The Effect of Emotional States on Theory of Mind

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Abstract

The purpose of this study was to investigate the influence of emotional state on Theory of Mind, or the capability of someone to make inferences about the thoughts, intentions and emotions of other people. This was done by manipulating participants' emotions via a film mood induction procedure and having participants complete the Faux Pas Task, which assesses Theory of Mind. This task has a general score, as well as sub scores for both Cognitive and Affective Theory of Mind. The moods induced were sadness, happiness, anger, and fear. It was hypothesized that participants induced with a sad and fearful mood would have a more accurate General Theory of Mind, as well as a more accurate Cognitive and Affective Theory of Mind compared to participants with a Happy or Angry mood. It was hypothesized that cognitive processing styles associated with these emotions would drive this effect. Four One-Way Analyses of Variance were run analyzing the effects that emotional states and cognitive styles have on performance on Theory of Mind Tasks, which yielded no statistically significant effects. Thus, the hypotheses were not supported. A Pearson Product moment correlational analysis revealed that scores on the Cognitive Reflections Task were negatively correlated with scores on the Faux Pas Task, which suggests that participants primed with a heuristic based intuitive cognitive processing style performed better on a measure of General Theory of Mind. The conclusion of this study is that the evidence suggested that emotional states influenced cognitive processing style, while little evidence supported the link between emotional state and theory of mind.

Key Words: Theory of Mind, Mood Induction, Appraisal-Tendency Framework

The Effect of Emotional States on Theory of Mind

In order for people to properly navigate the social world, they need to be able to quickly and accurately understand the mental states of others. They need to recognize sarcasm, read social cues, take on the perspective of others and properly interpret idioms. This ability to understand the mental states of others is referred to in psychological research as Theory of Mind (Epa & Dominica., 2015; Saxe & Baron-Cohen., 2006; Sebastian et al., 2012; Shaw et al., 2004). While there has been prior research on the ways in which Theory of Mind develops in childhood, there has been little research on the external factors which could influence peoples' accuracy in this ability.

One such external factor is one's emotional state, which has been shown to moderate people's cognitive faculties (Angie, Connelly, Waples, & Kligyte., 2011; Baas, De Dreu, & Nijstad., 2012; Bagneux, Bollon, & Dantzer., 2012; Bagneux, Font, & Bollon., 2013; Todd, Forstmann, Burgmer, Brooks, & Galinsky., 2015). For example, anger was shown to cause people to assess negative future events as less likely to happen, while fear was shown to cause people to assess negative events as more likely to happen (Angie et al., 2011). Furthermore, anger was shown to cause people to engage in intuitive, heuristic based information processing while sadness causes people to engage in more analytical cognitive processing. An explanatory theoretical model for why emotions have this influence in cognitive processing is the Appraisal Tendency Framework. This framework says that our perception of an emotion is caused by both our physiological response to a stimulus as well as our appraisal of a stimulus. This appraisal, specifically in regards to how our certainty of the stimulus is appraised, shapes cognitive processing. This model predicts that sadness and low-level anxiety will elicit an analytical cognitive processing style, while happiness and anger will elicit a heuristic based cognitive

processing style.

Since emotions have been shown to influence people's cognitive faculties, then it is possible that different discrete emotional states elicit different effects on one's ability to engage in Theory of Mind. Thus, the purpose of this study is to examine the influence of emotional states on the expression of Theory of Mind capabilities in a healthy emergent adult population. It is hypothesized that happiness and anger, which are theorized to elicit a heuristic based cognitive processing style will be associated with lower accuracy of Theory of Mind, while sadness and low-level anxiety, which elicit an analytical cognitive processing style, will be associated with higher accuracy of Theory of Mind.

Theory of Mind

Overview of Theory of Mind

There are two established operational definitions of Theory of Mind. First, Theory of Mind has been defined as the knowledge that other people have minds which are distinct from one's own. This operational definition has been used from a developmental perspective in which researchers examine how the ability to understand that other people have minds which are distinct from one's own develops from infancy through the preschool years (Henry, Phillips, Ruffman, & Bailey., 2013; Valle, Massaro, Castelli, & Marchetti., 2015). Second, Theory of Mind has been defined as the capacity to attribute specific thoughts, intentions and beliefs to other people in order to understand their mental states (Mier et al., 2010; Sebastian et al., 2012). The latter definition of Theory of Mind has been studied in research which seeks to understand how this understanding moderates one's behavior, as well as in the neurological correlates of Theory of Mind (Gaesser, 2012; Saxe & Baron-Cohen., 2006; Young & Saxe, 2009). This second operational definition of Theory of Mind is what was investigated in this research.

Theory of Mind can further be broken down into two variations (Sebastian et al., 2012). The first is Cognitive Theory of Mind, which is the ability to use context cues to infer the thoughts and intentions of other people. For instance, if someone points to a door and says "there's the door" after a disagreement most people will understand that this individual is not providing information about the exit; he or she is telling us to leave. The other variation of Theory of Mind is referred to as Affective Theory of Mind. This involves using facial expressions, social cues and body language to understand or predict the emotional states of others (Mier et al., 2010; Sebastian et al., 2012). For example, if we see somebody sitting in the waiting room of a doctor's office who was fidgeting, with crossed arms and a stern look on his or her face, we might infer that this person is nervous. This is an inference about the individual's emotional state which is drawn from the person's facial expressions and behavior, as well as the setting.

Although Cognitive Theory of Mind and Affective Theory of Mind are similar in nature, there are some significant differences between the two that would suggest the two are indeed different processes which would be modulated by one's current emotional state in unique ways. First and foremost, research comparing adolescents and adults on Theory of Mind suggested that Cognitive Theory of Mind seemed to develop earlier than Affective Theory of Mind (Henry, Phillips, Ruffman, & Bailey., 2013).

Second, the two processes utilize different parts of the brain (Sebastian et al., 2012). Specifically, the Ventromedial Prefrontal Cortex, or vmPFC, seems to be associated with the use of Affective Theory of Mind, but not Cognitive Theory of Mind (Sebastian et al., 2012; Vetter et al., 2014). The significance of this is that the vmPFC has been implicated in the elicitation of emotions, fear conditioning, and emotion regulation (Hansel & Von Kanel, 2008; Koenig &

Grafman, 2009). This hints at the possibility that one's own affective state could influence Affective Theory of Mind specifically. There are two potential reasons why this difference between Affective and Cognitive Theory of Mind exists. One is that Affective Theory of Mind and Cognitive Theory of mind are distinct processes since Affective Theory of Mind recruits additional brain regions in its processing. Two, the different neural correlates of the two tasks may suggest that different strategies were being employed to perform the two tasks.

Neuroscience of Theory of Mind

The majority of the literature on Theory of Mind in healthy adult populations describes fMRI studies designed to reveal the neural correlates of Theory of Mind. Through this work, researchers have found a rich network of neural circuitry involved in Theory of Mind (Saxe & Baron-Cohen, 2006). For example, Spunt, Satpute and Lieberman (2011) conducted an fMRI study to compare which brain regions were active during tasks where participants were asked to identify either how an action was performed, or why an action was performed. The latter of these is a task which requires Theory of Mind. The researchers were testing the Embodied Simulation Theory, which states that people infer the mental states of others by simulating their actions and expressions using the mirror neuron system. This system has been observed in macaques and humans when they are asked to either watch a task being performed, or to perform a task themselves. The researchers asked participants in an fMRI to view 5 second video clips of a man performing mundane tasks and asking participants to identify either what the actor is doing, how he is doing it, or why he is doing it. The researchers investigated a theoretical framework that conceptualized these identifications as increasing levels of mentalization, and found that participants were faster at identifying what an actor was doing, compared to how and why. It was also found that the brain regions which became more active during higher levels of mentalization

are not associated with the mirror neuron system as observed in prior research, refuting the embodied simulation hypothesis. Instead increased mentalizations seem to activate a neural system which is associated specifically with Theory of Mind.

As previously discussed, the use of Cognitive and Affective Theory of Mind seems to require different brain regions. Cognitive Theory of Mind has been previously shown to utilize a well-defined network of brain regions which includes the Superior Temporal Sulcus or STS, the Temporal Poles, and the right Temporoparietal Junction or rTPJ (Saxe & Baron-Cohen, 2006; Sebastian et al., 2012). Although the precise functions of all of these brain regions are still being investigated, they appear to play roles in social cognition including joint attention, which is the ability to focus on the same stimulus as another individual, semantic processing, and perspective taking respectively (Belfo, Bruss, Karlan, Abel. & Tranel, 2016; Materna, Dicke, & Thier, 2008; Saxe & Baron-Cohen., 2006; Semenza, 2011; Tsapkini, Frangakis, & Hillis, 2011). Affective Theory of Mind is associated with activations in many of these same regions, as well as with activations in the vmPFC which is typically linked to emotional processing (Sebastian et al., 2012). Further research illustrates that vmPFC activations were stronger in adolescents performing Affective Theory of Mind Tasks relative to matched adults (Vetter et al., 2014). These findings suggest that one's affective state could be a moderator of Affective Theory of Mind since this function uses brain regions associated with the elicitation of negative affect (Hansel & Von Kanel, 2008; Koenig & Grafman, 2009).

Further findings seem to corroborate these findings. The literature has been particularly strong in the implication of the rTPJ, as a brain region which is specialized and necessary for reasoning about the mental states of others (Krall et al., 2015). The reason this literature is particularly strong is because much of the research on this particular brain region utilizes

Transcranial Magnetic Stimulation, or TMS. This is a tool which uses magnetic pulses to temporarily disrupt the functioning of an area of the cortex in order to allow researchers to examine how this alters its function. The upshot of this methodology is that it is a direct manipulation of cortical functioning which allows researchers to make causal inferences about a brain regions function (Young, Camprodon, Hauser, Pascual-Leone, & Saxe, 2010).

The research examining how the application of TMS to the rTPJ affects Theory of Mind does not explain what role the other brain regions in the Theory of Mind network play in reasoning about the mental states of others. Although it is tempting to assume a one to one relationship between a brain region and a particular function in any cognitive domain, the most recent research on the neuroscience of Theory of Mind seems to suggest that it is the interaction between these brain regions which facilitates the ability to make inferences about the mental states of others. Researchers examining how the development of the connections between brain regions associated with Theory of Mind contributed to the development of Theory of Mind in children aged three to four found that the development of white matter tracts which project from parts of the cortex to the arcuate fascicle, a bundle of axons which connects portions of the posterior temporal lobe to the inferior frontal gyrus, is associated with the development of Theory of Mind (Weismann, Schreiber, Singer, Steinbeis, & Friederici, 2017). White matter tracts such as the arcuate fascicle facilitate communication between areas of the cortex. These findings demonstrate that it is each component of the Theory of Mind Network working together which facilitates this cognitive ability, rather than any one part of the brain working independently.

Theory of Mind in Psychological Research

Although it is scarce, there is research on adult use of Theory of Mind in research outside the field of neuroscience. This research typically examines the moral decisions one makes when inferring the mental states of other people (Gaesser, 2013; Young & Saxe, 2008; Young, Nichols, Saxe, 2010). For example, one series of studies asked participants to imagine themselves helping another person in a given scenario, and then asked these participants to report the likelihood that they would actually help a person in need in real life. These researchers also asked participants to rate the extent to which they imagined what the other person was thinking and feeling in order to understand how this affects helping behavior as well. They found that increased usage of Theory of Mind increases the likelihood of helping other people (Gaesser, 2013). Other research examines the development of Theory of Mind after adulthood into old age. For example, one meta-analysis examined literature comparing Theory of Mind in young and late adults found that during late adulthood performance on Theory of Mind tasks decreases (Henry et al., 2013).

There is some debate over what factors influence the ability to infer the mental states of others. For example, Black and Barnes (2015) investigated how Theory of Mind abilities are influenced by viewing television dramas. Black and Barned (2015) asked participants to watch 26 minutes of either a television drama, or a documentary. Afterwards, participants completed the Reading the Mind in the Eyes test, or RMET. Black and Barnes (2015) found that participants who viewed the television dramas performed better on the RMET than participants who viewed the documentaries. In a follow up experiment which included a control group which did not watch any television show, the authors replicated this finding. Participants who viewed both television dramas and documentaries performed better on the RMET than control

participants, but this was only statistically significant for participants who viewed television dramas. An attempt to replicate this finding failed, however (Panero et al., 2016). These conflicting findings highlight that research on whether or not external factors can influence Theory of Mind is still needed.

