CUTENESS AS A PRIME TO ENHANCE EMOTIONAL RECOGNITION

By

Andrew Diaz

A Thesis Presented to

The Faculty of Humboldt State University

In Partial Fulfillment of the Requirements for the Degree

Master of Arts in Psychology

Committee Membership

Dr. Amanda Hahn, Committee Chair

Dr. Amber Gaffney, Committee Member

Dr. Brandilynn Villarreal, Committee Member

Dr. Christopher Aberson, Program Graduate Coordinator

December 2020

Abstract

CUTENESS AS A PRIME TO ENHANCE EMOTIONAL RECOGNITION

Andrew Diaz

The ability to recognize emotional expressions has important implications for survival and cooperation. Failing to recognize emotions indicative of some form of threat (anger, fear, disgust) may be particularly costly given these emotional expressions communicate a potential source of danger in the environment. Previous studies have shown that people tend to recognize threatening emotions faster and more accurately than non-threatening emotions. Infantile characteristics (*kindchenschema*) readily capture the attention of adults and have been shown to influence a variety of behaviors associated with caretaking; viewing cute stimuli increases behavioral carefulness on various visual and motor tasks. The current study sought to determine if viewing cute stimuli increases sensitivity to emotional expressions, particularly those related to threat, as the ability to recognize emotional displays has important implications for caretaking. In a sample of 43 women, viewing cute stimuli enhanced sensitivity to emotional expressions generally, but was not specific to threat-relevant emotions. This effect of priming was not apparent in a sample including men (n = 6) and non-binary (n = 3) participants. These results suggest that priming a caretaking mentality may enhance emotional sensitivity in addition to behavioral carefulness, at least in women.

Acknowledgements

I would like to pay special regards to my advisor, Dr. Amanda Hahn, for the countless hours of guidance she has provided to make this entire process all the more enjoyable. I would also like to thank the members of my thesis committee and the Behavioral Endocrinology Research Lab for giving valuable feedback throughout the course of this project. Finally, I would like to express my gratitude to my family for being so supportive and encouraging while I spent the last six and a half years away from home to reach this point. This was all made possible thanks to your support.

Table of Contents

List of Figures

Introduction

Emotions serve as effective signals of non-verbal communication in social species. Human and non-human animals alike share a similar propensity to reliably detect and respond to the emotions of conspecifics (e.g., Paul, Harding, & Mendl, 2005; Tate et al., 2006). For example, Paul and colleagues (2005) state that the way animals interpret and evaluate environmental stimuli will influence their subsequent emotional response; a veridical evaluation of said stimuli would likely result in more appropriate responses which would foster better socialization between conspecifics. Emotions thus serve as important signals of socially-relevant information and the capacity to recognize emotions reliably is paramount for survival, especially when verbal communication is not feasible (Tate et al., 2006). Some of the pressures behind these evolved communicative mechanisms include fostering cooperation amongst groups of individuals, directing attention towards the gaze of a conspecific, and detecting potential threats in the environment based on perceived emotions (Adolphs, 2002; Tomasello, Hare, Lehmann, & Call, 2007). Moreover, these emotions serve as reliable indicators of one's internal affective state, which is advantageous when an individual, such as an infant, lacks the ability to engage in explicit verbal communication.

It has been suggested that there are at least six basic, universal emotions that each share the same implicit meaning across cultures ("basic emotions"; Ekman & Friesen, 1971). These emotions are happiness, sadness, anger, fear, surprise and disgust. Although the ability to accurately perceive and respond to all of these emotions may facilitate effective social communication, the ability to perceive and respond to negative emotions or those indicative of potential threat may be particularly important for survival. The basic emotions that are considered to be indicative of potential threat include disgust, fear, and anger (Babchuk, 1985; Hampson, Anders, & Mullin, 2006). The negative affect associated with these emotions results in avoidant behaviors targeted at a threatening stimulus (LeDoux, 2014). For example, disgust has been shown to serve as a salient behavioral motivator in avoiding potential contamination via pathogenic sources (Tybur et al., 2013), while fear serves the important function of triggering the “fight or flight” response when an individual becomes aware of a possible threat to the wellbeing of themselves or others, which facilitates a suite of physiological changes aimed at combating or avoiding the threatening stimulus (LeDoux, 2014; Öhman & Mineka, 2001).

