THE ROLE OF SELF-CONSCIOUS EMOTIONS ON INFERENCE GENERATION

A Thesis by

Brady A. Marzolf

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The following faculty members have examined the final copy of this thesis for form and content, and recommend that it be accepted in partial fulfillment of the requirement for the degree of Master of Education with a major in Educational Psychology.

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Marlene Schommer-Aikins, Committee Chair

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Catherin M. Bohn-Gettler, Committee Member

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Gayla Lohfink, Committee Member

DEDICATION

To my parents, who inspired my love of reading and learning.

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ABSTRACT

Emotion may play a critical role in a reader's ability to comprehend text. Past research has shown that happy and sad emotions influence processing, which can impact comprehension. More specific emotions, such as self-conscious emotions, require a reader to allocate more cognitive resources to process those emotions. This study examines the effects of pride, shame, guilt, and neutral emotions on readers' abilities to generate bridging inferences. After an autobiographical memory task, participants read texts and answered questions that required a bridging inference to be generated. Response times and accuracy rates for the inference generation task were examined. Statistically significant effects of emotion were found when examining accuracy rates for knowledge validating questions: Pride may facilitate general knowledge activation during reading. The results suggest that emotion may play an important role in learning, and hence should be attended to by educational professionals.

TABLE OF CONTENTS

Chapter 1 - Introduction

Whether someone is reading for pleasure or for education, reading comprehension is important to children and adults. For learning purposes, students rely on reading comprehension in order to learn and complete coursework in most subjects. For example, students must read in order to write essays or learn the proper order of operations for algebra. In practical and vocational settings, adults require comprehension skills as well, whether it is reading instructions for their job or following instructions to construct furniture in their home. In order for such successful comprehension to occur, multiple processes are utilized to form a mental representation of text. Although several theories attempt to detail the processes that underlie comprehension, the predominant model is the tri-partite theory. This theory defines comprehension as the process that involves combining text information with what one already knows (Kintsch & van Dijk, 1978). An important component of this is inference generation, which is when readers make connections between textual elements and prior knowledge in an effort to derive meaning from the text (Graesser, Singer, & Trabaso, 1994).

Many variables can influence how a person understands text. The reader themselves is one variable. This includes the reader's attention span, attention-allocation skills, inferential skills, background knowledge, and basic reading ability (Thurlow & van den Broek, 1997; van den Broek & Kremer, 1999). The current study will examine the way the readers' emotions can impact inference generation involved in reading comprehension. Previous research has studied mood and how it influences reading comprehension (Bohn-Gettler and Rapp, 2011; Egidi and Gerrig, 2009). Bohn-Gettler and Rapp (2011) discovered that readers experiencing positive moods construct more text-based inferences than readers who are in a neutral mood do. A positive mood could possibly benefit processes involved in comprehending text. However, this

work generally examined positive versus negative moods, but not specific emotions that may occur in learning settings. Pekrun (2006) researched specific emotions that can come about in academic situations. Academic emotions relate specifically to achievement and the results of classroom tasks. These emotions can also be self-conscious, meaning that an individual's self-representations can be influenced by their emotions (Tracy & Robins, 2007). Pride, shame, and guilt are among these emotions, because they are reflective of how a person feels about themselves and their skills/performance. Such emotions require people to use their limited cognitive resources to generate and process these specific emotions.

Comprehending text, generating inferences, and managing emotions require several processes that can place extra strain on a person's already limited cognitive resources (Ellis, Thomas, & Rodriguez, 1984). Too much strain can lead to an individual placing less attention on other cognitive tasks. To examine how this might occur, Forgas (1995) developed the affect infusion model, which states that affect, moods, and emotions can impact cognition when engaging in constructive processing. Complex inferences require that readers construct connections between textual information and prior knowledge, and hence emotions may influence inference generation during reading.

Understanding the role emotion may play in inference generation is vital for explicating the factors involved in text comprehension. The current study examines self-conscious emotions and inference generation during reading. Participants will experience the emotions of pride, shame or guilt. Once these emotions are induced, participants will read texts and generate inferences. It is hypothesized that the positive emotion of pride will facilitate inference generation, whereas the negative emotions of shame and guilt will hinder it.

Chapter 2 – Literature Review

Comprehension and Inference Generation

Kintsch and van Dijk (1978) developed the tripartite theory, which provides a definition for reading comprehension as well as a framework upon which modern comprehension research is based. During the process of comprehension readers build a mental representation of the text. A mental representation is a collection of the text information and ideas that the reader creates in his or her mind. In order to achieve a high level of comprehension, the reader must have a coherent mental representation of the text. The tripartite theory describes comprehension as involving three different levels that are organized from the most superficial level to deeper levels of encoding information from a text. The three levels in this model are the surface structure, the propositional level (also referred to as the textbase), and the situation model. The most superficial level is the surface structure, in which a reader would simply encode the words seen during reading. At this level, readers see and recognize words and can memorize them, but do not necessarily attach much meaning to them. Consider the example, "Don looked back at the house one last time as he drove away." At the surface structure, readers simply encode the words and their grammatical structure without necessarily their meaning, and may simply memorize that sentence.

The second level, the propositional (or textbase) level, involves a reader encoding gist meanings from the text into memory. At this level, only the basic meanings of the words are encoded. For instance, in the example about Don, the reader would encode that Don is driving as he leaves his home. Thus, although the exact words are not encoded, the general meanings of the words are encoded.

The third and deepest level is the situation model. At this level, the reader encodes more than just the meaning of the words in the sentence, but also makes connections by generating inferences based upon the sentence contents, logical deductions, and their own background knowledge. Again, when considering the example of Don, a reader would encode more than simply that Don is driving away from a house. Using clues from the sentence and background knowledge, a reader may also generate the inference that Don is driving a car (which is not explicitly stated), and that he is moving and taking one last look at his home as he leaves for a new one.

In line with the tripartite theory, McKoon and Ratliff (1992) define comprehension as a combination of what is explicitly stated in the text and what the reader already knows, allowing them to make inferences. An inference is defined as information that is not explicitly stated in the text, and thus that a reader "fills in" to aid comprehension. Thus, a vital part of reading comprehension is inference generation. Graesser, Singer and Trabasso (1994) developed a theory of reading comprehension stating that readers use background knowledge stored in long-term memory to generate inferences. They also determined that the background knowledge used in generating inferences ranges from generic to specific. Generic background knowledge refers to information that constitutes general world knowledge and is easily accessible in memory. For example, if the word "school" is mentioned while reading a text, a reader can use generic knowledge to know there are desks, chalkboards, and more inside of a school. However, sometimes readers have to use more specific knowledge. For example, if someone were reading instructions on how to make bread, they would need specific understanding regarding how yeast reacts in order for the bread to rise.

In addition, inference generation can occur automatically or strategically (Graesser et al., 1994). Automatic inference generation occurs without conscious thought from the reader; it does not require attention from the reader and therefore does not interfere with other ongoing cognitive tasks. In contrast, strategic inference generation is a process that readers use intentionally in order to better understand text. Magliano, Trabasso, and Graesser (1999) found that readers use strategic inference generation as a method of better understanding what they are reading. The reader is actively engaged in strategic processes such as increased attention, activating background knowledge, using logic, and re-reading to understand the text; therefore it requires more attention and cognitive resources than automatic inference generation. During strategic processing, cognitive resources cannot be used elsewhere. In contrast, during automatic processing, cognitive resources can be used elsewhere for other tasks (Thurlow & van den Broek, 1997).