Further research examined how external information influences one's judgments of other people's minds. Young and Saxe (2008) investigated how morally relevant facts, such as whether one person's actions harmed another person, influences one's spontaneous mental state inference of the first person. In two experiments, participants were shown a series of scenarios in which a protagonist made an action. In half of these scenarios, this action brought harm to another individual, which was described in the study as morally relevant information. In the other half of the scenarios, there was nobody harmed by the action. The authors found that the neural networks involved in Theory of Mind were active in the morally relevant information conditions, indicating that they used the morally relevant information to make mental state inferences about the protagonist. These findings were built upon by a follow-up study which examined how participants morally judged people whose actions harmed others when these actions were based upon either supported or false beliefs (Young, Nichols, & Saxe, 2010). This study presented participants with a scenario where a father left his son alone in the bathtub for a moment. Depending on the experimental condition the father came home to either find his son dead or alive, and participants were given information that either indicated that the father had good reason to believe his son would be ok, he had reason to believe his son may be harmed, or there being no indication one way or the other. The researchers found that in all conditions where the son had died participants judged the father as being more blame worthy. It was also found that when the father had good reason to suspect his son would have been fine alone, participants

judged the father to be less worthy of blame. These findings are significant in that they demonstrate that the ability to infer the mental state of other people can impact how individuals assign blame to them, which has significant social and legal implications. Second, these findings show that external forces, such as the outcome of an action and possibly the emotional reaction people have to that action, can alter how they judge other people.

Theory of Mind and Emotion

The literature on how emotions may affect Theory of Mind is scarce. Some research suggests that in terms of visual emotion recognition there is a mood congruency bias. This is a bias in judgment in which people are better able to recognize the emotional state of other people when their emotions are congruent with that of the other individual. For example, a sad person will be better able to recognize the emotional state of other sad people (Angie et al., 2011). This is in regards to strict emotion recognition, however, and not necessarily Theory of Mind.

The most thorough study on the topic examined how the induction of an anxious mood would affect how people can take on the perspective of other people (Todd, Forstmann, Burgmer, Brooks, & Galinsky, 2015). In two experiments, researchers found that people manipulated to feel anxiety were less able to describe the location of objects using the visual perspective of another person compared to those manipulated to feel anger. They were also more likely to use information which only they had to predict the reaction of another person to a sarcastic email compared to participants manipulated to feel anger. Finally, participants manipulated to feel anxiety and surprise were more likely to use privileged information to predict the mental state of characters in a false belief task compared to angry and to proud participants. The researchers found through a mediation analysis that uncertainty appraisals drove these effects and they interpreted these findings as an indication that when manipulated to feel

emotions associated with uncertainty appraisals, people rely on privileged information when reasoning about the mental state of other people.

This study had significant limitations. The mental state reasoning task used in this study required participants to respond as fast as they could to prevent ceiling effects. This is problematic because it reduces the generalizability of the findings since in everyday situations people are often given an opportunity to deliberate over the mental states of other people, which alters the nature of the task. Furthermore, this research only examined the impact of mood on Cognitive Theory of Mind was influenced by privileged information.

The present study differs from this study in three key ways. First, Todd et al (2015) examined how mood would influence the use of privileged information in the use of Theory of Mind. The present, however, will not examine privileged information in any way. This will likely lead to different findings since uncertainty based appraisals lead to the reliance on privileged information if it is available (Todd et al., 2015). Based upon the Appraisal-Tendency Framework, when people are elicited with an emotional state which is associated with uncertainty appraisals, they are motivated to reduce this uncertainty which can cause them to rely on privileged information which is perceived as more certain. Thus, without privileged information for the participant to rely on, participants induced with an emotion associated with uncertainty appraisals adopt an analytical cognitive processing style and rely on processing contextual information in order to make mental state inferences.

Second, the present study examined how different mood states would influence Affective Theory of Mind. Finally, the present study examined the influence of different emotional states on the performance of Theory of Mind tasks which are starkly different from the one's used by Todd et al (2015). Todd et al (2015) used visual perspective taking tasks and tasks requiring

direct communication. The present study used tasks requiring context dependent Theory of Mind assessments from the third person perspective.

Cognitive Styles

Overview of Cognitive Styles

Cognitive styles refer to the strategies people use to reason about problems, situations and events in their daily lives. One's cognitive processing style influences how people process information, use it to make judgments and decisions (Sagiv, Amit, Ein-Gar, & Arieli, 2013; Talhelm et al., 2015). Although there are several models of cognitive processing styles, these are all similar in that they describe two cognitive styles. There are the analytical cognitive styles, and the heuristic cognitive style. Analytical cognitive styles, also called rational and systematic, are when someone processes information using rule based, logic-oriented thinking (Sagive et al., 2013; Talhelm et al., 2015). Heuristic cognitive styles, also called the intuitive, holistic or experiential cognitive styles, are when someone processes information using heuristics, instincts and intuition to make judgments (Klaczynski, 2001; Sagive et al., 2013; Talhelm et al., 2015). Cognitive styles are assumed to be a stable component of one's personality (Sagiv et al., 2013). Sometimes, however, they can be primed by various situational factors (Talhelm et al., 2015).

Since the analytical cognitive style is defined by one systematically processing information, carefully considering all contextual information, it makes sense that this style would improve certain forms of cognitive judgements. In relation to the present study, it was hypothesized that Theory of Mind Judgments derived from context, regardless of whether it is cognitive and affective, would be more accurate for those using an analytical cognitive style.

Emotions and Cognitive Styles

Since Cognitive Styles play an important role in influencing how people interact with their environment, including the social world, variables which can moderate Cognitive Style require further investigation. Prior research has shown that the cognitive style that one uses can be influenced by his or her emotional state. (Angie et al., 2011; Baas, De Dreu, & Nijstad., 2012; Bagneux, Bollon, & Dantzer., 2012; Bagneux, Font, & Bollon., 2013; Todd, Forstmann et al., 2015). For example, sadness, and low-level fear have been found to prime an analytical cognitive processing style. Conversely, happiness, and anger have been associated with heuristic cognitive processing. (Angie et al., 2011; Baas, De Dreu, & Nijstad., 2012; Bagneux, Bollon, & Dantzer., 2012; Bagneux, Font, & Bollon., 2013; Todd, Forstmann et al., 2015).

In general, research has indicated that positive emotions such as happiness seem to be associated with top down, heuristic based information processing, while negative emotions such as sadness tend to lead to more analytic information processing (Angie et al., 2011). A problem with this interpretation is that it is reductionistic. People's emotions differ across many factors that go beyond a simple negative-positive spectrum, and the influence of emotions on our cognitive processing strategies seems to be influenced by more complex factors than the valence of our emotional state. This is evidenced by contradictory findings in the literature regarding emotion and cognition. For example, sadness and anger are both negatively valenced affective states, yet they induce analytical and heuristic cognitive processing styles respectively (Bagneux, Bollon, & Dantzer., 2012; Bagneuz, Font, & Bollon, 2013).

Most models of emotions conceptualize different emotions as various states which differ on where they lay on one or more spectrums. The Core Affect model of emotion categorizes specific discrete emotions as lying on differing points on the spectrums of valence and arousal.

Such models of emotion, however, are insufficient for explaining why specific emotional states elicit the changes in cognitive processing they are associated with. This is because research has shown that some emotions may lay on similar points of valence and arousal, but differ in the cognitive processing style they elicit (Angie et al., 2011). For instance, while anger and fear are both negatively valanced, high arousal emotions, anger elicits a heuristic information processing style, while fear elicits an analytic based cognitive processing style (Lerner & Keltner, 2001). Furthermore, emotions which differ in their valence and arousal may elicit similar cognitive processing styles. For example, happiness and anger are oppositely valanced, yet they both elicit heuristic cognitive processing styles.

Another type of theoretical model which seeks to explain how different emotional states influence cognitive processing are appraisal models of emotion. Appraisal models of emotion argue that our appraisal of a situation or stimulus works in conjunction with the valence and arousal of an affective state to produce a discrete emotion. These models suggest that how people appraise a situation or stimulus may influence how their emotional states moderate our cognitive processing styles (Baas, De Dreu, & Nijstad., 2012; Bagneux, Bollon, & Dantzer., 2012; Bagneux, Font, & Bollon., 2013; Tiedens & Linton, 200). One such model of emotion which may explain why different discrete emotions may elicit different cognitive processing styles is the Appraisal-Tendency Framework (Bagneux, Bollon, & Dantzer., 2012; Bagneux, Font, & Bollon., 2013; Lerner & Keltner, 2001). Under this framework an emotion is elicited by an appraisal of a stimulus, and this appraisal can bias cogitive processing and appraisal further subsequent stimuli. For example, if a student takes an exam which was difficult, he or she would consider the period before finding out his or her grade on the exam scary because he or she is in a negative situation where the outcome is uncertain. This uncertainty would elicit an analytic

cognitive processing style which would influence not only how this student thought about his or her exam grade, but also how he or she thought about other topics as well. Under this framework, the appraisals which lead to a given emotion will affect our cognitive processing style in unrelated situations.

Research suggests that one appraisal dimension which can have an impact on our cognitive processing style is the level of certainty associated with an emotion (Baas, De Dreu, & Nijstad., 2012; Bagneux, Bollon, & Dantzer., 2012; Bagneux, Font, & Bollon., 2013; Tiedens & Linton, 2001). This certainty appraisal is based on how much an individual understands both what is happening in a given situation, or what will happen next. For example, anger is associated with certainty in that people are often angered by a specific well understood cause. This causes anger to lead to heuristic cognitive processing.

Tiedens and Linton (2001) conducted a series of experiments which demonstrated that emotions associated with certainty elicited a heavier reliance on stereotypes, a specific type of social heuristic regarding groups of people, in making judgments. In their first experiment, the researchers induced participants with specific emotions using an autobiographical writing task and then asked them to make predictions about their futures. The participants then rated how certain they were about their predictions. The researchers found that the emotions of disgust and happiness produced more certain predictions about the future, while the emotions of fear and hope lead to less certain ones, confirming that emotions do differ on their level of associated certainty. In a follow-up experiment, Tiedens and Linton (2001) induced either uncertain or certain emotions in participants and asked them to read a persuasive essay and rate if they agreed with it. The essays shown to the participants were all identical. Depending on the experimental condition, the essays were either attributed to a university professor or a student. They

researchers hypothesized that for participants who were induced with certain emotions, participants asked to read the professor attributed essay would agree with it at higher levels than participants asked to read student attributed essays. The authors also hypothesized that this difference would be much smaller in the uncertainty associated emotions. The reasoning for this is that certainty based emotions would lead participants to use the author's status as a heuristic for assessing the essay's quality. It was found that these hypotheses were confirmed.

Further studies have corroborated the finding that the elicitation of emotions associated with certainty seem to induce a heuristic cognitive processing style while emotions associated with uncertainty induce an analytic information processing style (Bagneux, Bollon, & Dantzer., 2012; Bagneux, Font, & Bollon., 2013). This suggests that the Appraisal-Tendency Framework has good predictive value in determining which cognitive states will be elicited from a given emotional state. Thus, it is logical to use this dimension of the Appraisal-Tendency Framework to make predictions regarding how specific discrete emotions may influence people's ability to process information relevant to Theory of Mind, considering differing cognitive processing styles may lead to different outcomes in Theory of Mind Tasks. Based on these considerations, the present study used Appraisal-Tendency Framework as its theoretical framework.

Mood Induction Procedures

There have been many methods used to elicit emotional states in participants in psychological research. These are referred to in the literature as mood induction procedures (Westermann, Spies, Stahl, & Hesse., 1996). Some studies used autobiographical writing tasks as a mood induction procedure (Bagneux, Bollon, & Dantzer., 2012; Bagneux, Font, & Bollon., 2013). Other researchers have used music, video clips or guided imagery as mood induction procedures (Westermann, Spies, Stahl, & Hesse., 1996; Zang, Yu, & Barrett., 2014).

Experiments on mood induction procedures seem to suggest that one particularly powerful method of inducing a mood is to ask participants to view emotionally charged film clips (Hewig et al., 2005). This method is advantageous in that it has been previously validated in prior research, both examining mood induction research and research on emotions and cognition (Hewig et al., 2005). Film clips are legal to use in academic research due to Title 107 of the United States Copyright Act regarding Fair Use. Furthermore, unlike autobiographical writing tasks, this method does not pose a risk to the privacy of the participants. It also does not pose any risk to the participant which exceeds what one would normally expect when watching a commercially available film in everyday life. It is for these reasons that this study used film clips in order to elicit discrete emotions in participants.

Hypotheses

Theoretical Framework

The theoretical framework from which the present study draws its hypotheses from is the Appraisal Tendency Framework. (Bagneux, Bollon, & Dantzer., 2012; Bagneux, Font, & Bollon., 2013; Todd et al., 2015; Tiedens & Linton, 2001). The Appraisal Tendency Framework states that our appraisals of a given stimulus or situation will prime different cognitive styles, and that emotions associated with uncertainty appraisals elicit an analytical processing style, while emotions associated with certainty appraisal elicit a heuristic cognitive processing style (Bagneux, Bollon, & Dantzer., 2012; Bagneux, Font, & Bollon., 2013). Thus participants exposed to film clips eliciting the uncertainty based emotions of sadness and fear will perform better on Theory of Mind tasks which require analyzing contextual information to make judgments about another person's emotions. This theoretical model was selected based on its established predictive value on research on how emotions prime cognitive processing styles.