Given the adaptive benefit of responding to potential threats in the environment, researchers have proposed that humans may show a perceptual bias for detecting threatening emotions (Cisler & Koster, 2010). In the presence of a perceived threat, humans tend to respond fearfully which will motivate one to either avoid or escape from the threatening stimulus (Öhman & Mineka, 2001). Being able to readily detect when others are disgusted, angry, or fearful provides an individual with valuable environmental information they themselves may not have perceived firsthand. When attempting to decode an emotional signal from another member of one’s group, individuals will extrapolate relevant information and predict how another may be feeling. Then, they may adapt their behavior in accordance with their prior perception (Hampson et al., 2006). Human faces, particularly infants, displaying emotional cues indicative of threat preferentially capture the attention of other conspecifics (Cárdenas, Harris, & Becker, 2013). When searching for a specific face among other faces, participants were much faster at finding a face displaying a threat-relevant emotion among a "crowd" of non-threat emotions than the reverse (i.e., faster detection of an angry face in a crowd of happy faces compared to a happy face in a crowd of angry faces; Hansen & Hansen, 1998). Additionally, participants were able to attend more quickly to a specified area after an angry face had been presented there compared to a happy face being presented there beforehand (Mogg & Bradley, 1999). In a similar vein, viewing a conspecific's face express disgust as well as subjectively being disgusted resulted in similar neural activation in the anterior insula and the anterior cingulate cortex, areas associated with the subjective feeling of disgust (Wicker et al., 2003). Together, these studies provide evidence for an attentional bias for threat-relevant emotional displays. Although quickly and accurately recognizing non-threat relevant emotions, such as happiness, may facilitate social interactions accurate perception of these non-threat relevant emotions is not necessarily imperative for one's survival whereas accurate perceptions of threat-relevant emotions may facilitate avoidance or defensive behaviors that would directly impact survival due to the high fitness costs associated with false negatives in the perception of threat. According to the Error Management Theory posited by Haselton and Buss (2000), it is far more costly to fail to detect a threat in the environment (false-negative) than it is to inaccurately detect a threat that was not present (false-positive).

Sex Differences in Emotion Perception

Some research has suggested that women may outperform men in terms of detecting or perceiving emotions in various recognition tasks (Babchuk, Hames, & Thompson, 1985; Hampson et al., 2006; Thompson & Voyer, 2014). Hampson and colleagues (2006) found that women were faster than men in correctly recognizing emotions, especially negative emotions. Additional work has shown that when stressed, women displayed greater fusiform face area (FFA) activity than men, suggesting enhanced face processing during periods of stress (Mather, Lighthall, Nga, & Gorlick, 2010). Socialization and gender roles may play a part in these observed sex differences. For example, work by Uskul, Paulmann, and Weick (2016) has shown that individuals in positions of power tend to recognize emotional signals less accurately of those in positions of power lower than themselves. Given that men have historically more often held positions of high power in society (Birns, 1976), these findings may explain in part why men are less accurate with emotional recognition than women.

While participants in general do demonstrate a proficient ability to quickly and accurately recognize the varying emotions, women typically display an advantage in each category. There is a heightened degree of activation in the brains of women looking at social stimuli compared to men and the regions where significantly different activation occurred are highly implicated in emotional processing (Proverbio et al., 2008). Even from a young age, girls tend to outperform boys on emotional recognition tasks. Girls around the age of 3.5 performed equally as well as 5 year old boys when having to select photographs of faces that corresponded to the appropriate emotion (Boyatzis, Chazan, &

Ting, 1993). However, some research suggests that this advantage may also be emotion specific; women outperform men in detecting expressions of disgust (Aleman & Swart, 2008) and fear (Mandal & Palchoudhury, 1985), whereas men have been shown to outperform women in detecting expressions of anger (Kret, Pichon, & De Gelder, 2011; Mandal & Palchoudhury, 1985).