Causal Inferences

One example of an inference that can be either automatic or strategic is the generation of causal inferences. Causal inferences are generated by readers to facilitate understanding of cause-and-effect relationships when such relationships are not stated explicitly in a text. When comprehension is considered as a search for understanding, causal inferences are crucial to help determine why specific events occurred, which thus maintains a coherent understanding of the text (Trabasso, van den Broek, & Suh, 1989). Generating these types of inferences allows the reader to create a timeline of events to better understand what they are reading. In addition to generating causal inferences, the reader uses the information to better understand the relationships between events within the text (Tapiero, van den Broek, & Quintana, 2002; Thurlow & van den Broek, 1997; Trabasso & van den Broek, 1985). There are three different

types of causal inferences that can be generated: backward, forward, and elaborative. Backward inferences are generated when a reader refers to a previous sentence or statement in order to understand the sentence they are currently reading. Forward inferences occur when a reader uses prior knowledge stored in long-term memory to predict what will happen next in the text (Graesser et al., 1994). Elaborative inferences also use background knowledge, but do not attempt to predict or look back in the text. Instead, they seek to explain the current text by utilizing a reader's prior knowledge (McKoon & Ratcliff, 1989). Thurlow and van den Broek (1997) state that one type of elaborative inference is a consistent inference, which occurs when a reader expands upon what is written in order to make the text logically consistent.

When long-term memory cannot be counted upon to make an inference a reader will then make a bridging inference. If the current sentence cannot be understood with automatically accessible, general background knowledge, then the reader must create a bridge between different pieces of information contained within the text in order to understand the content (Singer et, al, 1992, Haviland & Clark, 1974, Kintsch & van Dijk, 1978). For example, imagine that a student is reading a history textbook and reads that the American Civil War occurred from 1861 to 1865. This student also has the prior knowledge that Abraham Lincoln was in office from 1861 to 1865. If the student is asked on a homework assignment to name the president during the Civil War, the student can correctly infer the answer. Background knowledge that is easily accessible is typically the first step in comprehension. When that does not work, the reader will either refer to previous text to create a bridging inference or search their long-term memory to create an elaborative inference. Such inferences allow the reader to connect sentences so that they are better comprehended.

The Role of Affect in Cognition

Affect plays an important role in cognitive processing in several ways. As one example, anxiety can have a negative effect on learning and testing (Pekrun, 2006). In an effort to better understand how affect can influence cognition, Forgas (1995) provides a theoretical model that defines the important parts of affect. First, affect is a broad term that covers both mood and emotion. Next, mood is a general, low intensity state that lasts for an extended period of time. Finally, emotion is short lived but of high intensity.

Emotions can be both pleasant and unpleasant as well as have varying degrees of arousal. Arousal refers to the state of being able to respond to stimuli. At high levels of arousal, one's body may experience increased heart rate and blood pressure, as well as be more attentive to what is happening in the environment. At low levels of arousal, an individual may not be as attentive and not as responsive to stimuli. Hence, emotions are often categorized as a function of whether they are pleasant versus unpleasant, and also by the level of arousal it causes (high versus low). As an example, enjoyment can be a pleasant activating emotion because it is associated with increased arousal. In contrast, relief can be a pleasant deactivating emotion because it is associated with decreased arousal, but at the same time is pleasant because the person feels something negative has been removed. Anxiety would be categorized as an unpleasant activating emotion, whereas hopelessness would be categorized as an unpleasant deactivating emotion (Pekrun, Goetz, Fenzel, Barchfeld & Perry, 2011).

Forgas (1995) developed the Affect Infusion Model to explain the influences that affect can have on cognition. Forgas' theory contains two parts. The first part of the theory regards how emotions can differentially alter the types of processing that individuals use. Forgas specifies

four types of processing: direct access, motivated processing, heuristic processing, and substantive processing. First, direct access uses stored background knowledge about familiar items (Forgas, 1995). For example, if a person knows that there are trees in parks, that individual will use stored information to guess that most parks they see will have trees in them. This information can be recalled with minimal effort. Second, the motivated processing level also uses information stored in long-term memory, however this information is not as easy to retrieve because it is not necessarily general knowledge. For example, a person taking a history test might be asked what year Christopher Columbus sailed to find America. To answer this question they will have to access long-term memory to retrieve the answer (the year 1492). This method requires a greater degree of effort compared to direct access (Forgas, 1995). Third, heuristic processing involves processing information based upon rules that the individual has picked up through experience. Hence, general rules are applied to understand a situation. This type of processing can also treat affect as information. For example, if a person feels scared about taking a test, they can store this emotion as objective information to then attribute fear to all tests (even if this is not always accurate). Hence, it is a low-effort mode of processing, although it is considered "constructive" because it is filling in missing information. Fourth, substantive processing occurs when an individual uses analytic processing of a certain item. For example, a person who is trying to decide where to go to college will visit each college he or she is thinking about, gather information about where to live, what to major in, and more. This person will then take all pieces of information to mind and evaluate each school until deciding where to go. Hence, it requires a greater degree of effort compared to heuristic processing. It is also constructive because the individual must construct evaluations.

In summary, direct access and motivated processing do not require a high degree of creativity or constructive thinking (despite the varying levels of effort). According to the affect infusion model, direct access and motivated processing are therefore not influenced by affect. In contrast, heuristic processing and substantive processing are influenced by affect because these modes of thinking are considered creative and constructive (despite the varying levels of effort). Hence, the current study will examine heuristic and substantive processing that can occur when generating logical inferences, because such processing is more likely to be influenced by emotion.

The second part of the Affect Infusion Model broadly considers how positive versus negative emotions can have different effects on cognitive processing. Positive emotions are associated with open, creative and constructive thinking. Positive emotions can help a person to think more globally and also encourage him or her to encode and process information. Negative emotions, however, encourage a person to think more locally and on a more incremental level. In doing this the person will only search a narrow scope of information in order to respond and process information. They are not as likely to have as much of an open mind. These negative emotions also impact people in the way the read. When reading in a negative mood, according to the affect infusion model, the person should be more likely to analyze every small piece of information they read, regardless of its relevance.

Academic Achievement Emotions. Academic emotions are considered to occur in, and have an influence on, students, teachers, and academic settings. These are not emotions that are specific to academics, but rather refer to how specific emotions influence academic performance (Pekrun & Stevens, 2012). In particular, achievement emotions are elicited from academic activities and arise from receiving achievement-related feedback (Pekrun, 2006). Emotions

experienced during academic activities, such as studying, are referred to as activity emotions. In contrast, outcome emotions are experienced as a result of the outcome of an academic task, such as passing or failing an exam. The focus of the current research is on outcome emotions that are associated with either succeeding or failing at a task.

