.13	.87	1.38	1.28

$F(3, 89) = 4.01, p < .01, \text{partial } \eta^2 = .12.$

Note: Means with no subscript in common differ at $p < .05$ using Bonferroni post-hoc comparisons.

Source credibility. The credibility of the source who made the Facebook post was manipulated to be strong or weak. To make sure that the sources manipulated in the main study are clearly credible or non-credible, ten sources were pretested. In the pretest, participants were asked to rate the credibility of ten sources on a scale of 1 (not credible at all) to 7 (extremely credible). Sample items include a college instructor, a stay-at-home parent, an editor of the education section of New York Times, a college career advisor, etc. Based on the results, two sources that were rated as most credible and two sources that were rated as least credible were selected to be used in the stimuli for the main study. The two most credible sources were: an officer of the United States Department of Education ($M = 5.43$, $SD = 1.70$) and a college instructor ($M = 5.27$, $SD = 1.17$). The two least credible sources were: a stay-at-home parent ($M = 2.55$, $SD = 1.21$), and a high school student ($M = 2.42$, $SD = 1.42$).

Measurements

Emotion. The emotion scale was adapted from Fredrickson, Tugade, Waugh, and Larkin's (2003) modified Differential Emotional Scale (mDES). In the pretest, participants were asked to rate how much they felt about 11 sets of emotions from 1 (not at all) to 7 (extremely) on a 33-item scale. Each set of emotion contains three related emotions that represent a more general emotion (e.g., happy, joyful, glad represented the concept of happiness). To avoid unexpected fatigue or frustration due to a long questionnaire, only 3 sets of positive emotions and 3 sets of negative emotions were measured in the main study, which shortened the scale to 18 items. Reliability tests suggested that emotion subscales all reached satisfactory reliability: anger ($\alpha = .84$, $M =$

1.51, $SD = .92$), sadness ($\alpha = .79$, $M = 1.46$, $SD = .80$), fear ($\alpha = .88$, $M = 1.37$, $SD = .79$), interest ($\alpha = .71$, $M = 3.57$, $SD = 1.35$), happiness ($\alpha = .92$, $M = 4.10$, $SD = 1.69$), and awe ($\alpha = .83$, $M = 3.76$, $SD = 1.64$). In this study, I will particularly look at the effects of happiness and awe. To ensure that the scale for happiness and awe are valid discriminately, a factor analysis using a principal-axis factor extraction was conducted (see table 3). In line with the factorial structure of the original mDES, I expected to find two factor loadings for happiness and awe. The Kaiser criterion (eigenvalues greater than 1) suggested two factors and the screen plot recommended two factors as well. A Promax oblique rotation was used because the factors were potentially correlated. Based on the pattern matrix, happiness items all loaded on factor 1 and awe items all loaded on factor 2. Based on this result, the happiness and awe scales are deemed to be valid.

Table 3
Happiness and Awe Items Loadings

Item	Factors	
	1	2
I feel joyful (happiness item)	.95	-.03
I feel happy (happiness item)	.95	-.02
I feel glad (happiness item)	.87	.05
I feel wonder (awe item)	-.07	.92
I feel awe (awe item)	-.03	.87
I feel amazed (awe item)	.18	.77

Note: Factor loadings over .60 appear in bold.

Attitude. Attitude was the firstly measured dependent variable. The scale was adapted from the semantic differential scale developed by Petty and Cacioppo (1984). On a 7-point scale, participants were asked to rate the extent to which the compressive exam was good/bad, unpleasant/pleasant, beneficial/harmful, and unfavorable/favorable. Two

items were reverse coded because these items had positive terms on the left side of the scale. The average score of these four items was computed to be a single variable that reflects one's attitude towards the comprehensive exam ($\alpha = .82$, $M = 3.94$, $SD = 1.32$).

Difficulty of allocating cognitive resource to process information. The second measured dependent variable was one's ability to allocate cognitive resource to process the information they encounter, which intends to capture one's processing style. Difficulty of allocating cognitive resources was measured using a resource allocation scale developed by LaMarre et al. (2014). A 7-point Likert-type scale (1-strongly disagree, 7-strongly agree) asked participants to rate how much they agree with 3 statements (e.g., "I found it difficult to think about the argument about the comprehensive exam"). If the participant selected 7, it means that the participant found it was very hard to think about or pay attention to the argument they read, and vice versa. Two items were reverse coded. The average score of three items was then computed to reflect participant's resource allocation while they read the argument ($\alpha = .75$, $M = 3.21$, $SD = 1.26$).

Thought-listing. As discussed above, there are two distinct routes of information processing according to the elaboration likelihood model (Petty & Cacioppo, 1986). Petty and Cacioppo (1984) developed a thought-listing technique to capture one's processing style, which has later been successfully used in various studies. Similar to the original thought-listing technique (Petty & Cacioppo, 1984), in this study, participants were asked to list up to five thoughts that appeared while they were reading the argument about the comprehensive exams. Two trained coders coded two variables derived from the data: the number of thoughts (Krippendorff's $\alpha = .99$, $M = 3.66$, $SD = 1.74$) and the ratio of

systematic thoughts to all thoughts (Krippendorff's $\alpha = .92$, $M = .63$, $SD = .35$). To calculate the ratio of systematic thoughts, two coders divided the number of systematic thoughts (i.e., topic-relevant and shows in-depth thinking) over total thoughts. For the participants who listed zero thoughts, their corresponding ratios of systematic thoughts were coded as .50 to reflect a point where one's using an equal amount of systematic and heuristic processing. The other reason to code them as .50 is to retain more statistical power since these ratios would otherwise be treated as missing data¹.

Information recall through an open-ended question. Information recall was first measured using an open-ended question. The question asked the participants to write down as many as facts they can remember about the comprehensive exam. Based on the data, two trained coders coded one variable that reflects one's information recall performance: number of accurate facts recalled (Krippendorff's $\alpha = .81$, $M = 1.60$, $SD = 1.32$).

Information recall through multiple choice questions. Information recall was additionally measured by asking participants to answer four multiple choice questions. The questions tested how many details participants remembered from the introduction of the comprehensive exam, where all participants read the same content. Participants received one point for each correctly answered question, which means that the maximum they could get was 4 and the minimum they could get was 0 ($M = 2.78$, $SD = 1.13$).