Emotion Perception Facilitates Caretaking

What might account for this sex difference in emotion detection? The Primary Caretaker Hypothesis posits that “the sex that through evolutionary time has dominated infant caretaking will differentially exhibit skills that are important in caretaking (e.g., the ability to rapidly recognize infant emotional expressions)” (Babchuck et al., 1985, p. 89). Historically, the primary caretaker has been the mother. Thus, according to the Primary Caretaker Hypothesis, women may have evolved superior adaptive abilities, such as the ability to accurately detect facial emotional expressions, that increase the likelihood of offspring survival as a result of having a consistent role as the primary caretaker for offspring. Further work by Hampson and colleagues (2006) found that women demonstrated increased sensitivity to all emotions (positive and negative) as compared to men while both men and women demonstrated increased sensitivity to threat-relevant emotions as compared to non-threat-relevant emotions.

Not only does threat detection play an important role in an individual’s survival, the ability to detect and react to threats in the environment also plays a crucial role in offspring survival. As a result of prioritizing fetal brain development in utero over other physical development, human infants are born incredibly vulnerable and are highly dependent on a caregiver (Zeveloff & Boyce, 1982). This places a significant responsibility on the part of the caregiver to ensure that their offspring are protected from various environmental risks. Even before a child is born, expectant mothers are far more sensitive to subtle environmental cues indicative of disgust. Upon becoming pregnant, progesterone influxes lead to increased immunosuppression which put both mother and infant at an increased risk of infection. To compensate for these immunological deficiencies, expecting mothers display an elevated sensitivity to cues related to pathogens (Conway et al., 2007; Fessler, Eng, & Navarrete, 2005). Moreover, when compared to men, women displayed greater neural responsiveness to viewing facial expressions of disgust (Aleman & Swart, 2008).

In addition to allowing an individual to interact more effectively with their environment, the ability to perceive emotions from conspecifics, and particularly negative emotions, may also facilitate more effective caretaking behavior. For example, if a nearby adult was expressing distress (e.g., fear), it would be advantageous for the caregiver to respond to potential threats to the fitness of an offspring (i.e. the source of another's fear) and adapt their behavior in such a way as to protect the infant from harm. Therefore, in addition to benefiting individual survival, the ability to accurately detect and respond to emotional displays is beneficial for effective caretaking (Lucion et al., 2017).

Infant-Relevant Stimuli Trigger Caretaking

The noted ethologist Konrad Lorenz posited the notion of *Kindchenschema* (Lorenz, 1943). This phrase roughly translates into "baby schema" and essentially means cute, baby-typical features that serve as an innate releasing mechanism to be taken care of. These features are typically characterized by big eyes, a large head, and a round face. Baby schema is classified as a "releaser", which is a stimulus that contains features sufficient enough to elicit any sort of response (Glocker et al., 2009). Simply having non-parents view images of infants activates regions in the brain implicated in caretaking and speech behaviors that may or may not be voluntary – the supplementary motor area and the lateral insula respectively (Caria et al., 2012). In other words, baby cuteness serves as a signal to be taken care of which increases an infant's chances of survival and reproduction. Moreover, the cuter an infant is, the more time adults spend looking at them (Hildebrandt & Fitzgerald, 1978), and even children as young as three to six have shown a developed response to cute features in human infants (Borgi et al., 2014). Similarly, cuter infants have a higher chance of being adopted using hypothetical adoption ratings, are associated with fast attentional capture and positive emotions, and adults are more willing to protect and defend them (Alley, 1983; Franklin & Volk, 2017; Senese et al., 2013). Given the importance of responding to threat-relevant stimuli in the environment (outlined above), these findings raise an interesting question - does a caretaking mentality, regardless of actual offspring and/or caretaking role, enhance the perception of threat-relevant stimuli?