Positive emotions are associated with the feeling that everything is going well in the classroom. Positive academic emotions commonly investigated include hope, pride, enjoyment and relief. An activating emotion is one that will encourage a student to continue working toward good feelings, while a deactivating emotion is one that leads a student to cease action in order to avoid a negative feeling. Pride, hope, and enjoyment are viewed as activating emotions that can focus the learner's attention on a task and help them persevere on challenging tasks. They can provide increased motivation and enhance students' beliefs that they can achieve their goals. The current research focuses on the activating effects of pride (Tracy and Robins, 2007). Pride is defined as a positive, self-conscious emotion that arises from an achievement that is credited to an individual's ability or effort (Williams & DeSeteno, 2008; Langey, 1997; Tangney, 1999).

Negative emotions are also considered to have two dimensions; activating and deactivating. Activating negative emotions such as shame, anger, and fear tend to lead the learner toward having thoughts that are not relevant to their current task (Pekrun, 2006). These emotions can also decrease motivation to learn, which can lead the learner to give up on some tasks. However, the effects of negative activating emotions are not consistent, because in some cases they can motivate an individual to act in an effort to change the situation. Negative deactivating emotions are emotions that cause the learner to lose focus, thus taking attention away from the task at hand (Pekrun, 2006). Common negative deactivating emotions are boredom and hopelessness. The current research focuses on negative activating emotions, more

specifically shame and guilt. Shame is a negative activating emotion defined by feelings of low self-worth, and shame brings about feelings of self-debasement (Covington & Beery, 1976). Guilt is similar to shame in the sense that it can bring about bad feelings and can lead to an individual to question their representations of self.

A self-conscious emotion is one that the person is self-aware of and actively monitors (Tracy & Robins, 2007). This active monitoring sets emotions like pride and shame apart from other emotions. Self-conscious emotions require the person to generate self-representations in which they are evaluating themselves and then representing themselves using an emotion such as pride or shame. These emotions also develop later in childhood than other basic emotions like happiness and sadness. Self-conscious emotions also help people to attain social goals: For instance, perseverance can be driven by pride (Williams & DeSteno, 2008). These emotions also do not have outward expressions that are universally known. That being said, body posture can be combined with a facial expression to convey pride or shame (Tracy & Robins, 2004). Cognitively, self-conscious emotions are complex, which can make their expression and study difficult as well.

Emotion and Reading

When considering the work that separately examines comprehension and emotion, a number of potential hypotheses could emerge regarding how emotion could affect reading comprehension. In fact, previous work demonstrates that moods and emotions can influence comprehension processes that occur during reading, as well as memory after reading (Bohn-Gettler and Rapp, 2011). When a reader is feeling a positive mood, they are more likely to generate text-based inferences. Readers in positive and negative moods paraphrased text more

compared to readers in neutral mood. These results support research by Bless and Fielder (1995): Individuals in a positive mood are able to focus on a wider range of information and connect pieces of text with information stored in long-term memory. Participants induced in a sad mood generated fewer inferences than the readers in a positive mood.

When considering memory, emotional information tends to be more memorable therefore making it distinct in memory when compared to non-emotional information. Each person's cognitive resources are limited and the experience of emotions is taxing on these limited resources. If cognitive resources are involved in processing emotion, there still may be enough resources left to complete easy tasks. More difficult tasks may cause the individual to perform worse. However, it is possible that the type of mood may change the way the individual performs. Ellis and Ashbrook (1989) found that those in negative moods may focus attention on information that is irrelevant to the task at hand. As a result of this, individuals demonstrate decreased performance on problem-solving tasks and slower learning processes (Seibert & Ellis, 1991). Recent research states that positive and negative moods can lead to the individual processing information differently. These studies look at moods in the range of just positive and negative. But more specific emotions can come into play in classroom settings, making it important to extend the research beyond basic emotions.

Hypotheses

The current study will focus on the role of pride, shame, and guilt on inference generation in readers. In particular, it will focus on how emotions that are more specific than just positive and negative moods (pride, shame, and guilt) might influence on inference generation. This is

helpful in developing an understanding of how emotions influence comprehension in academic settings.

In this study, participants thought about and wrote down a past event where they felt pride, shame or guilt, in order to induce that specific emotion. Upon completion of emotion induction participants then took part in a task where they generated bridging inferences. Previous research has shown that the emotion induction task of writing about past events is effective in inducing emotion (Kraus, Adler, & Chen, 2012; Laird & Strout, 2007; Schwarz & Clore, 1983; Westermann, Spies, Stahl, & Hesses, 1996). Based on this previous research, the first hypothesis was that participants would successfully be induced to feel pride, shame, and guilt.

Negative self-conscious emotions require a greater amount of cognitive processing than other emotions. Hence, participants induced to feel these emotions may need more time to produce inferences (Pekrun, 2006). Bridging inferences require individuals to make connections between pieces of text so this requires the participants to use more cognitive effort (Forgas, 1995). Affect infusion is more likely to take place during tasks that require more cognitive effort; therefore it was hypothesized that those induced to feel negative self-conscious emotions would be less accurate than those in a neutral mood.

Finally, although self-conscious emotions require individuals to use cognitive resources to process the emotions, there may be a difference between the specific emotions of pride, shame and guilt. Pride is a positive activating emotion and can aid performance and increase an individual's motivation (Pekrun, 2006). This should lead to individuals in the pride condition to generate more accurate inferences and do so more quickly than those in the guilt and shame conditions. Thus, it was hypothesized that pride should aid in inference generation relative to

guilt and shame, which should hinder inference generation. This should result in participants in the pride condition producing more accurate inferences than those in the other emotion conditions.

Chapter 3 - Method

Participants

This study included 92 participants currently enrolled in undergraduate and graduate degree programs. These participants were recruited from education and psychology classes at a Midwestern university. Some of these participants were given extra credit as part of their classroom grade for their participation, as set by their professors. All participants were native English speakers so that language would not affect the results, because reading in a second language may modify reading behaviors.

Materials

State Shame And Guilt Scale (SSGS; Marschall, Saftner, and Tagney, 1994). The SSGS is an instrument designed to measure an individual's feelings of shame, pride, and guilt. This scale measures state emotions, which means they measure how the participant is currently feeling at that moment. This is in contrast to trait emotions, which refer to how the individual generally feels the majority of the time. The SSGS is comprised of fifteen items: five that measure pride, five that measure shame, and five that measure guilt. Participants responded to each item, rating how they felt on a 5-point Likert scale. Reliability was calculated by the creators for each emotion, with inter-item reliability scores of .89 for shame, .82 for pride, and .87 for guilt. See Appendix A for the SSGS scale.

Emotion Induction. Each participant was randomly assigned to one of four conditions, in which they were induced to feel pride, shame, guilt, or neutral emotions (the control group). To accomplish this, participants completed an autobiographical memory task in which they were asked to write about a time when they felt the emotion they were assigned to (pride, shame, or

guilt; Kraus, Adler, & Chen, 2012; Laird & Strout, 2007; Schwarz & Clore, 1983; Westermann, Spies, Stahl, & Hesse, 1996; see Appendix B). The control group (neutral emotions) was asked to remember waking up that morning. Participants were asked to visualize a specific event that made them feel that way. Participants were then asked to write in as much detail as possible, everything they remember about that event, including the environment, to the people around them, and even what they were thinking in that moment. (See Appendix B for the specific instructions.) In an effort to increase the likelihood that participants wrote about an emotionally meaningful event, the researchers did not collect or analyze what the participants wrote. Instead, participants were given the choice to either keep what they wrote or place it in a sealed envelope to be shredded so that no one else read what was written. The participants manually wrote about the event and wrote for a full ten minutes, even if they had to repeat some parts of what they had already written.