¹ Running the analyses with these as missing data didn't change the pattern of the results.

Chapter 3

Data Analysis and Results

Manipulation Check

At the beginning of the experiment, participants were randomly assigned to watch a video clip that was designed to induce neutral feelings, happiness, or awe. Two hundred and three participants watched the neutral video (33.7%), two hundred participants watched the happiness video (33.2%), and one hundred and ninety-nine participants watched the awe video (33.1%). Several chi-square analyses and a one-way analysis of variance (ANOVA) were performed to confirm that there were no unexpected differences between emotion conditions on demographics variables. Results suggested that each emotion condition was not significantly different from other emotion conditions regarding gender, $\chi^2 = 3.45$, $df = 4$, $p = .49$, age, $F(2, 593) = 1.15$, $p = 3.20$, academic standing, $\chi^2 = 2.05$, $df = 6$, $p = .92$, or race, $\chi^2 = 3.85$, $df = 8$, $p = .87$.

Results from an ANOVA test with Bonferroni post-hoc analysis revealed that the emotion condition significantly influenced how much participants felt happy, $F(2, 599) = 55.48$, $p < .001$, partial $\eta^2 = .16$. Specifically, participants in the control condition felt significantly less happy ($M = 3.16$, $SD = 1.59$) compared with participants in the happiness condition ($M = 4.64$, $SD = 1.60$) or participants in the awe condition ($M = 4.52$, $SD = 1.48$). However, the happiness condition and awe condition were not significantly different from each other ($p = 1.00$). Since awe is typically categorized as a positive emotion, it's not surprising that awe elicits happiness as well. Therefore, although the happiness videos didn't elicit more happiness compared with the awe videos, the

manipulation should still be considered as successful since the happiness videos induced more happiness than the neutral videos.

Another one-way ANOVA test revealed that emotion condition significantly influenced how much awe participants felt, $F(2, 599) = 202.64, p < .001$, partial $\eta^2 = .25$. Specifically, participants in the awe condition felt significantly more awe ($M = 4.93, SD = 1.58$) compared with participants in the control condition ($M = 3.16, SD = 1.32$) or participants in the happiness condition ($M = 3.22, SD = 1.35$). There's no significant difference between the control condition and the happiness condition ($p = 1.00$). Based on the results, the manipulation was considered successful. Emotion induction conditions were then dummy coded to reflect whether it's a happiness video and whether it's an awe video.

Table 4
Estimated Means and Standard Errors of Dependent Variables by Emotion Condition

	Neutral		Happiness		Awe	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Attitudes	3.93	.09	3.99	.09	3.90	.09
Number of thoughts listed	3.84	.12	3.62	.12	3.54	.12
Ratio of systematic thoughts to all thoughts	.60	.02	.64	.03	.66	.61
Difficulty of allocating cognitive resources	3.25	.09	3.22	.09	3.16	.09
Number of accurate recall	1.59	.09	1.54	.09	1.67	.09
Score of recall question	2.79	.08	2.67	.08	2.89	.08

Hypotheses Testing

The hypotheses predicted the influence of emotion on information processing, information recall, and attitude changes. Table 4 is a summary of key variables by emotion conditions. More in-depth analyses and interpretation are provided below.

Emotion and Information Processing Strategy

Hypotheses 1 to 5 predicted the direct and indirect effects of different emotion induction conditions (i.e., happiness and awe) on individuals' information processing strategy. I constructed a comprehensive model in AMOS to get a bigger picture of the relationship between emotion induction, emotions, and information processing. In the initial model, I didn't let any error terms covary. A chi-square goodness-of-fit test reported the model had a poor fit, $\chi^2 = 481.28$, $df = 52$, $p = .000$, RMSEA = .12 (90% CI = .11 to .13), CFI = .87. To improve model fit, I let the error terms of two emotion measurements covary based on modification index from AMOS. The model then reached an acceptable fit, $\chi^2 = 195.60$, $df = 51$, $p = .000$, RMSEA = .07 (90% CI = .06 to .08), CFI = .96. Figure 2 provides a graphic depiction of the revised model with standard path coefficients and significance levels indicated.

To test the total effect and indirect effect of happiness induction on information processing measurements, bootstrapping procedures using 2000 bootstrap samples and bias-corrected confidence intervals were employed. According to the results, the total effect of happiness induction on the number of thoughts listed was nonsignificant ($\beta = -.06$, $p = .18$). Thus H1a was not supported. However, an indirect effect of happiness induction on the number of thoughts through feeling of happiness was found ($\beta = -.08$, p

= .02). Therefore, H4a was supported. A nonsignificant total effect with a significant indirect effect suggests that the direct effect and indirect effect worked in opposite direction, and their effects were canceled out. Therefore, it may be concluded that happiness video will have a negative effect on the number of thoughts generated only if it successfully elicits happiness. Next, the total effect of happiness induction on the ratio of systematic thoughts was also nonsignificant ($\beta = .06, p = .24$). Moreover, the indirect effect for the mediator level of happiness was not found ($\beta = -.06, p = .18$). Therefore, H2a and H4b were not supported. This suggests that although the happiness video can influence how many thoughts generated while participants read the message, it didn't significantly impact the content (i.e., systematic vs. heuristic) of the thoughts. Finally, the total effect of happiness induction on the difficulty of allocating cognitive resources was not significant ($\beta = .00, p = .99$). The mediating effect of level of happiness was also not significant ($\beta = .07, p = .11$). Based on the results, happiness, in general, doesn't influence one's ability to allocate cognitive resources. H3a and H4c were therefore not supported.

The same bootstrapping procedures were performed to test the effects of awe induction on information processing. Total effect of awe induction on the number of thoughts listed was not significant ($\beta = -.08, p = .10$). Therefore, H1b was not supported. However, the results revealed a significant indirect effect of awe induction on the number of thoughts through feeling of awe ($\beta = .18, p = .003$). H5a was then supported. It's noteworthy that awe induction videos were found to significantly influence participants' feeling of happiness. Therefore, the indirect effects of awe induction on number of thoughts listed through happiness and awe canceled out each other, which led to a

nonsignificant total effect. There might also be a suppression effect because when the feeling of awe was added as a mediator, the sign of the zero-order correlation coefficient between awe induction and the number of thoughts listed changed (i.e., $r = -.12$ to $r = .14$). In the case of awe induction videos, it is possible that when emotional feeling is taken away from the video, what's left (e.g., calmness) causes people to pay attention to the experiment, which in turn influences their willingness to respond to the thought-listing question.