General Theory of Mind

The first hypothesis predicted that participants induced with a Fearful or Sad emotion will have better use of Theory of Mind in general than participants in the happy or angry conditions. This hypothesis was tested using the overall scores on the Faux Pas Test.

Cognitive Theory of Mind

The second hypothesis predicted that participants induced with a Fearful or Sad emotion will have better use of Cognitive Theory of Mind than participants in happy or angry conditions. This hypothesis was tested using the Cognitive Theory of Mind subscores of the Faux Pas Test.

Affective Theory of Mind

The third hypothesis predicted that participants induced with a Fearful or Sad emotion will have better use of Affective Theory of Mind compared to participants in the Happy or Angry conditions.These hypothesis was tested using the Affective Theory of Mind subscores of the Faux Pas test.

Heuristic vs Analytical Cognitive Style

The fourth hypothesis predicted that the emotions of Sadness and low level anxiety will elicit an analytical cognitive style.

The fifth hypothesis predicted that the emotions of Happiness and Anger will elicit a Heuristic Based cognitive style. Hypotheses 4 and 5 were tested using questions designed to assess the conjunction fallacy.

Alternative Hypotheses

In addition to the above hypotheses, further alternative hypotheses were considered based upon prior fMRI research examining the neurological correlates of Affective and Cognitive Theory of Mind tasks, as well as on lesion literature on the vmPFC. As previously stated

Affective Theory of Mind tasks are more likely to elicit increases in activity in the vmPFC, particularly for young adults and adolescents (Leopold, et al., 2012; Sebastian et al., 2012; Vetter et al., 2014). Lesion studies confirmed that the vmPFC was necessary for the use of Affective Theory of Mind (Leopold, et al., 2012). The vmPFC appears to be associated various aspects of emotion and cognition (Hansel & Von Kanel, 2008; Koenig & Grafman, 2009). Thus a final sixth competing hypothesis was constructed. The sixth hypothesis predicted that the elicitation of emotions in general will result in lowering performance of Affective, but not Cognitive Theory of Mind. This hypothesis was be tested via the Faux Pas Test.

Method

Participants

Demographics

Two hundred and thirty participants were recruited online to participate in this study. Of the 230 participants recruited, 153 (66.5%) were female, 75 (32.6%) were male, and two (0.9%) preferred not to answer (See Table 1.). In order to participate in this study, participants needed to be an emergent adult, and thus the age range of participants was limited to those between 18 to 26 years of age. The mean age was M = 22.1087 years of age (SD = 2.16). Of the 230 recruited participants, (25.7%) reported high school as their highest level of education, while 102 (44.3%) reported completing an Associates/Professional degree or some college, (22.6%) reported completing a Bachelors degree, (4.8%) reported some graduate school, and (2.6%) reported completing a Master's Degree. One hundred and sixty of the participants (69.6%) were white/Caucasian, (13.0%) were African American/African, (8.3%) were Hispanic/Latino, (6.1%) were Asian American/Asian/Pacific Islander, (1.7%)were Indigenous American, and (1.3%) were Middle Eastern American/Middle Eastern. Originally, (64.7%) of the participants were

recruited from Amazon Turk. After cleaning the data, however, there are (27.4%) participants who were definitely recruited from Amazon Turk. There were (23%) who were recruited from the SUNY New Paltz Subject Pool. The remaining (49.6%) could not be categorized as either with any certainty.

Table 1.

Descriptive Statistics for the Sample

Demographic Category	Frequency	%
Ethnicity		
White/Caucasian	160	69.6
African American	30	13.0
Hispanic &/or Latino	19	8.3
Asian American/Pacific Islander	14	6.1
Indegenous American	4	1.7
Middle Eastern Descent	3	1.3
Education Level		
Associates/Some College	102	44.3
Completed High School	59	25.7
Bachelors Degree	52	22.6
Some Graduate School	11	4.8
Master's Degree	6	2.6
Sex		
Female	153	66.5
Male	75	32.6
Prefer Not To Answer	2	0.9
Recruitment Source		
New Paltz	53	23
Amazon Turk	63	27.4
Mixed	114	49.6

Recruitment Procedures

Participants were recruited through two resources. The first of these was the SUNY New Paltz Email Recruitment System. This is a recruitment pool used to recruit psychology students from the State University of New York at New Paltz. The second source was Amazon Mechanical Turk. This is an online recruitment tool used to recruit participants to complete online work. Participants were compensated for their time. SUNY New Paltz students were compensated with course credits which contributed towards their graduation, while Amazon Mechanical Turk participants were compensated with 3.00 USD.

Manipulation

Emotions were elicited using a film-based mood induction procedure. The film clips to be used were drawn from previous studies examining mood and cognition (Hewig et al., 2005). They were chosen to induce happiness, fear, anger and sadness. These include a happy, a scary scene, an anger inducing scene, and a sad scene. The happy scene, from "An Officer and a Gentleman," depicts a man in a military uniform walking into a factory, picking up a woman, and carrying her out while happy music plays in the background. The scary scene, from "Halloween," showed a young woman finding a dead body and then being chased by a masked man wielding a kitchen knife. The anger inducing scene, from "My Bodyguard," depicts a young man getting beaten up, and his bike is then thrown into a lake. The sad scene, from "The Champ," depicts a child watching his Father die and crying.

Measures

Faux Pas Task

In order to assess theory of mind, participants were asked to complete an adult version of the Faux Pas Task (See Appendix A). This is an assessment tool which asks participants to read several vignettes of social interactions between people (Stone, Baron-Cohen, & Knight, 1998). In half of these vignettes, a social faux pas was presented, while none occurred in the other half. Participants were then asked a series of questions regarding the mental states of the people within the vignettes. Three questions were of interest for this study. These asked participants to identify the reasoning behind a character's actions, a question regarding the knowledge and beliefs behind a character, and a question asking participants the emotional reaction of characters within the vignettes. The former two questions keyed in on aspects of Cognitive Theory of Mind, while the questions on emotions were used as an assessment of Affective Theory of Mind. The questions asking participants to identify the reasoning behind a character's actions in the stories were scored as correct if the participant correctly identified why a character in a vignette committed an action, or if the character intended the consequences of them. The question regarding a character's knowledge was scored as correct if participants could correctly identify what a vignette character could reasonably know, given his or her circumstances. The question regarding emotional reactions was scored as correct if the participant could correctly predict emotional reaction of a given character in a vignette. The total score of this task was used to assess Theory of Mind in a general sense. Additionally, control questions were used on this assessment tool which allow one to control for the possibility that a score could be influenced by a misinterpretation of the story, or the reader not reading a key piece of information. The total range of scores for each subsection of the Faux Pas Test is from 0 to 20. The range of scores for

the total score on the Faux Pas Test was the sum of scores on the subsections. The range of scores on the total Faux Pas Test was 0 to 200. Scores on this assessment were expected to be high for each participant.

For clarity, the scores on the total Faux Pas Task will be referred to as scores of General Theory of Mind. Scores on the Emotion component of the Faux Pas Task will be referred to as "Affective Theory of Mind." Scores on the Motivation and Knowledge components of the Faux Pas task will be referred to as the "Motivation" and "Knowledge" recognition scores of "Cognitive Theory of Mind" respectively.

The primary advantage of the Faux Pas Task is that it has been used in research with healthy adult populations prior to this study (Ahmed, & Miller, 2010: Bottiroli, Cavallini, Ceccato, Vecchi, & Lecce., 2016; Zita, Katalin, Karolina, & Dezso., 2014). Psychometric data on the Faux Pas Task indicates it is a reliable psychometric tool. For example, one study using Portuguese adults found a reliability of Cronbach's Alpha of $\alpha = 0.82$ (Fraisca et al., 2016)

Cognitive Reflections Task

The Cognitive Reflections Task, or CRT, is a three-question test in which participants are asked questions designed to elicit an intuitive, incorrect answer (See Appendix B). In order to answer correctly, participants must look beyond their initial intuition of what the correct answer must be, and work towards a correct answer. This test was scored by adding the total number of correct responses together. Since this test can only be correctly answered by suppressing an intuitive answer, and by deliberating over what the correct answer is, this serves as a measure of the degree to which a participant uses a Heuristic and Analytical Cognitive Styles. The task has a total range of scores of 0 to 3. The scores are expected to be lower for participants in the Happy and Angry conditions, and higher for participants in the Sad and Fearful conditions. Prior

research has shown that the scores on the CRT are positively correlated with the REI subscale of Need for Cognition (r = 0.33), which is a questionnaire asking participants about their tendencies to deliberate over information (Liberali, Reyna, Furlan, Stein, & Pardo., 2012). It is also negatively correlated to the REI subscale of Faith in Numeracy scale (r = -0.15), which is a questionnaire of the degree to which one uses heuristic based processing. This suggests that it is a measure of the tendency to use system two analytical processing. The same research found that the reliability of the scale varies from sample to sample, with Cronbach's Alpha scores ranging from $\alpha = 0.64$ to $\alpha = 0.74$. This variance is likely to due to differences in exposure between samples.

Conjunction Fallacy

Cognitive style was also assessed using two questions designed to assess the conjunction fallacy (See Appendix C). In this task, a participant is given a brief description about an individual. Then participants are given a list of traits. These traits are either by themselves or given in pairs. For example, for one description the described individual was either a bankteller, a feminist, or both a bankteller and a feminist. Participants are asked to rank the likelihood that the described person has these traits. The two questions used were the Linda Problem, and an adaptation of the problem used in prior research (Klaczynski, 2001). The conjunction fallacy asserts that people judge that combinations of traits are more likely to describe a person than the individual traits alone. This is not true from a statistical standpoint. The conjunction fallacy questions were scored as correct if participants listed individual traits as being the most likely to be true, and incorrect if a combination of traits was ranked as the most likely to be true. Participants were considered to be using the conjunction fallacy if one of the questions were incorrect. The total range of scores is from 0 to 2. It is expected that participants who are in the

Happy and Angry conditions will score a 0 or a 1. Participants in the Sad and Fearful conditions are expected to score a 2. Although the task has been used in a number of research studies, there is little data regarding it's psychometric properties. One study, however, did offer evidence that it is a valid method of assessing cognitive style (Liberali et al., 2012. In this study, the researchers found that when giving participants the Conjunction Fallacy task and a numeracy scale, scores on Conjunction Fallacy questions were negatively correlated with the number of verbatim matching errors a participant made (r = -0.28). These errors occur when a participant answers a mathematical question using a number in the problem itself that one would not arrive at if he or she understood the question, analyzed it, and answered it correctly. An example of this is if a person were asked approximately how many times out of a thousand a di would land on an even number such as two, three or six, and the participant responded with two, three or six. The wrong answer comes from using a quick repetition of the numbers he or she heard and not through understanding and thinking about the question, which is indicative of not using analytical thinking.

Film Mood Manipulation Check

Following the mood induction procedure, participants were shown a single question which asked them to rate the extent to which they felt the emotions of Happiness, Sadness, Fear, Anger and a Neutral Mood (See Apendix D). The ratings were on a 0 to 9 scale, with 0 indicating they felt none of the emotions and 9 indicating they felt an extreme amount of the emotion. Participants were asked to rate the extent they felt all of the emotions. This was used as a manipulation check.

Procedure

Preliminary Study Procedures

A pilot study was conducted to determine if the selected film clips chosen for the mood induction procedure were effective in inducing the desired emotional state. Participants were recruited for this study online from the SUNY New Paltz subject pool. In this study participants viewed the film clips and then rated to what extent they felt the emotions of fear, anger, sadness, happiness, or nothing (See Appendix D). The film clips were designed to elicit the emotions of fear, anger, sadness and happiness. The results of the pilot study were analyzed via a Multivariate Analysis of Variance. The results of this analysis was statistically significant ($F(3, 43) = 31.469$, $P < 0.001$). Data were further analyzed via One-Way Analyses of Variance. Four videos were chosen based on these tests, clips from the films The Champ ($F(3, 43) = 58.67$, $p < 0.001$), An Officer and a Gentleman ($F(3,43) = 94.67$, $p < 0.001$), Halloween ($F(3,43) = 37.5$, $p < 0.001$) and My Bodyguard ($F(3,43) = 48.49$, $p < 0.001$). These films elicited the emotions of sadness, happiness, fear and anger. The results of the ANOVAs for these films were statistically significant. Tukey's Post Hoc Tests revealed that these films induced the emotions they were designed to induce (See Table 2).

Table 2.