Previous research has demonstrated that merely being primed with cute stimuli, such as babies, kittens, or puppies, increases an individual's behavioral carefulness on a range of fine motor dexterity and visual search tasks (Nittono et al., 2012; Sherman et al., 2009). Sherman and colleagues (2009) had participants view kittens and puppies prior to performing a task that requires a high degree of carefulness and fine motor movements to assess the influence of cute stimuli on behavioral carefulness. Participants in the 'high-cute' condition performed significantly better on the dexterity task. Researchers suggest that these findings imply that cute features not only serve as effective motivators to care for offspring, but they may increase caretaking efficacy as well. Similar work from Nittono and colleagues (2012) expands on the paradigm of using cute images as a prime to influence subsequent behavior putatively related to caretaking. Participants performed significantly better on a similar fine motor task after viewing 'kawaii', or cute, stimuli in line with previous research (Sherman et al., 2009). In a second study, participants completed a non-motor visual search task that requires meticulous attentional focus. Again, the results demonstrated that participants performed significantly better when attempting to search for a designated number in a large matrix of other numbers. In the final study, participants completed a task that measures attentional precedence on global and local features. Prior to viewing cute images, participants displayed a preference for perceiving more global features. Subsequent to viewing the cute stimuli, participant preferences became less global and more local suggesting a narrowing of attentional focus as a result of viewing cute images beforehand. Additionally, environmental activists in Japan have begun using cute images as a means of increasing environmental awareness and one's willingness to identify themselves as a caretaker of the environment (Brecher, 2015).

If viewing cute images increases one's behavioral carefulness and makes their role as a caretaker more salient, priming someone with cute stimuli could affect other aspects of perception relevant to effective caretaking. The current study aims to determine whether priming people with cute images similarly increases their ability to detect emotional displays in conspecifics. In line with previous research, it is predicted that this effect will be more pronounced for emotions indicative of threat and particularly so for female participants. Whether or not this observed female superiority will be attenuated as modern family units evolve from more traditional ones is outside the scope of the present study, however, it is an important question to consider when assessing potential differences between men and women.

Method

Participants

Fifty-two participants (Female *n* = 43, Male *n* = 6, Non-binary *n* = 3) participated in an emotional recognition task (Hampson et al., 2006). Participants were recruited from the SONA system and online. There were no age, sex, or ethnicity restrictions on the sample. The sample consisted of 3.8% Black, 1.9% Native American, 11.5% mixed ethnicity, 23% Latino and 59.6% White participants with a mean age of 25.3 years (*SD* = 7.06). All participants provided their informed consent prior to completing the study.

Stimuli

The stimuli consisted of 120 adult faces. Each face displayed one of six emotions (happiness, sadness, fear, anger, disgust, or a neutral expression). These faces were gathered from the Karolinska Directed Emotional Faces (KDEF) imageset (Lundqvist et al., 1998), a freely available image set that depicts the same individuals making several emotional expressions. The 120 faces included 20 identities (10 male, 10 female) depicting each emotional expression (happiness, sadness, fear, anger, disgust, neutral). The 20 identities were randomly selected from the KDEF image set. These 120 faces were split across two presentation blocks such that three of the emotional expressions for each identity appeared in each block. Each block thus consisted of 60 faces (10 of each of the 6 emotional expressions) containing 20 different identities. The 20 different identities were represented equally across blocks A and B. The order of the first presentation was counterbalanced across participants (see Procedure for details).

Procedure

Due to COVID-19, all data was collected online. Participants completed an emotion recognition task via their personal device (computer, phone, or tablet). Following Hampson and colleagues (2006), during the emotion recognition task participants were shown a series of faces. For each face, they were asked to identify the emotional expression displayed as quickly and accurately as possible. They chose from a set of 6 buttons (happiness, sadness, fear, anger, disgust, or neutral; see Figure 1). The presentation order of the faces was fully randomized to prevent potential order effects.