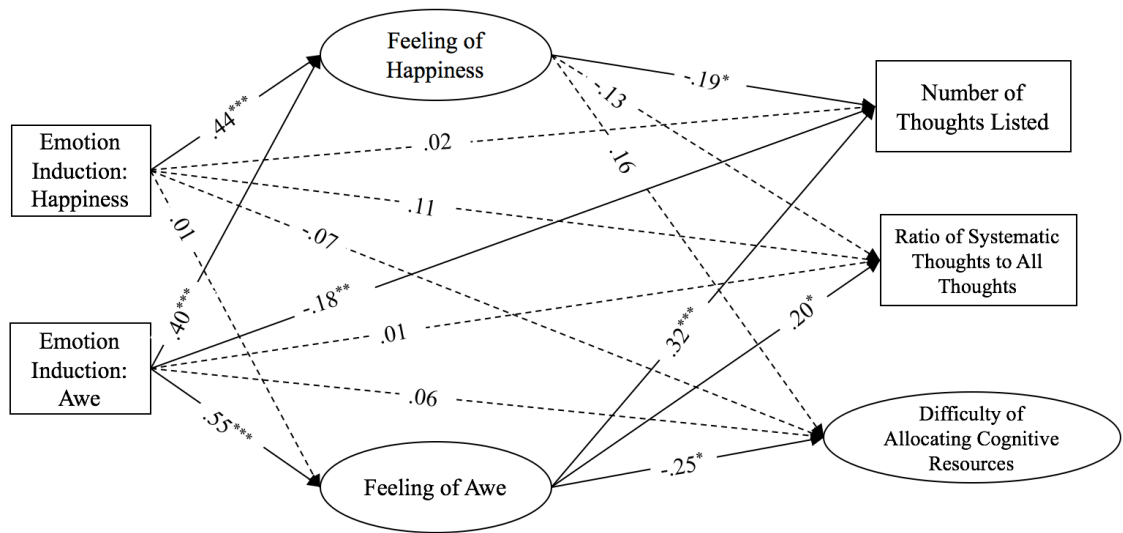


Figure 2. Structural Equation Model (SEM) of emotion induction, emotion, and information processing strategy
 $* p < .05$, $** p < .01$, $*** p < .001$
 Model Fit: $\chi^2 = 195.60$, $df = 51$, $p = .000$, RMSEA = .07 (90% CI = .06 to .08), CFI = .96

Note: Variables in rectangles are observed variables and variables in ovals are latent variables. Solid line indicates that the path is significant while dotted line indicates that the path is nonsignificant.

H2b predicted the effect of awe on the ratio of systematic thoughts. According to the results, the total effect was nonsignificant ($\beta = .07$, $p = .10$). However, the mediating effect of level of awe was significant ($\beta = .18$, $p = .04$). It can be concluded that awe not only influenced the amount of thoughts generate, it also had an impact on the content of

the thoughts listed. H2b was therefore unsupported, but H5b was supported. Finally, the total effect of awe induction of difficulty of allocating cognitive resources was not significant ($\beta = -.01, p = .89$). However, results revealed a significant indirect effect of awe induction on resource allocation through feeling of awe ($\beta = -.14, p = .02$). In this case, the indirect effects of awe induction on resource allocation through happiness and awe were of opposite direction, resulting in a nonsignificant total effect. Therefore, H3b was not supported but H5c was supported. Taken together, these findings suggest that feeling of awe does influence the way people process information.

Emotion and Information Recall

Hypotheses 6 to 9 predicted that the emotion induction (i.e., happiness and awe) would have a direct and an indirect effect on participants' information recall. Again, I constructed a comprehensive model in AMOS, which pictured the relationship between emotion induction videos, emotions, and information recall. I assessed the overall model with a chi-square goodness-of-fit without any of the error terms covarying. The initial model fit was poor, $\chi^2 = 524.33, df = 26, p = .000, RMSEA = .18$ (90% CI = .17 to .19), CFI = .83. Based on the modification index from AMOS, I let the error terms of two emotion scales (i.e., happiness and awe) covary. Also, I let the error terms of two information recall measurements (i.e., free recall and multiple choice) covarying. The revised model reached an acceptable fit, $\chi^2 = 107.24, df = 24, p = .000, RMSEA = .08$ (90% CI = .06 to .09), CFI = .97. Figure 3 provides the standardized path model coefficients with significance level for the hypothesized model.

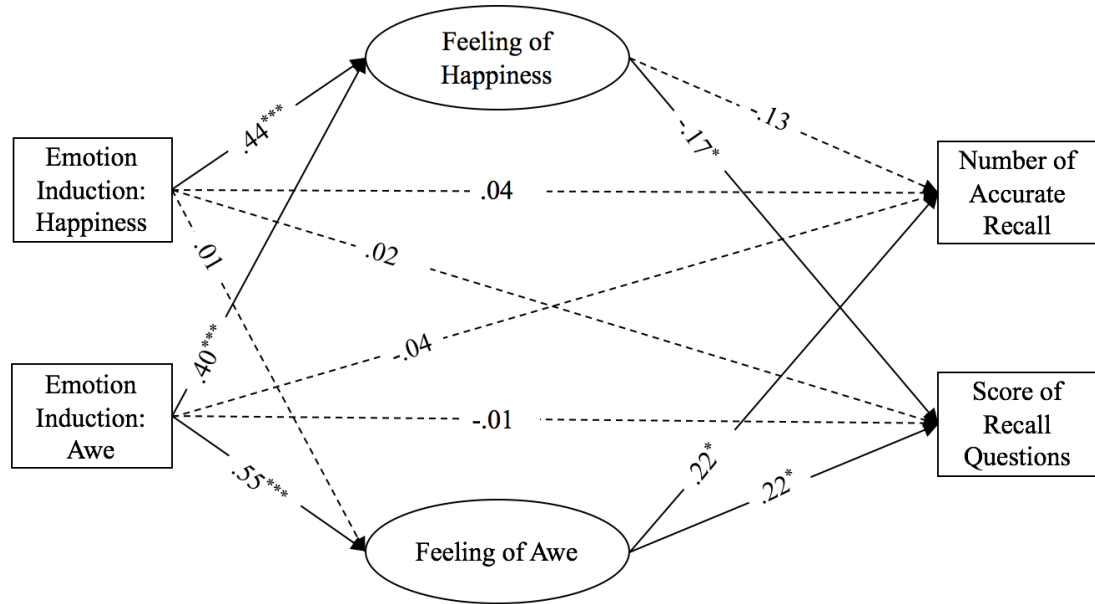


Figure 3. Structural Equation Model (SEM) of emotion induction, emotion, and information recall