Tukey's Post Hoc Test for the Pre-Test Results

Film	Emotion (I)	Emotions (J)	Mean Difference (I-J)	95% CI Lower	95% CI Upper
An Officer & a Gentleman	Happy	Sad	4.28**	-6.3	-5.3
		Angry	6.89**	4.7	5.8
		Afraid	6.59**	4.5	5.5
		Neutral	4.02**	-5.2	-2.7
The Champ	Sad	Happy	8.26**	5.5	6.8
		Angry	5.22**	2.5	3.8
		Afraid	6.12**	2.0	4.1
		Neutral	5.72**	4.3	7.1
My Bodyguard	Angry	Happy	4.66**	-7.5	-6.1
		Sad	0.27**	-3.1	-1.7
		Afraid	2.91**	-5.7	-4.3
		Neutral	5.29**	-6.7	-3.9
Halloween	Afraid	Happy	3.99**	-6.6	-5.3
		Angry	5.07**	2.4	3.7
		Sad	2.04**	-4.7	-3.3
		Neutral	3.54**	-5.0	-2.1

*$p < 0.05$, **$p < 0.01$

Study Procedures

All participants were asked to take part in an online survey hosted on Qualtrics. The survey began by providing participants with an informed consent page, outlining the requirements for participation in the study, a basic outline of what participation would entail, and contact information.

Following this, participants were brought to a page which showed a video clip which was designed to induce a specific emotion. The survey was programmed to randomly show the participants one of the four emotional video clips. The emotions induced were happiness, sadness, fear and anger (see description above). This was followed by a brief questionnaire asking participants to rank the extent to which they felt the emotions of happiness, sadness, fear,

anger, and nothing. The results from this questionnaire were used as a manipulation check. After the elicitation of emotions, participants completed the Faux Pas Test. Following this, participants then completed the Cognitive Reflections and Conjunction Fallacy tasks. Finally, participants provided demographic information.

After all of the surveys were complete, participants were brought to the debriefing section of the survey where they were informed of the purpose of the survey.

Data Analyses

Data Screening.

Data were downloaded into a Microsoft excel file. The original sample was composed of approximately 266 participants. Data were removed based on criteria of completeness, adequate scores on the control questions of the Faux Pas task, and age appropriateness. Data were removed if the Faux Pas Task, the Conjunction Fallacy Questions, or the Cognitive Reflections test were not finished. Data were removed if participants scored less than 30 points total out of a possible 40 on the Faux Pas Task control questions. This was because these questions assessed the extent to which participants actually understood the vignettes presented by the task. Had participants failed to understand the vignettes, then low scores on the subsections of the test could reflect this misunderstanding of the vignettes, rather than genuine differences in Theory of Mind. Finally, data were removed if participants reported ages outside of the accepted range of 18 to 26. The final sample had a total of N=230 participants.

Analysis Plan

Preliminary analyses were conducted to assess the effectiveness of the use of the film-based mood procedure. This was done using a Multivariate Analysis of Variance as well as One-

Way Analyses of Variance and a Chi Square Test of Independence.

Individual hypotheses regarding the effects of emotional states on Theory of Mind were tested in two ways. First, four One-Way Analyses of Variance with emotional condition as the independent variable and the scores on the subsections of the Faux Pas test as the dependent variables. Following this, independent samples t-tests were conducted to test the specific hypotheses predicted in this experiment examining how participants compared to one another on the Faux Pas test. This was done by grouping together participants in the happy and angry conditions and grouping together participants in the sad and fearful conditions. The hypotheses predicted that the emotions grouped together would have similar effects on Theory of Mind. If effect sizes are weak, then effects not detected with an ANOVA may show up in these t-tests.

Following this, the fourth and fifth hypotheses were tested using a Chi-Square Test of Independence. This was done to determine if the proportion of participants with a heuristic cognitive style was greater than the proportion of participants with an analytical cognitive style for any one of the emotional conditions to a statistically significant degree.

Results

Manipulation Checks

Comparing Recruitment Source

Participants in this study were recruited from two different sources. They were recruited from the State University of New York at New Paltz Subject Pool, and from Amazon Mechanical Turk. The former represents a very specific population which differs from the general emergent adult population in several key ways. One, they are generally more educated than the general emergent adult population. Further, they are in an environment in which they take many online and written tests, which may influence the strategies they use when taking

psychological assessment tests such as the Faux Pas task. Further, psychology students may be familiar with the test materials which could confound the results. Thus, analyses were performed comparing SUNY New Paltz Participants to Amazon Turk Participants.

The Analyses performed were Independent Samples t-tests. The independent variable was the source of the participants while the dependent variable were the scores on the Faux pas Task and its subsections. A total of N = 53 participants were recruited from SUNY New Paltz. A total of N = 63 Participants were recruited from Amazon Turk. For this analysis a total of N = 114 participants' data were not used because it was impossible to determine which population their data were drawn from.

First, descriptive statistics were run for the samples (See Table 3.). The t-test comparing scores on General Theory of Mind was not statistically significant ($t(114) = 0.113$, $p = 0.911$). The t-test comparing the scores on Affective Theory of Mind was not statistically significant ($t(114) = 1.331$, $p = 0.18$). For the t-test comparing scores of the Knowledge component of Cognitive Theory of Mind was not statistically significant ($t(114) = -0.711$, $p = 0.478$). Finally, the t-test comparing scores on the Motivation component of Cognitive Theory of Mind was not statistically significant ($t(114) = -0.436$, $p = 0.664$). These results indicate that there was no significant difference between participants recruited from the SUNY New Paltz Subject pool and participants recruited from Amazon Mechanical Turk. These two populations were combined for all further analyses.

Table 3.

Mean Scores: New Paltz Students vs Amazon Turk Workers

Recruitment Source		Total	Emotion	Motivation	Knowledge
New Paltz	M	108.60	18.56	17.02	17.58
	SD	(1.43)	(0.22)	(0.23)	(0.29)
Amazon Turk	M	108.38	18.11	17.50	17.85
	SD	(1.35)	(0.24)	(0.25)	(0.24)
Mixed	M	106.57	18.21	17.02	17.53
	SD	(1.11)	(0.19)	(0.23)	(0.18)

Emotion Manipulation

A Multivariate Analysis of Variance was used to test the effectiveness of the Film mood induction procedure, with emotional conditions used as the Independent variable, and the extent to which participants felt each emotion as the dependent variable. The results of the Multivariate Analysis of Variance were statistically significant ($F(3,15) = 27.489$, $p < 0.05$).

Tukey's Post Hoc tests revealed that for the Happy, Angry and Fear conditions, the targeted emotions for these conditions were reported to a greater extent than all other emotions (See Table 4). This was found to be statistically significant. These post hoc tests also revealed, however, that while the happiness, fear and sadness conditions were selective for their target emotions, the anger condition did not exclusively induce anger. The Anger condition induced near equal levels of anger and sadness (See Table 5). A final note is that a neutral mood was elicited to a relatively high level. The average level of neutrality elicited across all of the emotion conditions together is the second largest. This is the opposite effect which one might expect. Since all of the conditions were designed to elicit an emotion, neutrality ratings which indicate that the participant felt no emotion should have been low in every condition.

Table 4.

Means for the Emotion Ratings

Emotion Condition		Happiness	Sadness	Anger	Fear	Neutral
Happy	M	5.75	1.96	1.81	1.86	3.95
(Officer & Gentleman)	SD	(2.68)	(1.71)	(1.83)	(1.88)	(2.22)
Angry	M	1.89	5.58	6.05	2.96	3.0
(My Body Guard)	SD	(1.60)	(2.62)	(2.90)	(2.38)	(2.29)
Sad	M	1.67	6.69	2.36	2.72	2.58
(The Champ)	SD	(1.54)	(2.27)	(2.21)	(2.31)	(2.20)
Fear	M	1.93	3.60	2.88	5.03	3.78
(Halloween)	SD	(1.75)	(2.30)	(2.51)	(2.92)	(3.04)

Table 5.

Tukey's Post Hoc Test for the Manipulation Check

				95% CI	
DV	Condition(I)	Conditions (J)	Mean Difference (I-J)	Lower	Upper
Happiness	Happy	Sad	4.04**	3.1	5.0
		Angry	3.85**	2.9	4.8
		Afraid	3.81**	2.8	4.7
Sadness	Sad	Happy	4.72**	3.6	5.8
		Angry	1.10	-0.0001	2.2
		Afraid	3.09**	2.0	4.1
Anger	Angry	Happy	4.23**	3.0	5.3
		Sad	3.69**	2.5	4.8
		Afraid	3.17**	2.0	4.3
Fear	Afraid	Happy	3.16**	2.0	4.3
		Angry	2.06**	0.9	3.2
		Sad	2.30**	1.1	3.4
Neutral	Sad	Happy	-1.36*	-2.5	-0.1
		Angry	-0.49	-1.7	0.7
		Afraid	-1.20*	-2.3	-0.006

$*p < 0.05$, $**p < 0.01$

Descriptive Statistics

Descriptive statistics were run to explore the data. It was found that for the scores of General Theory of Mind, there was a mean score of 107.5348 (SD = 11.28) and the data were negatively skewed. For the scores on Affective Theory of Mind, the mean score was M = 18.265 (SD = 1.9) and the data were negatively skewed. For the Knowledge component of Cognitive Theory of Mind, the mean score was 17.6348 (SD = 2.03) and the data were negatively skewed. For the Motivation component of Cognitive Theory of Mind, the mean score was M= 17.2304 (SD = 2.27) and the data were negatively skewed

Main Analyses

Hypothesis One

The first hypothesis predicted that participants induced with a Fearful or Sad emotion would have better use of Theory of Mind in general than participants in the happy or angry conditions as measured by overall scores on the Faux Past Task. The first Analysis of Variance examined the effects of individual emotional states on the total score of General Theory of Mind. The results of this ANOVA were not statistically significant ($F(3, 226) = 0.589$, $p = 0.623$) (See Table 6). Means and standard deviations are shown on table 7.

The primary t-test confirmed the results of the ANOVA. The results of the t-test comparing scores on the Total Score of the Faux Pas Test which examines General Theory of Mind were not statistically significant ($t(228) = 0.671$, $p = 0.48$) (See Table 8). Participants' scores in the Happy and Angry (N = 115, M = 108.03, SD = 12.06) conditions were not different to a statistically significant degree from the scores in the Sad and Fearful Conditions (M = 107.03, SD = 10.46). Thus, Hypothesis 1 was not supported.

Table 6.

Main Analyses of Variance

Theory of Mind Measure	df	SS	MS	F-Value	P-Value
General ToM					
Between Groups	3	226.196	75.39	0.589	0.623
Within Groups	226	28923.026	127.978		
Total	229	29149.222			
Motivation Cognitive ToM					
Between Groups	3	3.193	1.064	0.203	0.894
Within Groups	226	1183.594	5.237		
Total	229	1186.787			
Knowledge Cognitive ToM					
Between Groups	3	0.773	0.258	0.062	0.980
Within Groups	226	946.548	4.188		
Total	229	947.322			
Affective ToM					
Between Groups	3	6.479	2.160	0.570	0.635
Within Groups	226	856.342	3.789		
Total	229	862.822			

$*p < 0.05$.

Table 7.

Mean Scores for the Faux Pas Task

Emotion Condition		Total Score	Emotion	Motivation	Knowledge
Happiness	M	107.58	18.35	17.06	17.68
	SD	(1.79)	(0.30)	(0.34)	(0.30)
Sadness	M	108.20	18.36	17.23	17.54
	SD	(1.42)	(0.23)	(0.30)	(0.28)
Anger	M	108.52	18.38	17.40	17.68
	SD	(1.32)	(0.24)	(0.29)	(0.22)
Fear	M	105.96	17.98	17.23	17.68
	SD	(1.33)	(0.23)	(0.25)	(0.24)

Table 8.

t-tests Comparing Happy & Angry Participants to Sad & Fearful Participants

Faux Pas Score Section	*df*	*mean difference*	*t-score*	*p-value*
General ToM	228	1.000	0.671	0.503
Motivation Cognitive ToM	228	0.008	-0.029	0.977
Knowledge Cognitive ToM	228	0.034	0.129	0.897
Affective ToM	228	0.200	0.781	0.436

Hypothesis Two

The second hypothesis predicted that participants induced with a Fearful or Sad emotion would have better use of Cognitive Theory of Mind than participants in happy or angry conditions. This hypothesis was tested using the Knowledge and Motivation components of the Faux Pas Task.

A One-Way Analysis of Variance examined the effects of individual emotions on the Knowledge component of the Faux Pas Test. The results of this ANOVA were not statistically significant ($F(3, 226) = 0.062$, $p = 0.980$) (See Table 6). The results of the t-test comparing scores on the Knowledge Component of the Faux Past Task were not statistically significant ($t(228) = 0.129$, $p = 0.99$) (See Table 8). Participants' scores in the Happy and Angry (M = 17.65, 2.06) conditions were not significantly different from scores (M = 17.61, SD = 2.01) in the Sad and Fearful Conditions (M = 17.61, SD = 2.01).