Inference Task. The inference task that was used in the current study was developed by Singer, Andrusiak, Reisdor, and Black (1992). The goal of the task was to measure how many correct inferences the participants would generate. Participants read six short three-sentence paragraphs that presented a combination of information including real world knowledge as well as made-up objects (e.g., a "hab"). The participants used information presented in the text, background knowledge, and logical deductions to generate correct inferences. At no point did the participants receive feedback about whether or not they were answering questions correctly. The first paragraph served as a practice task and the other five paragraphs were used to measure inference generation. The full list of paragraphs and questions is included in Appendix C. An example of a paragraph is:

A KIY is brighter than a spotlight.
A candle is brighter than a HAB.
A JUR is brighter than a KIY.

After reading each paragraph, the participant answered 18 yes or no questions. These questions required them to form inferences based on what they read as well as their background knowledge. Each item came from one of four categories. The first category represents *access* items, which require the participant to access real world knowledge and pair it with a statement from the paragraph. For example, "A KIY is brighter than a candle". This would require the reader to know that while the text states, "A KIY is bright than a spotlight," that a KIY would also be brighter than a candle. This inference uses real world knowledge that spotlights are brighter than candles.

The second category represents *memory* items. These items are presented directly in the paragraph and the participant is to recall that item to get the correct answer. For example, "A JUR is brighter than a KIY". This sentence was explicitly stated in the paragraph, and thus does not require generating an inference or incorporating background knowledge.

The third category represents *simple inference* items. These items can be answered by logically deducing relationships from the information provided in the paragraph, and do not require the use of previous real world knowledge. For example, "A JUR is brighter than a HAB". This can be deduced from the paragraph using several pieces of information. First, the paragraph tells the reader that a JUR is brighter than a KIY. The paragraph also states that a KIY is brighter than a spotlight. Thus, using the knowledge that spotlights are brighter than candles, the paragraph states a candle is brighter than a HAB. So in this case, the KIY is brighter than the HAB, and with a JUR being brighter than a KIY, the reader can deduce that the JUR must also be brighter than a HAB.

Finally, the fourth category represents *real* items. There are statements that link actual concepts that the reader would know. For example, “A spotlight is brighter than a candle”. Although both “spotlight” and “candle” are included in the paragraph, they represent real-world items in which the participants will have knowledge about, and thus can use their prior knowledge to indicate that a spotlight is indeed brighter than a candle (even though it is not explicitly stated in the paragraph).

Demographics. Upon completion of the experiment each participant was given a demographics questionnaire. Each participant was then asked to provide their age, gender, race, year in school, major, and their native language. See Appendix D for the demographic questionnaire.

Procedures

Participants began the session by completing the SSGS in order to establish a baseline for their current feelings of pride, shame, and guilt. Upon completion of the SSGS, each participant was assigned to a pride, shame, guilt, or neutral mood induction condition. Once randomly assigned, participants then completed the autobiographical memory task. This task required the participant to write, in detail, about an event that made them feel pride, shame, or guilt, or, in the control condition, to write about waking up that morning. They were asked to write about this event for a full ten minutes. The participants may have had to repeat themselves in their writing because they were required to write about their event for a full ten minutes. After the autobiographical memory task, the participants completed the SSGS for a second time to determine whether their emotions changed as a function of the emotion induction task.

Following the second SSGS, the participants completed the inference task. On a computer utilizing E-Prime software, participants were asked if they were ready to begin, and they pressed the ready button to start the task. The first task was practice, but the participants were not aware of this. The participant read the paragraph, and spent as much time as they liked reading the paragraph. Once they finished reading the paragraph, they pressed a button to view the yes/no questions for each paragraph. The questions were presented one item at a time, and participants were not allowed to refer back to the paragraph. When presented with a test item, the participants answered yes or no using corresponding keys on the computer keyboard. The keys pressed were the "x" key (which was be labeled "yes"), and the ">" key (which was labeled "no"). Each test item had an answer time limit of six seconds, if the participant did not answer within six seconds it was counted as an incorrect response. Each question was presented one at a time and the next question appeared once the previous question was answered or after the time limit of six seconds. The order of the questions was randomized across participants.

After completing the inference task, participants were dismissed. They were brought back for a second session in which they were given the demographics questionnaire and were debriefed on the full intent of the study. During the debriefing process students who were in the shame and guilt conditions watched happy videos to ensure that they did not leave the study in a negative mood. The videos they viewed were short clips from the television show *Whose Line Is It Anyway?* (Bohn-Gettler & Rapp, 2011; Mirous, 2012; Rottenberg et al., 2007).

Chapter 4 - Results

Verifying the Validity of the Emotion Induction Procedure

The first hypothesis posited that the emotion manipulation would be successful. Hence, it was expected that feelings of pride, shame, or guilt would increase as a function of their corresponding emotion induction conditions. A repeated measures ANOVA was used. The independent variable was emotion. The dependent variables were the SSGS scores before and after the mood induction procedure. Four outliers were removed from the analyses because accuracy rates were considerably lower than the rest of the participants. Descriptive statistics can be found in Table 1.

When pride was the dependent variable, the main effect of pre- vs. post-induction was not significant, $F(1) = 1.12$, $p = .29$, $\eta^2 = .01$. The main effect of emotion condition was not significant, $F(3) = 1.31$, $p = .28$, $\eta^2 = .04$. However, the interaction between pre-post and emotion condition was significant, $F(3) = 3.76$, $p = .01$, $\eta^2 = .11$. The significant interaction shows that those in the pride condition scored higher on the SSGS pride questions than those in the guilt and shame conditions. Pretest scores were similar across all emotion conditions, but after the mood induction task those in the pride condition showed an increase in pride scores on the posttest. Those in the pride condition also experienced a decrease in their shame and guilt scores on the post test. Those in shame and guilt conditions experienced a decrease in pride scores on the SSGS between pre and post-induction. Participants in the control condition had no significant change in the pride scores. Hence, the pride induction was deemed effective.

When shame was the dependent variable, the main effect of pre- vs. post-induction was not significant, $F(1) = 1.54$, $p = .22$, $\eta^2 = .02$. The main effect of emotion condition was not significant, $F(3) = .97$, $p = .41$, $\eta^2 = .03$. However, the interaction between pre-post and emotion

condition was significant, $F(3) = 5.29$, $p = .002$, $\eta^2 = .15$. The significant interaction shows that those in the shame condition scored higher on the SSGS shame questions than those in the guilt and pride conditions. There was no difference in emotion scores in the pretest, but after mood induction those in the shame group experienced an increase in shame scores between the pretest and posttest. They also experienced an increase in guilt scores as well and a decrease in pride scores. Participants in the pride condition experienced a decrease in shame scores between pre- and post-induction, while those in the guilt and control conditions experienced no significant change in shame scores. Hence, the shame induction was deemed effective.