* $p < .05$, ** $p < .01$, *** $p < .001$

Model Fit: $\chi^2 = 107.24$, $df = 24$, $p = .000$, RMSEA = .08 (90% CI = .06 to .09), CFI = .97

Note: Variables in rectangles are observed variables and variables in ovals are latent variables. Solid line indicates that the path is significant while dotted line indicates that the path is nonsignificant.

Bootstrapping procedures using 2000 bootstrap samples and bias-corrected confidence intervals were employed to test the effects of emotion induction videos on information recall. The total effect of happiness induction on the number of facts recalled was not significant ($\beta = -.02$, $p = .78$). Also, the indirect effect of happiness induction on the number of accurate recall through level of happiness was not significant ($\beta = -.06$, $p = .08$). Therefore, watching happiness videos did not influence how many accurate information participants recalled, and H6a and H8a were not supported. Next, the results didn't show a significant total effect of happiness induction on multiple choice score ($\beta = -.05$, $p = .30$), the indirect effect for level of happiness was barely significant ($\beta = -.07$, $p = .08$).

= .06). Therefore, watching happiness video didn't influence participants' performance on the recall questions. H7a and H9b were not supported.

Next, I analyzed the effects of awe induction on information recall using the same bootstrapping procedure. The total effect of awe induction on the number of facts recalled was not significant ($\beta = .03, p = .53$). But the mediating effect of feeling of awe was found ($\beta = .12, p = .02$). Based on these results, H6b was not supported, but H9a was supported. The total effect of awe induction on multiple choice score was not significant ($\beta = .04, p = .31$). But the mediating effect of feeling of awe was significant ($\beta = .12, p = .04$). Therefore, H7b was not supported but H9b was supported. Taken together, feeling of awe could be considered as a significant indicator of information recall. It's noteworthy that both of the total effects of awe induction were nonsignificant while the indirect effects were significant. This shows that experiencing awe had an influence on information recall. However, because the awe induction videos could have induced feelings other than awe (e.g., happiness), the indirect effects for happiness offset the indirect effects of awe on information recall, causing a nonsignificant total effect.

Processing Strategy, Information Recall, and Attitudes

Hypothesis 10 and 11 tested the basic propositions of ELM that argument strength and source credibility are two major predictors of attitudes² (Petty & Cacioppo, 1986). Hypothesis 10 predicted that argument strength has a positive effect on attitudes. An independent sample t-test revealed that argument strength significantly impacted

² A regression test using 5000 bootstrapping showed that there was no interaction effect between argument strength and emotion conditions on attitudes.

participants' attitudes, $t(600) = 5.90, p < .001$. Specifically, the strong argument ($M = 4.26, SD = 1.33$) led to more positive attitudes toward the senior comprehensive exam compared with the weak argument ($M = 3.64, SD = 1.24$). Therefore, Hypothesis 10 was supported.

Hypothesis 11 predicted that a more credible source will lead to more favorable attitudes. According to an independent sample t -test, the effect of source credibility on attitudes was not significant. In other words, compared with the non-credible source ($M = 3.88, SD = 1.30$), the credible source ($M = 4.01, SD = 1.34$) didn't generate significantly more positive attitudes toward the comprehensive exam, $t(600) = 1.18, p = .24$. Thus, hypothesis 11 was not supported.

Hypotheses 12 to 13 predicted that an individual's processing strategy will moderate the relationship between argument strength/source credibility and attitudes. Research question 3 further asked how information recall influenced attitudes. In this study, participants' information processing strategy was measured by 1) the number of thoughts recalled in the thought-listing question, 2) the ratio of systematic thoughts to all thoughts in the thought-listing question, and 3) difficulty of allocating cognitive resources. I chose the number of thoughts as the proxy of information processing to testing the moderation effect because it has high content validity and has been commonly used in previous studies as an indicator of one's processing strategy (e.g., Griskevicius et al., 2010)³. I chose the number of accurate recall as the proxy of information recall because compared to multiple choice questions, which essentially were testing

³ Analyses using the ratio of systematic thoughts to all thoughts and the difficulty of allocating cognitive resources as proxies of information processing strategy produced similar results.

recognition, free recall of details in an open-ended question better reflects the concept of information recall⁴. The zero-order correlations between variables are shown in table 5.

Table 5
Descriptive Statistics and Correlations (N=602)

Variable	ATT	AS	SC	IP1	IP2	IP3	IR1	IR2
ATT	1							
AS	.23 ^{***}	1						
SC	.05	.06	1					
IP1	.02	.01	-.00	1				
IP2	.03	.03	-.03	.04	1			
IP3	-.14 ^{***}	-.18 ^{***}	-.04	-.07	-.22 ^{***}	1		
IR1	.13 ^{**}	.03	.01	.27 ^{***}	.33 ^{***}	-.31 ^{***}	1	
IR2	.00	-.04	.02	.22 ^{***}	.28 ^{***}	-.30 ^{***}	.46 ^{***}	1
<i>M</i>	3.94			3.66	.63	3.21	1.60	2.78
<i>SD</i>	1.32			1.74	.35	1.26	1.32	1.13

** $p < .01$, *** $p < .001$

Note: ATT = Attitudes Scale; AS = Argument Strength; SC = Source Credibility; IP1 = Number of Thoughts; IP2 = Ratio of Systematic Thoughts to All Thoughts; IP3 = Difficulty of Allocating Cognitive Resources; IR1 = Number of Accurate Recall; IR2 = Score of Recall Questions

To test hypotheses 12 and 13, a hierarchical regression analysis was performed. Argument strength, source credibility, and proxy of information processing were entered in the first step of the regression analysis (model 1). The interaction terms (i.e., argument strength X information processing, source credibility X information processing) were then entered in the second step (model 2). The model 2, which included all the independent variables and interaction terms, was significant ($F = 7.64, p < .001$).