A One-Way Analysis of Variance examined the effects of individual emotions on the Motivation component of the Faux Pas Test. The results of this ANOVA were not statistically significant ($F(3, 226) = 0.203$, $p = 0.894$) (See Table 6). The results of the t-test comparing scores on the Motivation Component of the Faux Pas Task were not statistically significant ($t(228) = 0.29$, $p = 0.239$) (See Table 8). Participants' scores in the Happy and Angry (M =

17.22, 2.4) conditions were not significantly different from the scores in the Sad and Fearful Conditions (M = 17.23, SD = 2.2).

These results indicate that Hypothesis 2 was not supported.

Hypothesis Three

The third hypothesis predicted that participants induced with a Fearful or Sad emotion would have better use of Affective Theory of Mind compared to participants in the Happy or Angry conditions. A One-Way Analysis of Variance examined the effects of individual emotions on Affective Theory of Mind (See Table 6). The results of this ANOVA were not statistically significant ($F(3, 226) = 0.57$, $p = 0.635$).

The results of the t-test comparing scores on the Emotion Component of the Faux Pas Test which measures Affective Theory of Mind were not statistically significant ($t(228) = 0.781$, $p = 0.581$) (See Table 8). Participants' scores in the Happy and Angry (M = 18.36, SD = 2.08) conditions were not significantly different from the scores in the Sad and Fearful Conditions (M = 18.16, SD =1.79).

Thus, Hypothesis 3 was not supported.

Hypotheses Four and Five

The fourth hypothesis of this experiment predicted that participants in the Happy and Angry conditions would be primed with an intuitive cognitive style. The fifth hypothesis was that participants in the sad and fearful conditions would be primed with an analytical cognitive style. These hypotheses were tested using a Chi-Square Test of Independence (See Table 10 for results). The variables used in the Chi-Square Test of Independence were emotional condition

and whether or not participants' results on the Conjunction Fallacy questions indicated a use of this fallacy, which is an assessment of cognitive style.

For participants in the happy condition, 53.3% indicated they used the conjunction fallacy, while 46.7 % indicated they did not. For participants in the sad condition, 34.5 % indicated they used the conjunction fallacy, while 65.5% indicated they did not. For participants in the anger condition, 52.7 % indicated they used the conjunction fallacy, while 47.3% indicated they did not. For participants in the fear condition, 41.7 % indicated they used the conjunction fallacy, while 58.3% indicated they did not. The results of the Chi-Square Test of Independence indicated that these differences were not statistically significant (χ^2 (3, N = 230) = 5.655, p = 0.13). This indicates that there was no statistically significant difference between the proportion of participants who used the conjunction fallacy and those who did not use the conjunction fallacy. Thus, hypotheses four and five were not supported.

Table 10.

Chi-Square Test of Independence: Emotion x Cognitive Style

	Cognitive Style	
	Yes Conjunction	No Conjunction
Emotion	Observed, Expected, Residual	Observed, Expected, Residual
Happy	36 * 27.4(1.4)	32* 32.6(-1.4)
Sad	19* 25.1(-1.9)	36* 29.6(1.9)
Angry	29* 25.1(1.2)	26* 29.9(-1.2)
Afraid	25* 27.4(-0.4)	35* 32.6(0.4)

**Indicates the difference between observed and expected differences is greater than Adjusted Residual x 2, which indicates a significant effect. (M = 107.03, SD = 10.46) This only applies if the overall test is statistically significant.*
Top number indicates observed number, bottom number indicates expected number, bottom parenthesis indicates Adjusted Residual.

In addition to the analyses above, Hypotheses 4 and 5 were further tested using the cognitive reflections test. The rationale for this is that both the conjunction fallacy questions and the Cognitive Reflections Test serve as an indicator for cognitive processing style but may measure different aspects of it. The Cognitive Reflections Test examines the extent to which one can suppress an intuitive answer and think about a question analytically to come to the correct answer. The scores on the Cognitive Reflections Test were analyzed using a Kruskal-Wallis Test, and the results were not statistically significant ($\chi^2(3, N = 230) = 1.072$, $p = 0.784$). Emotional condition was not related to scores on the Cognitive Reflections Test. Thus, Hypotheses 4 and 5 were not supported.

Hypothesis Six.

My sixth hypothesis was that the elicitation of emotions in general will result in lowering performance of Affective, but not Cognitive Theory of Mind. This hypothesis was tested by identifying participants who indicated that they did not have an emotional reaction to the mood induction procedure. This was done by identifying participants who rated the mood of neutrality to be higher than the target emotion in any given condition. These participants were then compared to participants who did have an emotional reaction to the mood induction procedure via independent sample's T-Tests. The dependent variable were the scores on General Theory of Mind, Knowledge Based Cognitive Theory of Mind, Motivation Based Cognitive Theory of Mind, and Affective Theory of Mind. The findings of these analysis examining General Theory of Mind were $t(226) = 0.512$, $p = 0.609$. The analysis examining Knowledge based cognitive Theory of Mind were $t(226) = 0.113$, $p = 0.909$. The analysis examining Motivation based Cognitive Theory of Mind were $t(226) = 0.170$, $p = 0.864$. The results examining Affective

Theory of Mind were $t(226) = 0.776$, $p = 0.439$. None of the analyses were statistically significant. Thus, Hypothesis 6 was not supported.

Additional Analyses

Comparing Valences

Initially, it was assumed that any effects found for the influence of emotions on Theory of Mind could not be explained by differences in emotional valence. The assumption was that emotions are too complex to be understood only in terms of being either positive and negative. There have been past research findings which have found differences in cognitive processing along these lines, however (Angie et al., 2011). Thus, an analysis was conducted to test for the possibility that valence could influence Theory of Mind.

This was done by comparing participants in the Happy condition with participants in the Sad, Angry and Fearful conditions on their scores on the Faux Pas task and its subsections via an Independent Sample's t-test. The results yielded no statistically significant results (See Table 11).

Table 11.

t-tests Comparing Happy & Angry Participants to Sad & Fearful Participants

Faux Pas Score Section	*df*	*mean difference*	*t-score*	*p-value*
General ToM	228	0.065	0.039	0.969
Motivation Cognitive ToM	228	0.221	-0.647	0.518
Knowledge Cognitive ToM	228	0.024	-0.080	0.936
Affective ToM	228	0.114	0.393	0.695

Removing Potential Confounds

There were two important factors which may have confounded the results of the experiment. The most significant of these is the fact that the video designed to prime an angry

mood in participants also primed a sad mood in them as well. According to the Appraisal Tendency Framework, these two moods would prime opposite cognitive processing styles, and thus these two moods were hypothesized to have opposite effects on one's Theory of Mind abilities. A second confound to the experiment is the presence of outliers. The data for all of the measures of Theory of Mind are negatively skewed, and have outliers present in the data. This could lead to Type I and Type II errors in the data. Thus, a final exploratory analysis was conducted with outliers and the anger condition removed from the data.

Removing Outliers

The possibility of an outlier effect on the results of the experiment was suspected due to the negative skew of the data. Outliers were identified as any data point which was further than 3 standard deviations above or below the mean on any of the measures. A total of seven outliers were removed from the data. New descriptive statistics were calculated (See Table 12).

An Independent Samples t-test was then conducted to examine how participants who were outliers scored on control questions compared to participants who were not outliers. The independent variable was whether participants were or were not an outlier. The dependent variable were scores on the control questions of the Faux Pas Test. This analysis was conducted because the control questions assess how well participants understood the vignettes in the skit which could influence scores. It was found that the mean score of the control questions were lower for participants who were outliers (M = 34.28, SD = 3.35) than for participants who were not outliers (M = 38.03, SD = 1.97). The Independent Sample's t-test found this to be a statistically significant difference ($t(228) = 4.816$, $p < 0.05$). This indicated that the likely cause for the outlier scores may be that these participants to understand some of the vignettes in the Faux Pas Task.

The main analyses were conducted without outliers. This includes One-Way Analyses of Variance where the independent variables were the emotional states of the participant and the dependent variables were the scores on the Faux Pas Task. None of the Analyses of Variance were statistically significant: General Theory of Mind ($F(3, 223) = 1.415$, $p = 0.23$), the Motivation Component of Cognitive Theory of Mind ($F(3, 223) = 1.122$, $p = 0.94$), the Knowledge Component of Cognitive Theory of Mind ($F(3, 223) = 0.118$, $p = 0.94$), and Affective Theory of Mind ($F(3, 223) = 1.592$, $p = 0.19$). These results suggest that there is no main effect of emotion on Theory of Mind, even when controlling for statistical outliers.

Table 12.

Mean Scores for the Faux Pas Task: Outliers removed

Emotion Condition		Total Score	Emotion	Motivation
Happiness	M	109.82	18.71	17.42
	SD	(1.32)	(0.22)	(0.29)
Sadness	M	108.86	18.47	17.28
	SD	(1.30)	(0.20)	(0.29)
Anger	M	109.22	18.51	17.50
	SD	(1.14)	(0.20)	(0.28)
Fear	M	106.47	18.08	17.32
	SD	(1.25)	(0.21)	(0.24)

Exploring Anger, Sadness, & Neutrality.

The intent of this experiment was to explore the effects of discrete emotions on Theory of Mind. The results of the manipulation check appear to present two problems with this. First, the mood manipulation for the anger condition induced sadness to a near equal degree to anger (See Table 3.). This is particularly problematic since it was hypothesized that anger and sadness would yield opposite effects on both cognitive style and Theory of Mind.

The second problem presented by the manipulation check is that the overall mean score for the neutrality ratings were the second highest of all of the emotions, behind sadness (See Table 3.). This is the opposite of what was expected. Each emotion condition was designed to induce a specific emotional state. Thus, neutrality, which indicates the participant felt little or no emotion, should have been the lowest rated emotion since there was no neutral condition which would have pulled this emotion's mean up. This seems to suggest that there may have been participants who were not affected strongly by the film mood induction procedure.

The effect of neutrality was explored by removing all participants whose emotion ratings in the manipulation check indicated that they experienced a neutral emotional reaction to the films to a greater degree than the target emotion of the condition the participants were in. Descriptive statistics were then calculated for this new sample (See Table 13). A Chi-Square Test of Independence was then run to determine if the removal of neutral participants resulted in a correlation between emotional state and cognitive style. Then, One-Way Analyses of Variance were run to determine if any mean differences between groups were statistically significant.

Table 13.

Mean Scores for the Faux Pas Task: Neutral Controlled for

Emotion Condition		Total Score	Emotion	Motivation	Knowledge
Happiness	M	108.85	18.52	17.27	17.67
	SD	(2.01)	(0.34)	(0.39)	(0.34)
Sadness	M	107.95	18.34	17.19	17.44
	SD	(1.49)	(0.25)	(0.30)	(0.31)
Anger	M	108.53	18.39	17.37	17.72
	SD	(1.58)	(0.29)	(0.35)	(0.26)
Fear	M	105.57	18.02	17.00	17.68
	SD	(1.67)	(0.29)	(0.33)	(0.29)

For the Chi-Square Test of Independence, the independent variable was emotional state, while Cognitive Style as assessed by the Conjunction Fallacy was the dependent variable. This was found to be statistically significant (χ^2 (3, N = 168) = 8.289, $p < 0.05$) (See Table 14). This indicates that emotion did predict cognitive style. For all emotion conditions, the difference between the observed and expected proportion of participants exhibiting a cognitive style was found to be statistically significant. Thus, when neutral participants are removed emotion appears to predict cognitive style. It was observed that in the sad condition, 70.2% of participants used an analytical cognitive style. This was the strongest effect. It was observed that 57.9% of the participants in the fear condition used an analytical cognitive style. It was observed that 57.5% of the participants in the happiness condition used a heuristic based intuitive cognitive style. Finally, it was observed that 53.5% of the participants in the anger condition used a heuristic based intuitive cognitive style. These results support hypotheses 4 and 5.

One-Way Analyses of Variance were then conducted. The independent variables used were the emotion conditions, while the dependent variables were the scores on the Faux Pas

Task. These results were not statistically significant (See Table 15). Thus, even when participants who were neutral in mood were removed from the data, emotion did not predict changes in Theory of Mind.

Table 14.

Chi^2 Test of Independence: Emotion x Cognitive Style

	Cognitive Style	
	Yes Conjunction	No Conjunction
Emotion	Observed, Expected, Residual	Observed, Expected, Residual
Happy	23*	17*
	18.1(1.8)	21.9(-1.8)
Sad	14*	33*
	21.3(-2.5)	25.7(2.5)
Angry	23*	20*
	19.5(1.3)	23.5(-1.3)
Afraid	16*	22*
	17.2(-0.4)	20.8(0.4)

**Indicates the difference between observed and expected differences is greater than Adjusted Residual x 2, which indicates a significant effect. This only applies if the overall test is statistically significant.*
Top number indicates observed number, bottom number indicates expected number, bottom parenthesis indicates Adjusted Residual.

Table 15.