When guilt was the dependent variable, the main effect of pre- vs. post-induction was not significant, $F(1) = .123$, $p = .73$, $\eta^2 = .001$. The main effect of emotion condition was not significant, $F(3) = .93$, $p = .43$, $\eta^2 = .03$. However, the interaction between pre-post and emotion condition was significant, $F(3) = 5.50$, $p = .002$, $\eta^2 = .15$. The significant interaction shows that those in the guilt condition scored higher on the SSGS shame questions than those in the pride and shame conditions. While there was little difference between scores on the pretest, after mood induction participants in the guilt condition showed a large increase in guilt scores between the pre- and posttests. Their pride scores decreased and their shame scores remained about the same. Participants in the pride and control conditions experienced a large decrease in guilt scores, while those in the shame condition had a slight increase in guilt scores. Hence, the guilt induction was deemed effective.

Table 1

Means and Standard Deviations for SSGS Scores, by Emotion Condition

Emotion Condition	Pride Sum Scores				Shame Sum Scores				Guilt Sum Scores			
	Pre-Induction		Post-Induction		Pre-Induction		Post-Induction		Pre-Induction		Post-Induction	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Pride (n = 26)	18.12	3.87	19.58	4.06	7.5	2.06	6.54	1.94	9.53	4.05	8.35	4.44
Shame (n = 22)	19.27	4.65	17.86	4.88	6.96	2.48	8.36	3.55	9.23	4.19	9.18	4.56
Guilt (n = 25)	18.12	3.67	16.60	4.66	7.92	3.12	8.80	3.39	9.60	5.45	11.56	6.14
Control (n = 23)	19.61	3.47	19.52	5.31	7.61	3.56	7.44	3.87	9.00	5.12	7.83	5.49

Inference Tasks

Pearson correlations were conducted between the four different types of inference questions (access, memory, simple inference, and real inference). This served to examine the different types of stimuli and ensure replication of Singer et al.'s (1992) effects. See Table 2 for all correlations. Performance on memory questions was positively correlated with simple inference questions, $r(89) = .69$, $p < .01$, access questions, $r(89) = .58$, $p < .01$, and real questions, $r(89) = .24$, $p = .02$. Simple inference questions were strongly correlated with access questions, $r(89) = .79$, $p < .01$ and with real questions, $r(89)=.58$, $p < .01$. Access questions were strongly correlated with real questions, $r(89) = .61$, $p < .01$.

Table 2

Pearson Correlations Between the Different Questions Types

Question Type	Memory	Simple Inference	Access	Real
Memory	-	.69**	.58**	.24*
Simple Inference	.69**	-	.79**	.58**
Access	.58**	.79**	-	.61**
Real	.24*	.58**	.61**	-

* indicates statistical significance at the .05 level
** indicates statistical significant at the .01 level

The second hypothesis posited that those induced to feel negative self-conscious emotions would be less accurate than those in a neutral mood. The third hypothesis posited that pride should aid in inference generation relative to guilt and shame, which should hinder inference generation. Both of these hypotheses were tested with a two-way mixed ANOVA. The independent variables were the emotion induction condition (pride, shame, guilt, and control) and the types of inference questions (access, memory, simple inference, and real). The dependent variable was the participants' accuracy rates when responding to questions in the inference task.

The main effect of question type was significant, $F(3) = 24.764$, $p < .001$, $\eta^2 = .22$. Paired samples t-tests were conducted between question types in order to obtain post-hoc results. Post-hoc results indicated that the simple inference question type having higher accuracy scores than access type questions, $t(94) = 2.89$, $p = .005$, and a significant difference between simple inference and real questions, $t(94) = 2.89$, $p = .005$. Simple inference questions had higher accuracy scores than both access and real question types in post-hoc testing. The differences between other question types were not significant. The main effect for emotion condition was approaching significance, $F(3) = 2.582$, $p = .059$, $\eta^2 = .082$. The emotion condition of pride had higher accuracy rates on all types of questions when compared to the other emotion groups.

The interaction between question type and emotion condition was significant, $F(9) = 2.55$, $p = .008$, $\eta^2 = .081$. See Figure 1. Those in the pride condition performed better on all question types than those in the other three conditions (except for the "real" questions, in which the control and pride groups performed equally well). Participants in the shame condition performed better than those in the guilt condition when answering questions from the real

category. Those in the control group performed better than those in the shame and guilt groups for real, but were outperformed by shame and guilt participants in the memory category.

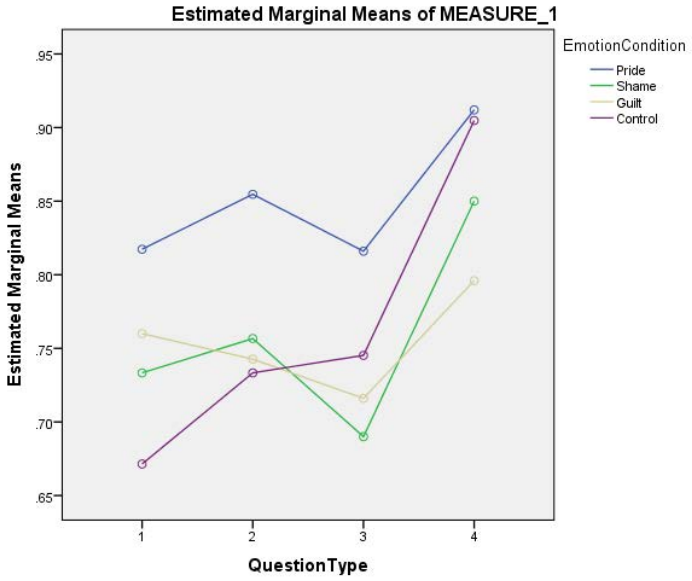

Figure 1
Differences in accuracy scores on each question type by each emotion condition. Pride, shame, guilt, and control are all indicated by separate lines and question type is indicated on the x-axis.
Note. Along the x-axis, 1 indicates memory questions, 2 indicates simple inference questions, 3 indicates access questions, and 4 indicates real questions.

CHAPTER 5

DISCUSSION

The goal of the present study was to determine the effects of specific self-conscious emotions (pride, shame and guilt) on bridging inference generation. The results yielded two important findings. First, the emotion induction procedure was effective with pre-induction and post-induction scores showing significant increases in the emotion that was induced as well as a decrease in the emotions that were not induced. Second, emotion influenced inference generation. Participants in the current study all demonstrated a statistically significant difference in accuracy rates when responding to bridging inference questions, as well as real world, access, and memory questions, when accounting for emotion condition. Hence, the results indicate that emotions may play an important role in inference generation. Each result of the current study will now be explained in greater detail.

Emotion Induction

The first hypothesis stated that emotion manipulation would be effective. This hypothesis was supported. The interactions between pre- and post-induction scores and emotion condition were significant for the measured emotions of pride, shame and guilt. Not only did pride, shame, and guilt scores increase when that emotion was induced, scores on the emotions not induced decreased. For example, participants in the pride condition experienced an increase in pride scores and a decrease in shame and guilt scores. This is important because previous studies have not utilized this autobiographical writing methodology with the emotions of pride, shame and guilt. Previous work often uses video induction tasks to look at more general basic emotions, such as happiness and sadness (e.g., Bohn-Gettler and Rapp, 2011). However, emotion induction tasks should be extended to more specific emotions that happen more readily in academic

settings. Going beyond happiness and sadness is helpful because it allows for an examination of more specific and nuanced effects of emotion on inference generation. Teachers can then use the information to create a better environment for learning. If a teacher knows happiness can lead to better inference generation, but that pride does so even better than general happiness, they can establish an environment that specifically fosters pride.