⁴ Analysis using the score of recall questions produced similar results.

According to the results from the hierarchical regression analysis (see table 6), information processing strategy didn't predict attitudes controlling for argument strength and source credibility ($\beta = .02, t = .39, p = .70$). Moreover, information processing strategy didn't moderate the relationship between argument strength and attitudes ($\beta = .15, t = 1.53, p = .13$), nor did it moderate the relationship between source credibility and attitudes ($\beta = -.06, t = -.61, p = .54$). Therefore, hypotheses 12 and 13 were not supported. It's noteworthy that, regardless of significance, the coefficients were all in the expected directions (i.e., more systematic processing increases the effects of argument strength but decreases the effects of credibility).

Table 6
Hierarchical Regression Analysis Predicting Attitudes from Argument Strength, Source Credibility and Information Processing Strategy Proxy (N=602).

	Model 1					Model 2				
	β	t	r_p^2	R^2	F	β	t	r_p^2	R^2	F
Step 1				.06	11.86***				.06	11.86***
AS	.23***	5.83	.23			.10	1.11	.05		
SC	.03	.86	.04			.08	.87	.04		
IP	.02	.39	.02			-.02	-.23	-.01		
Step 2									.06	7.64***
AS X IP						.15	1.53	.06		
SC X IP						-.06	-.61	-.03		

* $p < .05$, ** $p < .01$, *** $p < .001$

Note: AS = Argument Strength; SC = Source Credibility; IP = Information Processing. The argument strength, source credibility, and proxy of information processing were entered in the first step of the regression analysis, and the interaction terms were entered in the second step.

Research question 3 asked how information recall influences attitudes. To explore the effects of information recall, another hierarchical regression analysis was performed (see table 7). Argument strength, source credibility, and proxy of information recall were

entered in the first step of analysis (model 1), and the interaction terms were entered in the second step (model 2). The model 2, which included all the predictors and interaction terms, was significant ($F = 12.00, p < .001$). According to the results, information recall was a significant predictor of attitudes when argument strength and source credibility were controlled ($\beta = .13, t = 3.14, p = .002$). In addition, the moderation effect of information recall on the relationship between argument strength and attitudes was significant. Specifically, the positive effect of argument strength was stronger when the number of accurate recall was greater ($\beta = .24, t = 3.26, p = .001$). The moderation effect of information recall on the relationship between source credibility and attitudes was almost significant ($\beta = -.14, t = -1.90, p = .06$). To conclude, information recall in this study was deemed a better predictor of attitudes than information processing strategy.

Table 7
Hierarchical Regression Analysis Predicting Attitudes from Argument Strength, Source Credibility and Information Recall Strategy Proxy (N=602).

	Model 1					Model2				
	β	t	r_p^2	R^2	F	β	t	r_p^2	R^2	F
Step 1				.07	15.29***				.07	15.29***
AS	.23***	5.77	.23			.08	1.23	.05		
SC	.03	.84	.03			.12	1.94	.08		
IR	.12**	3.14	.13			.07	.98	.04		
Step 2									.09	12.00***
AS X IR	.24**	3.26	.13							
SC X IR	-.14	-1.90	-.08							

* $p < .05$, ** $p < .01$, *** $p < .001$

Note: AS = Argument Strength; SC = Source Credibility; IR = Information Recall. The argument strength, source credibility, and proxy of information processing were entered in the first step of the regression analysis, and the interaction terms were entered in the second step.

Chapter 4

Discussion

Decades of research suggest that emotion is a key influencer of cognition (e.g., Lench, Flores, & Bench, 2011). Much of the research has focused on the valence of emotions (i.e., positive vs. negative) and found distinctive patterns in term of their effects on cognition (e.g., Fredrickson & Branigan, 2005). Previous findings on positive emotions suggest that positive emotions are able to facilitate heuristic processing, which leads to increased reliance on rules of thumb (Bless et al., 1990). In addition to information processing, positive emotions are found to influence one's recall of information. Specifically, while positive emotions help individuals to gather more information, they sacrifice the accuracy of recall (Yegiyan & Yonelinas, 2011). Although the effects of general positive emotions (e.g., happiness, joy) are consistent across studies, recent studies with a discrete emotion perspective challenge the categorization of emotions by valence (Isen, 2000). What can be learned from these studies is that it may be more appropriate to treat discrete emotions, rather than valence, as the independent variable. Several of these studies found that the effects of the positive emotion of awe were more similar to negative emotions for that it encourages more systematic processing (Griskevicius, Shiota, & Neufeld, 2010; Yee & Shiota, 2013) and increases information recall (Danvers & Shiota, 2017). The current literature on awe is scarce. Therefore, how and why awe is different from other positive emotions is still not clear. The goal of this study was to examine the effects of awe on cognitive variables including information processing and information recall, which may in turn influence the persuasion process.

Nature of Awe

Awe is generally assumed to be a positive emotion (Shiota et al., 2007; Shiota et al. 2011). In this study, awe was induced by videos of natural scenery, which were more uplifting than scary. The results of this study proved that the experience awe is positive because awe videos induced both happiness and awe. Similarly, in previous studies of awe, scholars typically induced awe by asking participants to imagine or recall an awe experience or showing them pictures or videos depicting mentally overwhelming objects such as waterfalls or panoramic nature view. In these studies, the awe experiences induced were likely to be pleasant. I suggest using some caution when interpreting the results from these studies based on the theoretical difference between happiness and awe. According to the discrete emotion perspective, awe is a more complex emotion than happiness. Keltner and Haidt's (2003) conceptualized that awe has two core elements: perceived vastness and need for accommodation. However, awe also has fuzzy boundaries that it can have both positive (e.g., happiness, joy) and negative "flavors" (e.g., fear, uncanny), depending on the context. It's noteworthy that these "flavors" are not the core elements of awe experience. In other words, theoretically, awe can emerge without happiness. Therefore, the previous studies may have confounded the results because of the emotion induction induced happiness as well and may not reveal the whole picture of the psychological effects of awe. Nevertheless, the design of this study offers researchers who are interested in this topic a framework to further test the nature of awe.