Main Analyses of Variance

Measure of Theory of Mind	*df*	*SS*	*MS*	*F-Value*	*P-Value*
General Theory of Mind					
Between Groups	3	455.875	85.292	0.714	0.546
Within Groups	164	19636.976	119.738		
Total	167	19892.851			
Motivation Cognitive Theory of Mind					
Between Groups	3	2.988	0.996	0.197	0.898
Within Groups	164	829.298	5.0571		
Total	167	832.286			
Knowledge Cognitive Theory of Mind					
Between Groups	3	2.121	0.707	0.179	0.910
Within Groups	164	647.254	3.947		
Total	167	649.375			
Affective Theory of Mind	3	5.213	1.738	0.472	0.702
Between Groups	164	603.781	3.682		
Within Groups	167	608.994			
Total					

*$p < 0.05$

Scores on the Cognitive Reflections Test were also examined once neutral participants were removed. The scores on the Cognitive Reflections Test were analyzed using a Kruskal-Wallis Test. The results of the Kruskal-Wallis Test were not statistically significant ($\chi^2(3, N = 169) = 1.223$, $p = 0.745$). Thus, although removing outliers revealed that emotional conditions had a significant effect on cognitive processing style as measured by the Conjunction Fallacy Questions, it did not have a significant effect on cognitive processing style as measured by the Cognitive Reflections Test. Thus, although both tests examine cognitive processing style, it appears that they measure different aspects of cognitive processing style which are not similarly affected by emotional state.

Examining Cognitive Style by Itself

The findings thus far indicate that emotional states predict a cognitive processing style, but this cognitive processing style does not lead to a change in how accurate people are in making Theory of Mind judgments. It is of empirical interest to examine how cognitive style by itself influences the accuracy of Theory of Mind Judgments. This was done in two ways. First, participants who were indicated as having used the Conjunction Fallacy were compared to participants who did not use the Conjunction Fallacy on scores of the Faux Pas Task via Independent Samples t-tests. Second, participants' scores on the Cognitive Reflections Task and scores on the Faux Pas Task were compared via a Pearson Product-Moment Correlation. The reason both tasks were used was because even though scores on these tasks can provide an indication of whether or not one is using an analytical or heuristic based intuitive cognitive processing style, they may tap into different aspects of intuitive processing. The Conjunction Fallacy task deals directly with making judgments of others and relies on stereotypes. The Cognitive Reflections task words its questions in such a way that an intuitive answer seems to be correct, and a person must suppress the instinct to answer quickly and think about the question to answer it correctly. Thus, it is a measure of how easily one can suppress intuitive processing.

An Independent Samples t-test was used to determine if cognitive style as measured by scores on the Conjunction Fallacy predicted scores on the Faux Pas Task. (See Table 16). The scores on the Conjunction Fallacy test indicated whether participants used an analytical cognitive style, or an intuitive-heuristic based cognitive style. The Independent Samples t-tests were not statistically significant (See Table 17). Thus, participants primed with an analytical

cognitive processing style did not score higher or lower than participants who were primed with a heuristic based intuitive cognitive processing style (See Table 16).

A Pearson Product-Moment Correlation analysis was used to analyze the relationship between scores on the Cognitive Reflections Test (M = 1.26, SD = 1.25) and scores on the Faux Pas Task. This analysis was used because all of these measures are measured on an interval level. Scores on the Cognitive Reflections Test were the independent variable, and the Faux Pas Task Scores were the dependent variable. The analysis found only one statistically significant correlation (See Table 18). This was between scores on the Cognitive Reflections Test and scores on General Theory of Mind. (r = -0.137, $p < 0.05$). Thus, higher scores on the Cognitive Reflections Test seem to correlate to higher scores on the Faux Pas Test.

Table 16

Cognitive Style (as measured by Conjunction Fallacy) Descriptives

Cognitive Style		General ToM	Affective ToM	Motivation Cognitive ToM	Knowledge Cognitive ToM
Analytic	M	108.60	18.35	17.45	17.72
	SD	(8.95)	(1.60)	(1.96)	1.65
Heursitic	M	108.51	18.55	17.30	17.95
	SD	10.02)	(1.61)	(2.17)	(1.81)

Table 17

Independent Samples t-test: Analytical Conjunction vs Intuitive Conjunction.

Faux Pas Score Section	*df*	*mean difference*	*t-score*	*p-value*
Total Faux Pas Score	221	0.093	-0.074	0.941
Motivation Component	221	0.149	-0.537	0.592
Knowledge Component	221	0.226	0.975	0.331
Emotional Component	221	0.203	0.941	0.348

Table 18.

Correlation Coefficients for CRT by ToM Measure

		Total Faux Pas	Motivation	Knowledge	Emotion
CRT	*r*	-0.137*	-0.120	-0.114	-0.093
	p-value	0.042	0.074	0.089	0.167

* $p < 0.05$ level.

Discussion

A commonly held belief is that when someone becomes emotional, he or she will lose the ability to be rational or to see things from another person's perspective. Interestingly, the results of this experiment do not offer support for this stance. The results of the experiment suggest that emotions do not seem to influence Theory of Mind, and thus becoming emotional may not make it more difficult to see things from another person's perspective. Even more interestingly, no statistically significant main effect of for the influence of cognitive style on Theory of Mind accuracy was found, which suggests that the use of heuristics to make mental state inferences is not more or less accurate than the use of analytical cognitive processing. However, one should be cautious when interpreting null results. The findings may be indicative of a ceiling effect for the Faux Pas Task.

Hypothetical Predictions

Analyses testing the main hypotheses of this experiment did not show any statistically significant results. Thus, none of the hypotheses were supported. Follow-up analyses did not indicate that emotional states influence Theory of Mind in any measurable way. Further, the follow-up analyses did not indicate that there is an effect for cognitive style. Thus, hypotheses one, two, and three were not supported in follow-up analyses. Follow-up analyses, however, seem to indicate that emotional states predict cognitive style. Specifically, happiness and anger

were correlated with higher use of the conjunction fallacy, which indicates a use of intuitive heuristic based cognitive processing. Sadness and fear were found to be associated with less use of the conjunction fallacy, which indicates use of an analytical cognitive processing style. Thus, hypotheses four and five were supported in follow-up analyses.

Emotion

It was found in the primary analyses that there was no statistically significant main effect for the type of emotion an individual was feeling on Theory of Mind. This makes sense, since the primary analyses indicated that type of emotion one felt did not alter cognitive processing. This runs counter to commonly held beliefs that becoming emotional may make it more difficult for people to see things from another person's perspective.

In a series of follow-up analyses, participants who indicated that they felt neutral after the mood manipulation were removed from the data. During these analyses a relationship between emotional states and cognitive processing style was found. Further, these associations were the ones which were predicted by the Appraisal Tendency Framework (Baas, De Dreu, & Nijstad., 2012; Bagneux, Bollon, & Dantzer., 2012; Bagneux, Font, & Bollon., 2013; Tiedens & Linton, 2001). Thus, this experiment further adds support to the Appraisal Tendency Framework. There are reasons to remain skeptical of the results of the follow-up analyses' findings, however. First, the removal of outliers from the analyses resulted in a much smaller sample size, which made the likelihood of a type II error more likely to occur. Further, while the follow-up analysis ensured that participants who were neutral following the mood induction procedure were not influencing the results of the analysis, it did not control for the potential confounds of participants who experienced mixed emotions following the mood induction procedure. This is problematic because participants in the anger condition were equally likely to

experience feelings of sadness following the mood induction (See Table 3). Research has been conducted to explore the effects of single discrete emotions in the past (Angie et al, 2011). Little research has focused on mixed emotions. Furthermore, theoretical models, such as the Appraisal Tendency Framework, do not account for them (Tiedens & Linton, 2001).

The present study did not explore intensity as a moderator of the effects of emotion on cognitive processing or Theory of Mind. Intensity, in this case, refers to the strength of an emotion, as well as the accompanying change in physiological arousal which stems from it. This is a factor which is important to consider because it stands to reason that the intensity with which one feels an emotion may affect the extent and direction that the emotion influences cognitive processing. For example, a person experiencing a low level of anxiety may adopt an analytical cognitive processing style, as predicted by the Appraisal Tendency Framework. High levels of Anxiety, however, may result in the adoption of a less analytical cognitive processing style due to the participant engaging in the fight or flight response. This may account for why statistical significance was not found in this experiment.

Participants in this study were emergent adults between the ages of 18 and 26. At this age participants are likely to be able to regulate their emotions. This is especially true when watching films, a visual medium that all of the participants are likely to be familiar with. It is not unlikely that a participant feeling a negative emotion such as anger or sadness may successfully attempt to minimize the extent to which he or she feels these emotions. Thus, the non-significant effects could be the results of the mood induction procedure inducing low intensity emotional states.

It is also important to note that the Sadness condition not only had high levels of sadness, but participants also reported high levels of anger. Thus participants in this condition reported

experiencing mixed emotions. This is may be due to the nature of the clip used in this emotion condition. Further, in the pretest the Anger condition elicited both high levels of Anger and Sadness. This may be due to the fact that both the film clips for the Anger and the Sadness conditions depicted bad things happening to someone. In the film clip in the Anger condition a young man is bullied, while in the film clip for the Sadness condition a young boy watches his father die. It is possible that watching negative things happen to another person may elicit both feelings of sadness for the victim, as well as anger over the fact that bad things are happening to him or her.

The fact that in both the pretest and in the study, the anger and sadness conditions produced mixed emotions suggests that these two emotions may overlap. More research is necessary to determine whether this was an artifact of the way the emotions were manipulated in this study or that there is a high probability that these two emotions will co-occur. It is conceivable that people induced exclusively with anger would perform differently on Theory of Mind tasks compared to participants experiencing both anger and sadness. Comparing the effects of single discreet emotions and mixed emotions on cognitive processing is an area ripe for future research.

On Cognitive Style, & Accuracy

The hypotheses of this experiment were predicated on the idea that the induction of an analytical cognitive processing style leads deliberating more over the mental states of others, which in turn leads to more accurate Theory of Mind judgments. The results did not support this. The analysis examining cognitive style as measured by the Conjunction Fallacy Task found no evidence of the influence of cognitive processing style on Theory of Mind judgments. The analysis examining the relationship between scores on the Cognitive Reflections Task and

scores on the Faux Pas Task found that higher scores on the Cognitive Reflections Task were correlated with lower scores on the General Theory of Mind. Thus, more analytical mindsets as measured by the Cognitive Reflections Task were associated with less accuracy on Theory of Mind judgments.

One possible explanation for the negative correlation between scores on the Cognitive Reflections Task and scores on General Theory of Mind is that while an intuitive cognitive style may rely on heuristics and intuitions for the judgments one makes, these heuristics may not be inaccurate. An implicit assumption was that relying on heuristics and intuitions to make judgments is less accurate than using analytical thought. It is important to remember, however, that the use of heuristics in cognitive processing is an automatic response used for the majority of judgments people make (Bhatia, 2017). Yet, the majority of judgments people make are correct, so these judgments have a high rate of accuracy. This may account for the null results of the experiment. The Faux Pas task was not designed to be counter intuitive, and many of the intuitions of the participants may have been led them to the correct answer.

A possible explanation for the inverse correlation between scores on the Cognitive Reflections Task and the general scores on the Faux Pas Task may be that participants are overthinking their answers. The Cognitive Reflections Task operates by asking participants a question where an intuitive answer seems correct, but in reality, it isn't. Participants who are able to suppress their intuitions and analytically think about the answer perform the best on this test. High scores on this test may be indicative of a tendency for participants to overthink a question, which could cause them to not answer a question with an intuitive answer that is actually correct.

One possible explanation for the null results of the analysis examining the effect of cognitive style as measured by the Conjunction Fallacy questions is that the nature of the task may account for the findings. The Conjunction Fallacy questions are questions where participants read a description of an individual, and then rate the likelihood that this person holds certain traits. These traits are either individual traits, or pairs. The classic example of this is the Linda Problem (See Appendix C). In this particular example, a young woman is described as a working professional woman with a high education. The traits people need to rank are the likelihood that Linda is a feminist, a bankteller, or both. People often get this wrong because the description primes stereotypes which cause the reader to assume that a pair of traits is more likely than the traits occurring by themselves, which is statistically not the case. It is interesting that participants who got such questions wrong are making errors in Theory of Mind judgments, since both of these tests ask the participant to make a judgment about another person. One explanation is that the Faux Pas Task was written in such a way that stereotypes are not primed, which would mean that participants are not relying on misleading stereotypes to make judgments.

Another explanation may be that the cognitive processes used to make judgments about a person's general personality may not be the same as those used to make mental state inferences. Participants often get Conjunction Fallacy questions wrong because they rely on stereotypes about the stable traits of a character, such as their jobs and values. Theory of Mind, however, is one's ability to make judgments about a person's mental state in a specific context. Thus, the stereotypes which serve as heuristics for making judgments about the stable traits of someone may not be as influential.