An important consideration, however, is that some research has found that pride and shame may not be entirely distinguishable. Scheff (1990) posits that shame and pride are both social emotions that come from how one views themselves from the standpoint of another. While shame is a feeling of negative evaluation and pride is a positive evaluation, their similarities could lead to them materializing the same in someone's mind. However, the results from the present study indicate that pride and shame are distinguishable: Participants in the shame condition experienced in an increase in shame scores as well as a decrease in pride scores and increase in guilt scores. Those in the guilt condition experienced an increase in guilt scores, a decrease in pride scores, and no change in shame scores. Finally, those in the control condition showed a slight increase in pride scores, and no change in shame and guilt scores between pre- and post-induction.

These results replicate previous work that autobiographical memory tasks can be effective for emotion induction (Kraus, et al., 2012, Laird & Strout, 2007; Schwarz & Clore, 1983; Westermann et al., 1996). The autobiographical task is more appealing than other methods, such as video mood induction, because the situation and induction is individualized to each participant's experiences, and hence is a more meaningful task that could lead to a more effective induction. However, the task is not without its limitations. The participants were asked to write for a full ten minutes, and to even repeat themselves if they ran out of things to write.

However, it is not realistic to force participants to keep writing. In addition, participants may not always complete the task as they are instructed. The researchers did not read what the participants wrote in order to encourage them to be honest and open about their experiences. The possibility exists that participants may have taken this as license to not write about anything pertaining to the autobiographical memory at all. Regardless, because the participant is recalling an actual event from his or her own past it can create a stronger emotion. The strength of this is that, if they follow the instructions, they are able to write and immerse themselves in a specific memory openly and honestly without fear of judgement or repercussion from the researchers. This can help produce a successful mood induction that can be stronger because the individual is personally invested in the story and memory. The data for the current study did indicate general effectiveness for the autobiographical memory task in induction the specific emotions of pride, shame, and guilt. Hence, despite the limitations of this methodology, it still produced the desired changes in emotion for most participants.

Inference Generation

Correlations. The correlations between question types replicated that of Singer et al. (1992). In some instances, the correlations in the present study were stronger than in Singer's original study. The current study found strong positive correlations between all questions types except memory and real question types (although this was significant in the present study, albeit with a smaller effect size than the other correlations), whereas the Singer (1992) study found that memory questions were significantly correlated with access and simple inference questions. Simple inference questions were significantly correlated with all question types. Finally, real and access types were correlated. These results are similar to Singer (1992) because the current study's weakest correlation was between memory and real, which was also the weakest, and non-

significant, correlation in Singer et al. Replicating Singer's correlation findings between question types lends strength to the inference generation task as a viable measure of accurate inference generation.

The correlation between real items and memory items was lower than all other correlations, both in the current study and in the Singer et al. (1992) study. This weaker correlation most likely occurred because there was no overlap in the knowledge required to answer these questions. Participants should be able to correctly answer the real world items, regardless of the material presented in the paragraphs, while the memory items require recall of what was stated in the paragraphs without the need to activate real world concepts. However, this correlation was statistically significant in the current study, but not in Singer et al. (1992). This may have occurred for two reasons. First, if the current study had a larger sample size, there could have been more statistical power that could lead to even stronger correlations. However, Singer et al. (1992) had a sample size of 149, compared to the current study sample size of 92. Hence, it is not likely that sample size contributed to the differential effects. A second, and more likely, possibility may be that the induced emotions strengthened the correlations. The presence of the self-conscious emotions perhaps facilitated, or in the case of negatively valenced emotions, hindered, performance as a whole. This effect on performance by the self-conscious emotions could have led to stronger correlations.

Emotions and Inference Generation. The second hypothesis stated that those induced to feel a self-conscious emotion with a negative valence would have lower accuracy rates when responding to questions due to the amount of cognitive load the self-conscious emotion placed on the individual's limited cognitive capacities (Pekrun, 2006). This hypothesis was supported because those in the shame and guilt conditions had lower accuracy rates on each question type

than those in the control and pride groups. Bridging inferences require individuals to make connections between pieces of text, which necessitates additional cognitive effort on top of managing a self-conscious emotion. Hence, affect infusion is more likely to take place during tasks that require more cognitive effort because the task and the emotion are both taking up space in working memory (Forgas, 1995). Shame and guilt, which are negatively valenced, could put a limit on cognitive capacity and lead to lower accuracy rates than a participant experiencing a positive emotion.

The third hypothesis stated that pride should facilitate inference generation while shame and guilt would hinder it. This was supported by the results that showed that those in the pride condition had higher accuracy rates when responding to all types of questions when compared to those in the shame and guilt conditions. The finding that pride significantly influenced inference generation aligns with the affect infusion model's finding that positive affect enables connections to be made between different concepts (Forgas, 1995). Taking the affect infusion model further, Bohn-Gettler and Rapp (2011) found that those in a happy mood were able to make more text based inferences than those in a sad mood. In this current study, pride could be compared to a happy mood because they are both considered positive emotions. Making text-based inferences requires activation of prior knowledge (Graesser et al., 1994), and positive emotions are associated with a broadening of activation of prior knowledge, and hence pride facilitated activation, which led to improved inference generation.

Limitations

Despite the success of the emotion induction and support of the first hypothesis, one limitation of the study is that some participants had participated in similar research study prior to participating in the current project. This is not ideal because participants may have recalled the

procedures, which could lead to expectation effects. However, this is less of a concern because a year had passed between the two studies, and fewer than 10 of the participants had participated in the earlier study. While the expectation effect may not have played a large role in the current study, it is important to account for prior experience in order to minimize bias that can occur in research.

Another factor to consider is the role of working memory in both emotion regulation and inference generation. Working memory is the capacity that an individual has to manage information during a specific task. The amount of working memory varies among individuals and processing and storage are determined by activation in working memory (Just & Carpenter, 1992). Bohn-Gettler and Rapp (2011) found that effects of emotion on reading depended on working memory, with readers with higher working memory scores being able to regulate emotions better than those who did not score as high. Individuals with higher working memory did not allow emotion to affect their reading processes to the same degree as participants with lower working memory. In the context of the present study, during the inference generation task, participants with lower working memory capacities may not have been able to recall the initial paragraph. This could lead to lower accuracy scores when responding to the questions. Participants with smaller working memory capacity could have difficulty using their limited cognitive resources to manage both emotions and inference generation simultaneously, while those with larger working memory capacities may have the ability to regulate both, leading to increased inference generation scores. Future work should consider interactions with working memory and how it might influence the accuracy rates for some participants.