Awe, Happiness, and Cognition

Previous studies on positive emotions find that happiness increases one's reliance on general knowledge structures (Bless et al., 1996) and encourages individuals to make faster decisions even when limited information was given (Isen & Means, 1983), which all reflect heuristic processing. In this study, information processing was measured using a thought-listing technique and a resource allocation scale. The results of this study were not consistent with previous studies. Specifically, while happiness was found to influence the number of thoughts listed, it didn't significantly influence whether those thoughts were systematic (i.e., relevant) or heuristic (i.e., irrelevant) nor did it influence how difficult it was for participants to allocate cognitive resources. One possible reason of this nonsignificant effect is due to the length of the arguments participants read. According to the elaboration likelihood model (ELM), when people are motivated and are able to process the information, they tend to use a central route processing style (Petty & Cacioppo, 1986). Among the three measures of information processing, the number of thoughts better represents one's motivation to process while the ratio of systematic thoughts and difficulty of allocating cognitive resources better represent one's ability or perceived ability to process information. In this study, each argument was around 150 words long. Due to the short length of the argument, even when participants were not motivated to process the information (i.e., low elaboration), they may still be able to get the main idea of the argument without much effort. As a result, happiness only influenced the number of thoughts listed (i.e., motivation) but not the content of thoughts listed or cognitive resources allocation (i.e., ability). This finding suggests that general positive emotion may have independent effects on motivation and ability to process information.

This can be explained using an evolutionary perspective. Specifically, positive emotions signal that the environment is safe and there's no need to be alert of the surroundings (Frijda, 1988; Schwarz, 1990; Isen, 1987). In other words, in this study, participants were less motivated to process the information if they felt happy. However, this feeling doesn't impact their ability to process information.

On the other hand, awe was found to be a significant indicator of all three information processing proxies. The functional conceptualization of awe suggests that awe contributes to knowledge acquisition and therefore facilitates more systematic processing of information (Keltner & Haidt, 2003). As hypothesized, this study found that feelings of awe significantly influenced information processing. Specifically, awe encouraged participants to list more thoughts, and those thoughts listed were showed higher level of message elaboration. Also, participants who felt a higher level of awe reported that it was easier for them to allocate cognitive resources to process the message. Taken together, awe not only influences how motivated a person is to process information, but also impacts the perceived and actual ability to process information. While the results confirmed that awe leads to an overall more systematic information processing style, the total effect of awe induction was not significant. This was primarily due to the fact that awe videos also induced happiness. Mediation analyses (see figure 3) revealed the indirect effects of awe induction through happiness and awe on information processing had opposite signs, leading to a nonsignificant total effect.

A suppression effect of awe was suggested such that when awe was added to the regression, the sign of the correlation between awe induction and information processing changed. This means that when the overlapping variance between awe induction and

mediators were removed, aspects of the videos in the awe condition not responsible for creating awe made people slightly more likely to elaborate the information. One potential explanation is that, in addition to awe, awe videos may also evoke a state of calmness, which in turn makes people less impatient and more motivated to process information.

In addition to information processing, previous studies also suggest that emotions may have different impacts on memory. Specifically, general positive emotions are thought to help individuals to gather both central and peripheral information but sacrifice accurate recall of the information (Yegiyan & Yonelinas, 2011). On the other hand, because the awe experience facilitates individuals to accommodate new information, it is expected to have a positive impact on accurate recall (Danvers & Shiota, 2017).

Consistent with these predictions, happiness and awe had distinctive effects on information recall. In this study, information recall was measured by the number of accurate facts listed by participants and score of recall questions. It's noteworthy that although both of the measures examine memory retrieval (i.e., recall), they are different regarding the number of cues they provide (Gillund & Shiffrin, 1984). The multiple choice questions, in essence, were recognition questions that contain more cues. Therefore, it's easier for participants to pick an answer. On the other hand, the free-recall question offered very few cues, which made it harder for participants to list the information they remembered.

According to the results, happiness was found to have a near-significant negative impact on the answer of multiple choice questions but not the free-recall question. Therefore, it can only be concluded that when some cues are present, happy people are less likely to accurately recognize the details from the message they read. On potential

explanation of why happiness did not influence the free-recall question is that there might exist a floor effect. Specifically, if participants struggled to remember the facts without a prompt, then further inhibiting factor (i.e., being happy) wouldn't make much difference. Unlike happiness, awe was found to both forms of memory retrieval. These results imply that awe enhances people's attention to details in the message as well as helps people to encode information. Taking information processing together, it can be concluded that, unlike general positive emotions, awe facilitates thinking and enhances memory. Scholars who are interested in this topic could also look at other psychological and behavioral effects of the discrete emotion of awe.

Despite the findings of the effects of awe and happiness on cognition, it is worth noting that because the argument itself can also elicit emotion (i.e., comprehensive exam may induce a feeling of anxiety or annoyance), the effects of happiness/awe can also be interpreted from a transition of emotion perspective. Specifically, when the participants first encountered the description and argument about the comprehensive exam, they were likely in the emotional state induced by the video clips. However, the further they read the message, the more the effects of that message. It's possible that as they were reading the message, their feelings toward the comprehensive exams became stronger, and eventually replaced their initial emotional state. As a result, an alternative way to interpret the data is to consider the effects of happiness/awe on cognition as interaction effects between the emotional state they were in (i.e., happiness, awe, neutral) and the emotional state elicited by the message (e.g., anxiety, annoyance).