The two analyses yielded different results despite being measures of the same construct. It is possible that these represent either a Type I or Type II error. It may be, however, that these two measures are examining two different aspects of cognitive processing style. The Conjunction Fallacy questions tap into how people can become influenced by the priming and use of stereotypes in making judgments of others, while the Cognitive Reflections Test taps into suppressing an intuition. It is possible that different aspects of one's cognitive processing style can have separate relationships with various cognitive processes, including Theory of Mind. If these two measures do measure different aspects of cognitive processing style, it would explain why when neutral participants were removed from the analyses, emotional states significantly influenced cognitive processing style as measured by the Conjunction Fallacy questions, but not as measured by the Cognitive Reflections Test. The induction of certain emotional states may make it more likely for one to judge others using analytical thinking, but not necessarily to suppress intuitions. Research examining these differences is necessary.

Alternatively, the t-test examining the relationship between cognitive processing style as measured by the Conjunction Fallacy and Theory of Mind may not have had enough statistical power to detect a statistically significant effect. Since scores on the Faux Pas Task showed a ceiling effect, it is possible that the variance in scores for the Faux Pas Task could not detect small differences in Theory of Mind accuracy.

On the measures used in this Research

The primary measure used in this research was the Faux Pas Task. This task was selected because it was used in prior research with healthy adult populations (Bottiroli et al., 2016). It is important to remember, however, that this tool was not originally intended for use in this population and may not have enough sensitivity to detect variation in Theory of Mind for

healthy emergent adult populations (Stone, Baron-Cohen, & Knight, 1998). This may account for the failure to detect statistically significant effects in the primary analysis. The exploratory analyses found statistically significant results, but the effect sizes for these were tiny. Thus, future research would benefit from the use of more sensitive measures of Theory of Mind.

Suggestions for Future Research

Future research should continue to explore the strength of effect that emotions play on cognitive processes. Specifically, mixed emotions need to be explored. The manipulation check found that many of the participants in this study had mixed emotional reactions to stimuli. It would be interesting to further explore how different combinations of emotional states may induce different cognitive processing styles.

Future research should also continue to examine different populations. The sample used in this study is what cross cultural researchers refer to as a WEIRD population (Henrich, Heine, & Norenzayen., 2010). This is an acronym for Western, Educated, Individualistic, Rich and Democratic. This term is applied to refer to populations from the United States and Europe. Findings on WEIRD populations may not necessarily apply to participants who do not fall into this small category of individuals. Particularly those which focus on cognitive processing styles, since WEIRD populations tend to have a more analytical cognitive processing style compared to non-WEIRD populations. Further, different age groups need to be explored as well. Research has shown that Theory of Mind develops and changes throughout the lifespan into old age.

A further recommendation for future research would be to examine different aspects of cognitive processing style with Theory of Mind, as well as with other cognitive processes. The present research seems to indicate that suppression of one's intuitions which is indicative of an analytical processing style seems to negatively impact one's accuracy in Theory of Mind, while

increased use of stereotypes has no relationship with accuracy on Theory of Mind. This makes sense when one considers that an analytical cognitive processing style is comprised of several cognitive processing patterns. This includes analytical thought that relies on logical rules, non-reliance on intuitions, attributing cause and effect to attributes of a person or object, and field independent cognition (Henrich, Heine, & Norenzayen, 2010; Masuda & Nisbett, 2002; Talhelm et al., 2015). Hueristic based intuitive thought tends to include less reliance on logical rules, a greater reliance on intuitions, a greater tendency to attribute cause and effect to situational influences on a person or object, and field dependent cognition. These separate traits may have separate relationships with Theory of Mind and other cognitive processes. Thus, research needs to examine them individually.

Conclusions

There are three conclusions drawn from the results of this experiment. One, while the results of the primary analyses do not support the hypothetical prediction that different emotional states prime certain cognitive styles, follow-up analyses which controlled for the confounding influence of participants who reported a neutral affect following mood induction procedures did find that different emotional states prime cognitive processing styles. Specifically, participants induced to feel sadness and low level anxiety were primed with an analytical cognitive style while participants induced to feel anger and happiness were primed with a heuristic based cognitive style. This was the predicted patterns of the Appraisal Tendency Framework (Baas, De Dreu, & Nijstad., 2012; Bagneux, Bollon, & Dantzer., 2012; Bagneux, Font, & Bollon., 2013; Tiedens & Linton, 2001). Thus, emotional states can prime a cognitive processing style.

Two, the primary analysis of this experiment suggests that the elicitation of an emotional state does seem to alter accuracy of Theory of Mind. This is in contrast to the findings of prior research (Todd, Forstmann, Burgmer, Brooks, & Galinsky, 2015). The results seem to suggest that contrary to folk psychology theories, becoming emotional may not make it more difficult to understand the thoughts and emotions of person. Caution should be used, however, when one is interpreting null results, and further research is necessary.

Three, the analytical thinking characterized by the ability to suppress an initial intuition in order to deliberate over a problem is inversely related to accuracy in Theory of Mind judgments.

Overall, this research suggests that common assumptions regarding the relationship between emotions, cognitive processing and Theory of Mind need to be reevaluated and researched to a greater degree. The results of this research do not support the assertion that emotions hinder Theory of Mind accuracy, or that heuristic based cognitive processing is less accurate than analytical cognitive processing.

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Appendix A

The Faux Pas Task

1. Vicky was at a party at her friend Oliver's house. She was talking to Oliver when another woman came up to them. She was one of Oliver's neighbors. The woman said, "Hello," then turned to Vicky and said, " I don't think we've met. I'm Maria, what's your name?" "I'm Vicky." "Would anyone like something to drink?" Oliver asked.

Did anyone say something they shouldn't have said or something awkward? (Faux Pas recognition)

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it? (Cognitive ToM: Motivation)

Did Oliver know that Vicky and Maria did not know each other? (Cognitive ToM: Knowledge)

How do you think Vicky felt? (Affective ToM)

Control questions: In the story, where was Vicky?

Did Vicky and Maria know each other?

2. Helen's husband was throwing a surprise party for her birthday. He invited Sarah, a friend of Helen's, and said, "Don't tell anyone, especially Helen." The day before the party, Helen was over at Sarah's and Sarah spilled some coffee on a new dress that was hanging over her chair. "Oh!" said Sarah, "I was going to wear this to your party!" "What party?" said Helen. "Come on," said Sarah, "Let's go see if we can get the stain out."

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

Did Sarah remember that the party was a surprise party?

How do you think Helen felt?

Control question: In the story, who was the surprise party for?
What got spilled on the dress?

3. Jim was shopping for a shirt to match his suit. The salesman showed him several shirts. Jim looked at them and finally found one that was the right color. But when he went to the dressing room and tried it on, it didn't fit. "I'm afraid it's too small," he said to the salesman. "Not to worry," the salesman said. "We'll get some in next week in a larger size." "Great. I'll just come back then," Jim said.

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

When he tried on the shirt, did Jim know they didn’t have it in his size?

How do you think Jim felt?

Control question: In the story, what was Jim shopping for?

Why was he going to come back next week?

4. Jill had just moved into a new apartment. Jill went shopping and bought some new curtains for her bedroom. When she had just finished decorating the apartment, her best friend, Lisa, came over. Jill gave her a tour of the apartment and asked, "How do you like my bedroom?" "Those curtains are horrible," Lisa said. "I hope you're going to get some new ones!"

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

Did Lisa know who had bought the curtains?

How do you think Jill felt?

Control question: In the story, what had Jill just bought?

How long had Jill lived in this apartment?

5. Bob went to the barber for a haircut. "How would you like it cut?" the barber asked. "I'd like the same style as I have now, only take about an inch off," Bob replied. The barber cut it a little uneven in the front, so he had to cut it shorter to even it out. "I'm afraid it's a bit shorter than you asked for," said the barber. "Oh well," Bob said, "it'll grow out."

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

While he was getting the haircut, did Bob know the barber was cutting it too short?

How do you think Bob felt?

Control question: In the story, how did Bob want his hair cut?

How did the barber cut his hair?

6. John stopped off at the gas station on the way home to fill up his car. He gave the cashier his credit card. The cashier ran it through the machine at the counter. "I'm sorry," she said, "the machine won't accept your card." "Hmmm, that's funny," John said. "Well, I'll just pay in cash." He gave her twenty dollars and said, "I filled up the tank with unleaded."

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

When he handed his card to the cashier, did John know the machine wouldn’t take his card?

How do you think John felt?

Control question: In the story, what did John stop off to buy?

Why did he pay in cash?

7. Sally is a three-year-old girl with a round face and short blonde hair. She was at her Aunt Carol's house. The doorbell rang and her Aunt Carol answered it. It was Mary, a neighbor. "Hi," Aunt Carol said, "Nice of you to stop by." Mary said, "Hello," then looked at Sally and said, "Oh, I don't think I've met this little boy. What's your name?"

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

Did Mary know that Sally was a girl?

How do you think Sally felt?

Control question: In the story, where was Sally?

Who came to visit?

8. Joan took her dog, Zack, out to the park. She threw a stick for him to chase. When they had been there a while, Pam, a neighbor of hers, passed by. They chatted for a few minutes. Then Pam asked, "Are you heading home? Would you like to walk together?" "Sure," Joan said. She called Zack, but he was busy chasing pigeons and didn't come. "It looks like he's not ready to go," she said. "I think we'll stay." "OK," Pam said. "I'll see you later."

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?
Why do you think he/she said it?

When she invited her, did Pam know that Joan wouldn't be able to walk home with her?

How do you think Pam felt?

Control question: In the story, where had Joan taken Zack?

Why didn't she walk with her friend Pam?

9. Joanne had had a major role in last year's school play and she really wanted the lead role this year. She took acting classes, and in the spring, she auditioned for the play. The day the decisions were posted, she went before class to check the list of who had made the play. She hadn't made the lead and had instead been cast in a minor role. She ran into her boyfriend in the hall and told him what had happened. "I'm sorry," he said. "You must be disappointed." "Yes," Joanne answered, "I have to decide whether to take this role."

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

When he first ran into her in the hall, did Joanne's boyfriend know that she hadn't gotten the role?

How do you think Joanne felt?

Control question: In the story, what role did Joanne get?

What kind of role had she had the previous year?

What did her boyfriend say?

10. Joe was at the library. He found the book he wanted about hiking in the Grand Canyon and went up to the front counter to check it out. When he looked in his wallet, he discovered he had left his library card at home. "I'm sorry," he said to the woman behind the counter. "I seem to have left my library card at home." "That's OK," she answered. "Tell me your name, and if we have you in the computer, you can check out the book just by showing me your driver's license."

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

When Joe went into the library, did he realize he didn't have his library card?

How do you think Joe felt?

Control question: In the story, what book did Joe get at the library?

Was he going to be able to check it out?

11. Jean West, a manager in Abco Software Design, called a meeting for all of the staff. "I have something to tell you," she said. "John Morehouse, one of our accountants, is very sick with cancer and he's in the hospital." Everyone was quiet, absorbing the news, when Robert, a software engineer, arrived late. "Hey, I heard this great joke last night!" Robert said. "What did the terminally ill patient say to his doctor?" Jean said, "Okay, let's get down to business in the meeting."

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

When he came in, did Robert know that the accountant was sick with cancer?

How do you think Jean, the manager, felt?
Control question: In the story, what did Jean, the manager, tell the people in the meeting?

Who arrived late to the meeting

12. Mike, a nine-year-old boy, just started at a new school. He was in one of the stalls in the restroom at school. Joe and Peter, two other boys, came in and were standing at the sinks talking. Joe said, "You know that new guy in the class? His name's Mike. Doesn't he look weird? And he's so short!" Mike came out of the stall and Joe and Peter saw him. Peter said, "Oh hi, Mike! Are you going out to play football now?"

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

When Joe was talking to Peter, did he know that Mike was in one of the stalls?

How do you think Mike felt?

Control question: In the story, where was Mike while Joe and Peter were talking?

What did Joe say about Mike?

13. Kim's cousin, Scott, was coming to visit and Kim made an apple pie especially for him. After dinner, she said, "I made a pie just for you. It's in the kitchen." "Mmmm," replied Scott, "It smells great! I love pies, except for apple, of course."

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

When he smelled the pie, did Scott know it was an apple pie?

How do you think Kim felt?

Control question: In the story, what kind of pie did Kim make?

How did Kim and Scott know each other?

14. Jeanette bought her friend, Anne, a crystal bowl for a wedding gift. Anne had a big wedding and there were a lot of presents to keep track of. About a year later, Jeanette was over one night at Anne's for dinner. Jeanette dropped a wine bottle by accident on the crystal bowl and the bowl shattered. "I'm really sorry. I've broken the bowl," said Jeanette. "Don't worry," said Anne. "I never liked it anyway. Someone gave it to me for my wedding."

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

Did Anne remember that Jeannette had given her the bowl?

How do you think Jeanette felt?