Two other important factors to consider are the effects of utilizing two experimental sessions to collect the data, and the nature of the inferencing task. Utilizing two sessions reduced

(but did not eliminate) possible fatigue effects, but allowed for emotions to potentially change between the two sessions. (Note, however, that the inference task occurred all in one session, and this was the task of interest.) The inferencing task itself was challenging, which may have frustrated participants. Such frustration may have led some to decide not to come back for the second session and debriefing process. It should also be noted that some courses had a work day during the second session and some student chose not to come to class that day. Another class had a test, and several students chose to take the test and then leave (hence skipping the experimental session).

Fatigue may have also played a role in the results of the study. The inferencing task contained five paragraphs and 90 questions in total, which could have led to increased fatigue among participants. One way to account for this in future studies would be to limit the number of paragraphs and questions the participants see. Future studies could rotate in three paragraphs per participant rather than everyone seeing all five. The length of the study also could have impacted the emotion induction. It could be possible that the emotion induction wore off over time as students fatigued. It is also possible that students feeling shame and guilt may have tired more quickly. Those feeling pride may have persevered because of that feeling of pride. These factors should be studied further in future research.

Finally, participants received extra credit for participating in the study. It is worthwhile to consider this as a potential motivational variable: There could be a connection between being motivated to complete the study and trying harder on the tasks because of the extra credit. There could also be selection bias, such that only students who were motivated to receive the extra credit participated. Participants could feel compelled to work harder because they are receiving extra credit. However, per ethical guidelines, it should be noted that the participants received

their extra credit simply by participating, and not based upon their results or full completion of the tasks.

Future Considerations

A strength of the current study was the careful consideration given to the research design. First, the measures used in this study had been normed and used in previous research, therefore the measures are documented to be both reliable and valid. Second, the research was conducted in a setting in which most variables were controlled. Variables such as room temperature, outside noise, tables, chairs, time allotted to complete activities, and random assignment were used to increase reliability and internal validity. Actual academic settings do not allow for such a controlled environment though, so future research should study if these findings can be extended into more naturalist classroom environments. Future studies may also consider finding participants from non-academic populations, obtaining a more diverse sample, and controlling for working memory capacity. While controlling working memory might increase internal validity, it can reduce external validity because working memory cannot be controlled for in naturalistic educational settings.

The Singer et al. (1992) inference task used in this study has been validated in prior work, however may lack some external validity: It may not be reflective of every day educational settings. That being said, the skills it assesses are used in academic tasks. It is realistic that a student would be given a set of paragraphs with both real world and new information and then be asked to respond correctly to questions about what they just saw, and identify relationships among those concepts. Although students are not often presented with nonsense words, the inference task involves processing skills that would present themselves in numerous real world tasks. The need to memorize and order and organize information is used on a daily basis. In the

educational world, students are required to bridge information and make inferences in text every day. Future work should extend these findings to other types of authentic academic tasks, such as making inferences about content-area texts or literature.

Implications

This research may be able to inform to important applications in the classroom. These findings support a body of work that documents the effects of emotion on comprehension and even extends it further by examining self-conscious emotions. Pekrun (2002) found academic emotions relate to motivation, learning strategies, cognitive resources, and achievement. This study supports the idea that academic emotions may play a role in activation of knowledge. If emotion can facilitate knowledge activation, this could have an impact for teachers looking to improve comprehension skills. In the classroom, teachers can encourage an environment that promotes positive emotions such as pride to help students activate relevant knowledge.

Teachers can promote pride through the use of positive feedback. Even if a student did not perform as well as others on a particular assignment, a teacher's feedback can focus on what the student did correctly, provide constructive criticism for improvement, and highlight how the student's work has been improving over time. When a student performs well, teachers should provide positive, authentic feedback that focuses on self-growth as opposed to comparing the work to other students (i.e., to prevent hubris). Another way to prevent hubris would be to provide insight into what a student could do better, even though they did very well. Slavin (2012) posits that praise should be comprised of three aspects for it to be effective. First, it should be contingent, meaning that the student only receives praise for behaviors and achievements that are well-defined. Second, it should be specific. The teacher should point out specifically what the student did well. This provides the student with an example of what is and is not praised. Hubris

is prevented because they are being praised for specific achievements that are concrete. Finally, it should be credible. This mean it should be sincere for good work. Each student should be praised differently, according to his or her usual level of performance (Slavin 2012). This can prevent hubris because the students will know that only their best work will lead to praise. This, presented in a positive manner, would hopefully provide realistic pride, while preventing hubris, as well as shame and guilt. Hence, the results of the current study provide evidence for importance of fostering authentic pride in students to facilitate higher-order thinking and inference generation.

However, it is important to consider whether the results of this study can be generalized to broader educational settings and to students of different age groups (i.e., elementary, middle, and high school students). The current study was only conducted with adult learners. Adults have an awareness of their emotions and greater emotion regulation skills. This requires metacognition, which is a skill that younger learners are still gradually developing (Slavin 2012). Hence, it is possible that more developed metacognition skills are requirement for classroom management and feedback promoting authentic pride to be effective. Further studies should investigate the roles of emotion and learning among younger participants and in authentic classroom settings. In addition, motivation could be a pre-cursor to emotions playing a role: If a student is not motivated to complete a task, it becomes impossible to examine how emotions affect processing while completing that task. If a teacher builds a positive relationship with a student, it may increase the student's motivation and desire to exert effort (Slavin 2012). If a student is motivated, they may perform well for that teacher and these results could then lead to feel pride.

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APPENDIXES

Appendix A

SSGS

The following are some statements which may or may not describe how you are feeling **right now**. Please rate each statement using the 5-point scale below. Remember to rate each statement based on how you are feeling **right at this moment**.

	Not feeling this way at all	Feeling this way somewhat	Feeling this way very strongly
1. I feel good about myself.	1 ------- 2 ------- 3 ------- 4 ------- 5		
2. I want to sink into the floor and disappear.	1 ------- 2 ------- 3 ------- 4 ------- 5		
3. I feel remorse, regret.	1 ------- 2 ------- 3 ------- 4 ------- 5		
4. I feel worthwhile, valuable.	1 ------- 2 ------- 3 ------- 4 ------- 5		
5. I feel small.	1 ------- 2 ------- 3 ------- 4 ------- 5		
6. I feel tension about something I have done.	1 ------- 2 ------- 3 ------- 4 ------- 5		
7. I feel capable, useful.	1 ------- 2 ------- 3 ------- 4 ------- 5		
8. I feel like I am a bad person.	1 ------- 2 ------- 3 ------- 4 ------- 5		
9. I cannot stop thinking about something bad I have done.	1 ------- 2 ------- 3 ------- 4 ------- 5		

10. I feel proud. 1 ------- 2 ------- 3 ------- 4 ------- 5

11. I feel humiliated, disgraced. 1 ------- 2 ------- 3 ------- 4 ------- 5

12. I feel like apologizing, confessing. 1 ------- 2 ------- 3 ------- 4 ------- 5

13. I feel pleased about something I have done. 1 ------- 2 ------- 3 ------- 4 ------- 5

14. I feel worthless, powerless. 1 ------- 2 ------- 3 ------- 4 ------- 5

15. I feel bad about something I have done. 1 ------- 2 ------- 3 ------- 4 ------- 5

Appendix B

EMOTION INDUCTION SCRIPTS

Script for Pride Condition (Adapted from the script used in Kraus et al., 2012)

Researcher: Please close your eyes and remember a specific time when you felt proud or satisfied with something you did. Try to remember the event as if you were actually experiencing it for a second time. (*pause)* What lead up to that event? (*pause)* How did you feel in the moment? (*pause)* Who was with you during that time? (*pause)* During the moment, what did you see and hear? (*pause)* What thoughts were running through your mind? (*pause)* What actions were you doing during the moment? On the paper provided, write about this event in as much detail as possible.