Information Processing, Information Recall, and ELM

The traditional elaboration likelihood model (ELM) predicts that regardless of other factors, a strong argument and credible source should always lead to a more positive attitude (Petty & Cacioppo, 1986). In this study, argument strength was a significant predictor of attitudes. On the other hand, although having been pretested, source credibility did not influence attitudes. This may be due to the flawed design of the stimuli. There's only one sentence that stated the source (e.g., "Taylor Smith is a college student"), and therefore participants may have glanced through the argument and overlooked the source. The results may be different if the sources were made more obvious to the participants (e.g., change fonts or color). ELM also predicted that information processing strategy (i.e., elaboration) will moderate the relationship between argument strength/source credibility and attitudes. However, this study didn't find such moderation effect. As mentioned above, the short length of the manipulation materials may have reduced the moderating effect of processing strategy.

On the other hand, information recall was found to significantly influence attitudes. The results of this study revealed that information recall had a direct positive effect on attitudes when argument strength and source credibility were controlled. Moreover, information recall moderated the relationship between argument strength and attitudes. Specifically, when participants recalled more accurate details in the free recall question, the effects of argument strength on attitudes became stronger. In other words, when participants paid more attention to and remembered more of the details in the argument they read, a strong argument was more favorable.

Information recall is not a commonly studied variable in ELM studies, but it is considered an indicator of processing in some studies (e.g., Mitchell, Brown, Morris-Villagran, & Villagran, 2001). Although information processing and information recall were correlated in this study (see table 4), I argue that these two should be treated as different concepts. That is, even when people remember the details, it does not necessarily mean that they systematically process it. One possible explanation of why information processing was found nonsignificant but information recall was significant is that participants may not consciously form the attitudes toward the comprehensive exam until they were asked about it. Therefore, at that point, if participants remembered more information about the exam, they were more likely to base their attitudes on that information. However, because in this study, attitudes were measured before recall, so there's no direct support for this proposition. Future studies should address this point by altering the order of measures.

Implications

The current study has several theoretical implications for emotion and cognition theories. First, the results of this study demonstrate the importance of a discrete emotion perspective. Many emotion studies only focus on the valence aspect of emotion and categorize emotions as positive or negative. Nevertheless, this study shows that even when the valence is the same, emotions (i.e., happiness and awe) can have different, even opposite, psychological effects. Second, this study expands current understanding of awe as a discrete emotion. The results reveal that awe can motivate people to elaborate information as well as make people perceive that they have more cognitive resources at

hand. Moreover, awe has been found to facilitate memory retrieval through recognition and recall. These findings shed some lights on the nature and effects of awe. It is noteworthy that the studies of awe so far, including this one, mostly looked at pleasant awe experience. Whether an unpleasant awe experience would change the direction or the significance of the awe effects remains unclear.

Previous studies on general positive emotions suggest that positive emotions such as happiness facilitate heuristic processing because they reduce one's motivation and inhibit one's ability to process information (Bless et al., 1996; Schwarz, 1990; Isen, 1987). Results from this study showed that happiness only influenced motivation but not the ability to process information. This finding implies that happiness influences motivation and ability in distinctive ways. More studies are needed to disentangle the effects of happiness.

The study also found that information recall has a significant influence on persuasion. However, inconsistent with ELM, the moderation effect of information processing was not found. Taken together, this suggests that information recall should be considered as a factor to advance the validity of ELM model. The question is then, how does memory fit in the ELM model? Is it compatible with information processing? Does it mediate the moderation effect of information processing? Some caution should be used when conceptualizing and operationalizing information processing and information recall.

Since emotion is commonly used as a tool in persuasion, it's critical to determine what factors contribute to persuasion and what's the role of emotion in this process. Practically, this study suggests that emotion should be strategically elicited to meet

various persuasion goals. The results of this study offer advertisers and marketers a better understanding of how happiness and awe can influence message processing and recall, which eventually leads to attitude change. In this regard, advertisers and marketers should pay close attention to the content of the persuasive message when awe is evoked by the stimulus to avoid unwanted consequences due to consumers' increased scrutiny of the message.

Limitations and Future Research

This study has many limitations, which is typical of experimental research. First, this study used a convenience sample that consists of college students. The topic of the argument is tailored to this sample. Because of this, it is difficult to generalize the results to the general population. Future studies should adjust the topic and recruit different participants from other age/race/nationality groups. Second, the data were collected via an online experiment. Therefore, it's hard to control or monitor what participants were doing while they were taking the experiment. Although participants who showed traces of poor attention or concentration were eliminated during the data cleaning process, it's still not guaranteed that every participant paid full attention due to the nature of the study. Future studies should include attention check and may place time restrictions to increase the reliability.

The greatest limitation of the study was the manipulation argument strength and source. As discussed above, due to the short length of the argument, the effects of emotion on information processing and information recall were not entirely found. For future works, the manipulation should increase the length of the message to the extent

that it reveals the effects of general positive emotions but does not evoke frustration or boredom. Also, the results imply that manipulation of source credibility was unsuccessful. Due to the design of the message, the source information might be ignored by participants. Future studies should try to highlight the source to ensure that participants are aware of the source.

The awe eliciting videos in this study induced both happiness and awe. Nevertheless, according to the conceptualization of awe, awe experience can be unpleasant as well (Keltner & Haidt, 2003). Therefore, scholars who are interested in this emotion should test the effects of unpleasant awe experience and compare it with other discrete emotions (e.g. anger, sadness). Moreover, this study only looked at the influence of awe on cognition. Future studies should continue to examine other psychological and behavioral effects of awe. For instance, awe is considered as a self-transcendent emotion that promotes compliance with social groups, but the underlying mechanisms of awe's influences on the tendency of prosocial behaviors are not clear. Rudd and colleagues (2012) found that awe reduces impatience and expands one's perception of time, which in turn facilitates people to do more volunteer work. Scholars could examine other mediators such as the need for belonging and self-efficacy. Also, future works can test whether the findings of awe in this study can be applied to other self-transcendent emotions such as compassion or gratitude.

Conclusion

Emotion has been widely studied in the recent few decades. The power of emotions lies in the possibility that they can influence one's cognition and behavior.

Some clear patterns of the effects of positive and negative emotions have been found. Specifically, positive-valenced emotions are thought to inhibit message elaboration and facilitate heuristic processing while negative-valenced emotions have the opposite effects. Yet, recent studies on self-transcendent emotion awe revealed that there are questions remained to be answered regarding the nature and the effects of discrete emotions.