Control question: In the story, what did Jeanette give Anne for her wedding?

How did the bowl get broken?

15. At Fernhaven Elementary School, there was a story competition. Everyone was invited to enter. Several of the fifth graders did so. Christine, a fifth grader, loved the story she had entered in the competition. A few days later, the results of the competition were announced: Christine's story had not won anything and a classmate, Jake, had won first prize. The following day, Christine was sitting on a bench with Jake. They were looking at his first prize trophy. Jake said, "It was so easy to win that contest. All of the other stories in the competition were terrible." "Where are you going to put your trophy?" asked Christine.

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:
Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

Did Jake know that Christine had entered a story in the contest?

How do you think Christine felt?

Control question: In the story, who won the contest?

Did Christine's story win anything?

16. Tim was in a restaurant. He spilled some coffee on the floor by accident. "I'll get you another cup of coffee," said the waiter. The waiter was gone for a while. Jack was another customer in the restaurant, standing by the cashier waiting to pay. Tim went up to Jack and said, "I spilled coffee over by my table. Can you mop it up?"

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

Did Tim know that Jack was another customer?

How do you think Jack felt?

Control question: In the story, why was Jack standing by the cashier?

What did Tim spill?

17. Eleanor was waiting at the bus stop. The bus was late and she had been standing there a long time. She was 65 and it made her tired to stand for so long. When the bus finally came, it was crowded and there were no seats left. She saw a neighbor, Paul, standing in the aisle of the bus. "Hello, Eleanor," he said. "Were you waiting there long?" "About 20 minutes," she replied. A young man who was sitting down got up. "Ma'am, would you like my seat?"

Did anyone say something they shouldn't have said or something awkward?
If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

When Eleanor got on the bus, did Paul know how long she had been waiting?

How do you think Eleanor felt?

Control question: In the story, why was Eleanor waiting at the bus stop for 20 minutes?

Were there any seats available on the bus when she got on?

18. Roger had just started work at a new office. One day, in the coffee room, he was talking to a new friend, Andrew. "What does your wife do?" Andrew asked. "She's a lawyer," answered Roger. A few minutes later, Claire came into the coffee room looking irritated. "I just had the worst phone call," she told them. "Lawyers are all so arrogant and greedy. I can't stand them." "Do you want to come look over these reports?" Andrew asked Claire. "Not now," she replied, "I need my coffee."

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

Did Claire know that Roger’s wife was a lawyer?

How do you think Roger felt?

Control question: In the story, what does Roger's wife do for a living?

Where were Roger and Andrew talking?

19. Richard bought a new car, a red Peugeot. A few weeks after he bought it, he backed it into his neighbor Ted's car, an old beat-up Volvo. His new car wasn't damaged at all and he didn't do much damage to Ted's car either -- just a scratch in the paint above the wheel. Still, he went up and knocked on the door. When Ted answered, Richard said, "I'm really sorry. I've just put a small scratch on your car." Ted looked at it and said, "Don't worry. It was only an accident."

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

Did Richard know what his neighbor Ted's reaction would be?

How do you think Ted felt?

Control question: In the story, what did Richard do to Ted's car?

How did Ted react?

20. Louise went to the butcher to buy some meat. It was crowded and noisy in the shop. She asked the butcher, "Do you have any free-range chickens?" He nodded and started to wrap up a roasted chicken for her. "Excuse me," she said, "I must not have spoken clearly. I asked if you had any free-range chickens." "Oh, sorry," the butcher said, "we're all out of them."

Did anyone say something they shouldn't have said or something awkward?

If yes, ask:

Who said something they shouldn't have said or something awkward?

Why shouldn't he/she have said it or why was it awkward?

Why do you think he/she said it?

When he started wrapping up a chicken for Louise, did the butcher know that she wanted a free-range chicken?

How do you think Louise felt?

Control question: In the story, where did Louise go?

Why did the butcher start to wrap up a roasted chicken for her?

Instructions for Scoring the Faux Pas Task

There are 10 Faux Pas Stories (numbers 2,4,7,11,12,13,14,15,16, & 18), and 10 Control Stories without a faux pas (numbers 1,3,5,6,8,9,10,17,19 & 20).

Faux Pas Detection
First Question: "Did anyone say something they shouldn't have said?"

Faux pas stories:	Control stories:
Correct: Yes	Correct: No
Incorrect: No	Incorrect: Yes

Second question: "Who said something they shouldn't have said?"
Any answer that unambiguously identifies the correct person is correct, names are not necessary.
E.g., story about calling little girl a boy: Mary (also acceptable: the neighbor)
story about crystal bowl: Anne (also acceptable:the hostess, or the woman who got married, etc.)
story about lawyers: Claire (also acceptable: the woman, or the woman in a bad mood, etc.)
story about curtains: Lisa (also acceptable: the friend)
story about cancer joke: Robert (also acceptable: the guy who came in late)
story about losing story contest: Jake (also acceptable: the guy who won)
story about spilled coffee: Tim (also acceptable: the guy who spilled his coffee)
story about new kid in school: Joe (also acceptable: Joe and Peter)
story about surprise party: Sarah (also acceptable: the woman who spilled the coffee)
story about pie: Joe (also acceptable: Kim's cousin)
Respondents who answer "no" to the first question don't get asked this question and score a 0 for this one.

Scoring this 2nd question for the Control Stories is a bit more counterintuitive, because you give points for not answering, and take points off for answering. If they correctly say there was nothing inappropriate said, then they will not be answering this question. So, give them one point for each “who” question they do not answer on the Control Stories.

Understanding Inappropriateness
Third question: "Why shouldn't they have said it?"

For the Faux Pas Stories: Respondents who answer "no" to the first question don't get asked this question, and score a 0 for this. If they do answer this question for the Faux Pas Stories, any reasonable answer that makes reference to the faux pas is acceptable. The subject does not have to explicitly mention mental states, as in, "He didn't know about the guy who was sick with cancer, but everyone else did." It is sufficient to say, "Because John is terminally ill," or "because the guy standing right there is married to a lawyer," or "you shouldn't walk into a new apartment and criticize it; you don't know who bought what." This question only gets scored as incorrect if the person's answer doesn't reflect an understanding of the faux pas, that is, of what would have been offensive. Examples (from amygdala patients): "The neighbor shouldn't have called her little. Kids like to feel grown up." (Misses the point that Sally is a girl, not a boy.) "Claire shouldn't tell him she needs her coffee." (Misses the insult to Roger.) "You shouldn't come into a meeting late." (Doesn't mention the inappropriate joke.)

For the Control Stories: Scoring the Control Stories seems counterintuitive, because you give points for not answering, and take points off for answering. If they correctly say there was nothing inappropriate said, then they should not be answering this question. So, give them one point for each “why” question they do not answer on the Control Stories. For any Control Stories on which they do give an answer, give them zero points, because the answer will be incorrect. Exception: if you are really convinced that their answer is reasonable, give a point.

Intentions (Motivation)
Fourth question: "Why did they say it?" or "Why do you think they said it?"

For the Faux Pas Stories: Respondents who answer "no" to the first question don't get asked this question, and score a 0 for this one. If they do answer this question, any reasonable answer that makes reference to the faux pas is acceptable. As long as the subject's answer indicates that they understand that one of the story characters didn't know something or didn't realize something, it is correct, even if they do not explicitly mention mental states.
Note: This question gets scored as incorrect if the subject seems to think that the person said the awkward thing deliberately. Some more examples, from brain injury patients: "Tim shouldn't order around other customers. He just basically went up to an equal and said, 'On your knees, boy.'" (Doesn't reflect an understanding that Tim mistook Jack for someone who worked at the restaurant.) "He was trying to put Christine down, make himself one up by gloating." (Doesn't reflect that he didn't know Christine was in the contest.)
"She was trying to make Helen feel jealous." (Looks like a confabulation, and doesn't mention surprise party.) Some patients also just say, "I don't know," which also gets a zero.

For the Control Stories: Scoring the Control Stories seems counterintuitive, because you give points for not answering, and take points off for answering. If they correctly say there was nothing inappropriate said, then they should not be answering this question. So, give them one point for each intention question (4^{th} question) they do not answer on the Control Stories. For any Control Stories on which they do give an answer, give them zero points, because the answer will be incorrect.

Belief (Knowledge)
Fifth question: Did X know that Y?

For the Faux Pas Stories: This question gets at whether they realize the faux pas was unintentional. Respondents who answer "no" to the first question don't get asked this question, and score a 0 for this one. If they do answer it, scoring is straight forward – 1 point if they indicate that the person did not know or did not realize that their statement would be awkward, 0 points if their answer indicates they did not track the story character's knowledge and beliefs.

For the Control Stories: If they correctly say there was nothing inappropriate said, then they should not be answering this question. So, give them one point for each belief question they do not answer on the Control Stories. BUT: this question is to test that they can track knowledge and belief states in the story characters when no Faux Pas is present. So, even though they should not be answering this question because they should have said, no, no one said anything awkward, it is still informative to score this Belief question. Scoring is straight forward: 1 point if they accurately track the story characters' knowledge and belief states, 0 points if they do not.

Empathy (Affective)
Sixth question: How did X feel? A test of the respondents' empathy for the story characters.

For the Faux Pas Stories: Their answers should reflect feelings of hurt, anger, embarrassment, disappointment, as appropriate. Score 1 point for appropriate answers, and 0 points for answers that are obviously inappropriate. Even in cases ofsevere TBI where the patient misses the Intention question, I have always found that they answer this one correctly. Still, it will be informative if they get it wrong.

For the Control Stories: If they correctly say there was nothing inappropriate said, then they should not be answering this question. So, give themone point for each Empathy question they do not answeron the Control Stories. BUT: this question is to test that they can track others' feelings in the story characters when no Faux Pas is present. So, even though they should not be answering this question because they should have said, no, no one said anything awkward, it is still informative to score this Empathy question. Scoring is straightforward: 1 point if they appropriately attribute emotional states to story characters, 0 points if they do not.

Story Comprehension – Control Questions
Seventh and eighth questions: All respondents get asked these questions, even if they answer "no" to the first question. These control questions on story comprehension should tell you if the person has gotten confused and forgotten the details of the story, something we have found to be true in patients with more advanced dementia, and some patients with dorsolateral frontal damage. Answers are pretty obvious. These are scored separately from the other questions. Example correct answers for Faux Pas Stories,

In the story, where was Sally? "At her aunt Carol's house." (I think one subject said, "In the doorway next to her aunt," and I scored it as correct.)
In the story, what had Jeannette given Anne for her wedding? "A crystal bowl," "a bowl."
In the story, what did Roger's wife do for a living? "She was a lawyer."

In the story, what had Jill just bought? "New curtains," "curtains."
In the story, what had Jean West just told people in the meeting? "VP had cancer."
In the story, who won the competition? "Jake."
In the story, where was Jack standing? "By the cashier."
In the story, where was Mike while Joe and Peter were talking? "In the stalls (cubicles)."
In the story, who was Helen's husband throwing a surprise party for? "Helen."
In the story, what kind of pie had Kim made? "Apple."
Dorsolateral frontal patients, for example, often got some of these wrong. One patient said the surprise party was for Sarah's birthday, and that Helen was upset because her husband was throwing a party for another woman, and she wondered if they were having an affair.

Appendix B

Cognitive Reflections Test

The original test penned by Dr. Frederick contained only the three following questions:

1. A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost? _____ cents
2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? _____ minutes
3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? _____ days

The answers are: 5 cents, 5 minutes, and 47 days.

Appendix C

Conjunction Fallacy Questions

Timothy is very good-looking, strong, and does not smoke. He likes hanging around with his male friends, watching sports on TV, and driving his Ford Mustang convertible. He's very concerned with how he looks and with being in good shape. He is a high school senior now and is trying to get a college scholarship.

Based on this information, which of the following statements is most likely to be true? Rank each statement in terms of how likely it is to be true by rearranging the statements. The most likely statements should be moved towards the top and the least likely statements moved towards the bottom.

1 Timmy is popular

2 Timmy is an athlete

3 Tommy is an athlete and is popular

4 Timmy has a girlfriend

5 Timmy is a teachers pet

6 Timmy is a teachers pet and has a girlfriend

Linda is 31 years old, single, outspoken and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations.

Based on this information, which of the following statements is most likely to be true? Rank each statement in terms of how likely it is to be true by rearranging the statements. The most likely statements should be moved towards the top and the least likely statements moved towards the bottom.

1 Linda is active in the feminist movement

2 Linda is a bankteller

3 Linda is a bankteller and is active in the feminist movement

4 Linda takes yoga classes

5 Linda works in a book store

6 Linda works in a book store and takes yoga classes

To score the conjunction fallacy award the participant one point for each instance where they rate a joint description of the described character (I.E Linda is a bankteller and is active in the feminist movement) over each single description (I.E Linda is a bankteller OR Linda is active in the feminist movement).

Appendix D

Manipulation Check for the Mood Induction Procedure