Script for Shame Condition (Adapted from the script used in Kraus et al., 2012)

Researcher: Please close your eyes and remember a specific time when you felt shamed, disrespected, or devalued. Try to remember the event as if you were actually experiencing it for a second time. (*pause)* What lead up to that event? (*pause)* How did you feel in the moment? (*pause)* Who was with you during that time? (*pause)*During the moment, what did you see and hear? (*pause)* What thoughts were running through your mind? (*pause)* What actions were you doing during the moment? On the paper provided, write about this event in as much detail as possible.

Script for Guilt Condition (Adapted from the script used in Kraus et al., 2012)

Researcher: Please close your eyes and remember a specific time when you felt guilt or remorse about something you did. Try to remember the event as if you were actually experiencing it for a

second time. (*pause)* What lead up to that event? (*pause)* How did you feel in the moment? (*pause)* Who was with you during that time? (*pause)* During the moment, what did you see and hear? (*pause)* What thoughts were running through your mind? (*pause)* What actions were you doing during the moment? On the paper provided, write about this event in as much detail as possible.

Script for Neutral Condition (Adapted from the script used in Kraus et al., 2012)

Researcher: Please close your eyes and remember waking up this morning. Try to remember the event as if you were actually experiencing it for a second time. (*pause)* What lead up to that event? (*pause)* How did you feel in the moment? (*pause)* Who was with you during that time? (*pause)* During the moment, what did you see and hear? (*pause)* What thoughts were running through your mind? (*pause)* What actions were you doing during the moment? On the paper provided, write about this event in as much detail as possible.

Appendix C

Set 1
A DOP is longer than a metre.
A centimetre is longer than a SEF.
A SEF is longer than a WUM.

Questions:
A DOP is longer than a meter.
A centimeter is longer than a SEF.
A SEF is longer than a WUM.
A centimeter is longer than a WUM.
A DOP is longer than a SEF.
A meter is longer than a SEF.
A DOP is longer than a centimeter.
A DOP is longer than a WUM.
A meter is longer than a centimeter.
A meter is longer than a DOP.
A SEF is longer than a centimeter.
A WUM is longer than a SEF.
A WUM is longer than a centimeter.
A SEF is longer than a DOP.
A SEF is longer than a meter.
A centimeter is longer than a DOP.
A WUM is longer than a DOP.
A centimeter is longer than a meter.

Set 2:
A KIY is brighter than a spotlight.
A candle is brighter than a HAB.
A JUR is brighter than a KIY.

Questions:
A JUR is brighter than a KIY.
A KIY is brighter than a spotlight.
A candle is brighter than a HAB.
A JUR is brighter than a spotlight.
A KIY is brighter than a hab.
A KIY is brighter than a candle.
A JUR is brighter than a HAB.
A spotlight is brighter than a HAB.
A spotlight is brighter than a candle.

A KIY is brighter than a JUR.
A spotlight is brighter than a KIY.
A HAB is brighter than a candle.
A spotlight is brighter than a JUR.
A HAB is brighter than a KIY.
A candle is brighter than a KIY.
A HAB is brighter than a JUR.
A HAB is brighter than a spotlight.
A candle is brighter than a spotlight.

Set 3:
A shrub is taller than a JIR.
A VOK is taller than a DAF.
A DAF is taller than a tree.

Questions:
A VOK is taller than a DAF.
A DAf is taller than a tree.
A shrub is taller than a JIR.
A VOK is taller than a tree.
A VOK is taller than a JIR.
A DAf is taller than a JIR.
A tree is taller than a JIR.
A DAF is taller than a shrub.
A tree is taller than a shrub.
A DAF is taller than a VOK.
A tree is taller than a DAF.
A JIR is taller than a shrub.
A tree is taller than a VOK.
A JIR is taller than a VOK.
A JIR is taller than a DAF.
A JIR is taller than a tree.
A shrub is taller than a DAF.
A shrub is taller than a tree.

Set 4
A XIM is faster than a CET.
A car is faster than a XIM.
A JOL is faster than a plane.

Questions
A JOL is faster than a plane.
A XIM is faster than a CET.
A car is faster than a XIM.
A car is faster than a CET.
A JOL is faster than a CET.

A JOL is faster than a XIM.
A plane is faster than a XIM.
A JOL is faster than a car.
A plane is faster than a car.
A plane is faster than a JOL.
A CET is faster than a XIM.
A XIM is faster than a car.
A CET is faster than a car.
A CET is faster than a JOL.
A XIM is faster than a JOL.
A XIM is faster than a plane.
A car is faster than a JOL.
A car is faster than a plane.

Set 5:
A XIV is heavier than a piano.
A KUY is heavier than a XIV.
A chair is heavier than a JEZ.

Questions:
A KUY is heavier than a XIV.
A XIV is heavier than a piano.
A chair is heavier than a JEZ.
A KUY is heavier than a piano.
A XIV is heavier than a chair.
A XIV is heavier than a JEZ.
A KUY is heavier than a JEZ.
A piano is heavier than a JEZ.
A piano is heavier than a chair.
A XIV is heavier than a KUY.
A piano is heavier than a XIV.
A JEZ is heavier than a chair.
A piano is heavier than a KUY.
A chair is heavier than a XIV.
A JEZ is heavier than a XIV.
A JEZ is heavier than a KUY.
A JEZ is heavier than a piano.
A chair is heavier than a piano.

Set 6:
A FAS is larger than a grapefruit.
A YEQ is larger than a MOF.
An orange is larger than a YEQ.

Questions:
A FAS is larger than a grapefruit.

A YEQ is larger than a MOF.
An orange is larger than a YEQ.
An orange is larger than a MOF.
A FAS is larger than a MOF.
A FAS is larger than a YEQ.
A grapefruit is larger than a YEQ.
A FAS is larger than an orange.
A grapefruit is larger than an orange.
A grapefruit is larger than a FAS.
A MOF is larger than a YEQ.
A YEQ is larger than an orange.
A MOF is larger than an orange.
A MOF is larger than a FAS.
A YEQ is larger than a FAS.
A YEQ is larger than a grapefruit.
An orange is larger than a FAS.
An orange is larger than a grapefruit.

Appendix D

DEMOGRAPHIC SURVEY

Instructions: Please complete the following items by circling the appropriate option or filling in the blank. As with all aspects of this study, your responses will **not** be linked to your name, and you will remain anonymous.

1. Age (in years): _____
2. Gender: _____
3. Ethnicity: _____
4. Is English your native language? Yes No

   If English is not your native language, what is your native language?
   _____

5. Please indicate your current level of study. Graduate Undergraduate
6. What is your college major? _____
7. What year are you in your current program? _____