This research was designed to examine the psychological effects of awe on information processing and information recall, which in turn influence the attitudes. Consistent with the hypotheses, awe was found to increase information processing while happiness was associated with less information processing. For instance, a higher level of awe was correlated with more number of thoughts listed after participants read the argument, and those thoughts were more in-depth and relevant. Also, when participants experience awe, they reported being more easily to allocate their cognitive resources. In addition to information processing, awe was found to increase recall of details as well, which was correlated with more favorable attitudes. In sum, this study points out the importance of adopting a discrete perspective of emotions. This study also sheds light on a better understanding of the emotion of awe and suggests various avenues for future research.

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Appendix A Manipulation Material

General Introduction of the Proposal

American Association for Higher Education (AAHE) has recently proposed that all senior college students should be required to pass comprehensive exams in order to receive a degree. Faculty and students from universities that already have a comprehensive exam policy have been interviewed about whether the comprehensive exams are effective. The AAHE is now collecting a second round of data from students from universities that don't have a comprehensive exam yet. The final decision on the proposal will be made by the end of 2019. If the proposal is approved, the comprehensive exams will be instituted starting from 2022.

To help with this assessment, you will be presented with a specific argument from one source related to this proposal, and asked to evaluate the idea.

Arguments in Favor of the Proposal

Strong Argument, Credible Source 1

The following argument is posted by Taylor Smith on Facebook.

Taylor Smith is an officer of the United States Department of Education. Taylor wrote on Facebook that:

"Data from the University of Virginia, 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 Bob Picciano, 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."

Strong Argument, Credible Source 2

The following argument is posted by Taylor Smith on Facebook.

Taylor Smith is a college instructor. Taylor wrote on Facebook that:

"Data from the University of Virginia, 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 Bob Picciano, 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."

Strong Argument, Non-credible Source 1

The following argument is posted by Taylor Smith on Facebook.

Taylor Smith is a stay-at-home parent whose son is a college student. Taylor wrote on Facebook that:

"Data from the University of Virginia, 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 Bob Picciano, 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."

Strong Argument, Non-credible Source 2

The following argument is posted by Taylor Smith on Facebook.

Taylor Smith is a high school student. Taylor wrote on Facebook that:

"Data from the University of Virginia, 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 Bob Picciano, 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."

Weak Argument, Credible Source 1

The following argument is posted by Taylor Smith on Facebook.

Taylor Smith is an officer of the United States Department of Education. Taylor wrote on Facebook that:

"Data from the University of Virginia 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 Martin Picciano, a student whose father is a vice-president of IBM wrote in the school newspaper: 'The history of 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.'"

Weak Argument, Credible Source 2

The following argument is posted by Taylor Smith on Facebook.

Taylor Smith is a college instructor. Taylor wrote on Facebook that:

"Data from the University of Virginia 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 Martin Picciano, a student whose father is a vice-president of IBM wrote in the school newspaper: 'The history of 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.'"

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Appendix B Questionnaire

Emotion Induction

In the first task, we are interested in your feelings about a video clip. Please watch the following video clip and answer the questions. (Note: adjust your volume so you can hear the sound)

Neutral Videos:

<https://youtu.be/YDwbaQQTSRY>

<https://youtu.be/XKyfkzKNpYA>

Happiness Videos:

<https://youtu.be/IChGZxGyuY4>

<https://youtu.be/wfod9yXrbZI>

Awe Videos:

<https://youtu.be/vfdTrKTrpg4>

<https://youtu.be/7TOd7STgL88>

Emotion Scale

The following questions were asked on a 7-point Likert-type scale

Please indicate how much you feel each emotion on the following scales.

After watching the video, I feel...

1. Angry
2. Irritated
3. Annoyed
4. Sad
5. Downhearted
6. Unhappy
7. Scared
8. Fearful
9. Afraid
10. Interested
11. Alert
12. Curious
13. Glad
14. Happy
15. Joyful
16. Awe
17. Wonder
18. Amazement

Attitude Scale

The following questions were asked on a 7-point semantic differential scale

After you read the argument about the comprehensive exam, please indicate your positions on the statements listed below:

Comprehensive exams for seniors are:

1. Good/Bad (reverse coded)
2. Unpleasant/Pleasant
3. Beneficial/Harmful (reverse coded)
4. Unfavorable/Favorable

Difficulty of Allocating Cognitive Resources

The following questions were asked on a 7-point Likert-type scale

Please indicate the extent to which you agree or disagree with the following statements.

1. I found it difficult to think about the argument about the comprehensive exam.
2. I was able to pay close attention to the argument about the comprehensive exam. (reverse coded)
3. It was easy to understand the argument about the comprehensive exam. (reverse coded)

Thought-listing

Please list up to five thoughts that **helped you to form the attitudes** toward the proposed comprehensive exam. Your thoughts may have been about the author of the argument, or about the proposal of comprehensive exams, or neither. Just try to remember the thoughts that occurred while you were reading the online post about the comprehensive exam.

Information Recall (Open-ended Question)

Please write down as many **FACTS** as you can remember in the argument posted on the blog about the comprehensive exam.

Information Recall (Multiple Choice Questions)

In the following questions, please select the correct answer based on the information you read about the comprehensive exam.

Which of the following organizations made a proposal for implementing comprehensive exams for senior college students?

- American Association for Higher Education (AAHE) (Correct)
- American Commission of Higher Education (ACHE)

- National Higher Education Association (NHEA)

If the proposal is approved, the comprehensive exams will be instituted starting from which year?

- 2022 (Correct)
- 2020
- 2021
- 2019

The final decision on the proposal will be made by the end of which year?

- 2019 (Correct)
- 2020
- 2021
- 2022

In the blog post made by Taylor Smith, data from which of the following universities were referenced to assess whether comprehensive exams should be instituted?

- University of Virginia (Correct)
- University of Pennsylvania
- Vanderbilt University

Demographic Questions

Finally, we want to know more about you. Please answer the following demographic questions.

What is your gender?

- Male
- Female
- Other

What's your age? (e.g. 18, 19, 20)

What's your academic standing?

- Freshman
- Sophomore
- Junior
- Senior

Choose one race that you consider yourself to be:

- White
- Black or African American
- American Indian or Alaska Native
- Asian
- Native Hawaiian or Pacific Islander

- Other _____