Each participant completed a baseline emotion recognition block (60 faces), viewed cuteness primes (20 images), and then completed a second emotion recognition block (60 faces). During cuteness prime, participants passively viewed a series of cute images, each displayed for 2000ms. The order of stimuli presentation was fully randomized. The 20 images used in the cuteness prime included 5 images of each of the following categories: human infants, non-human primate infants, puppies, and kittens. To create the cuteness priming image set, first 40 images (10 from each category) were collected from online sources. These images were then rated for cuteness by 12 independent raters (6 male, 6 female; mean age = 25.4 years, *SD* = 7.90) using a 1 (not at all cute) to 7 (extremely cute) scale. The highest 5 rated images in each category were then selected for inclusion in the cuteness prime. The 20 images selected were rated as highly cute (*M* = 6.21, *SD* = 0.44).

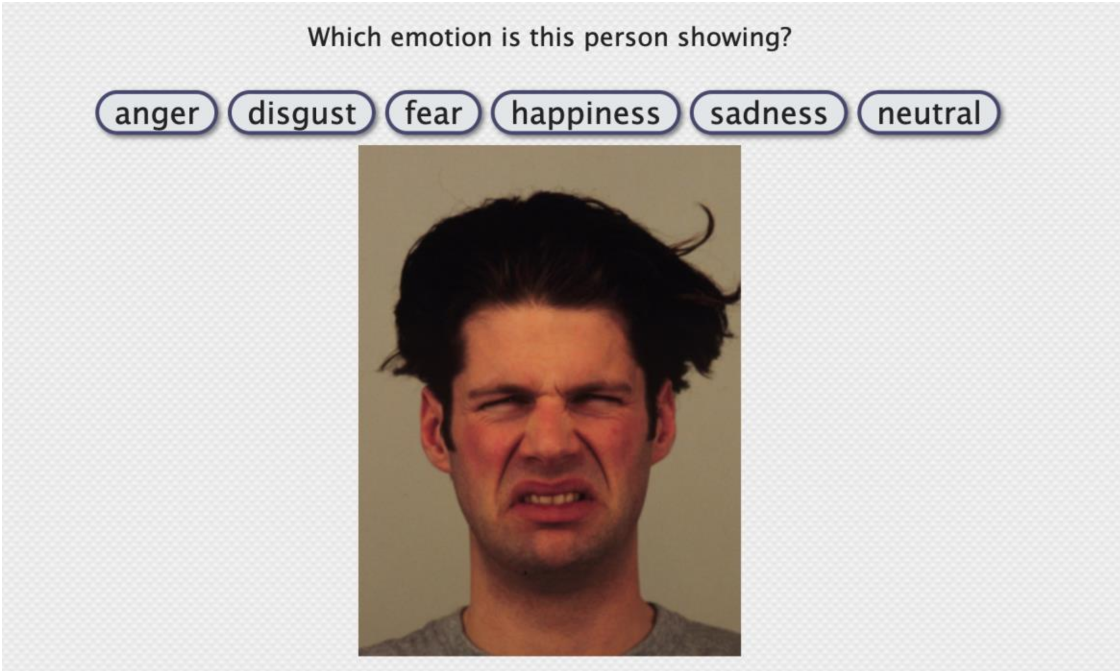

Figure 1. *Participants were presented with a photo from the KDEF image set and were asked to select from one of the six emotions shown above.*

Analysis

Participant's responses were assessed for accuracy and a general accuracy score was extrapolated by subtracting the number of correct responses from the total number of faces viewed (i.e., X correct out of 10 faces per emotion). Each emotion was categorized as threatening or non-threatening as follows: anger, fear, and disgust are threatening and happy, sad, and neutral are non-threatening. Average accuracy scores for threatening and non-threatening emotional recognition pre- and post-priming were calculated as the average score for the three emotions in each category. Scores below 16 percent (i.e. "guessing" from the 6 options) were excluded from the analysis reported below for falling below random chance (n = 1).

Although I initially planned to conduct an analysis that included sex as a between-subject factor, very few men completed the study (n = 6) preventing me from investigating potential sex differences. Instead, a 2 x 2 ANOVA (prime x emotion category) was run on the full sample (N = 52) with 2-levels for the prime factor (pre-priming and post-priming) and 2-levels for the emotion category factor (threatening and non-threatening). This analysis was then repeated restricting the sample to women (N = 43) only given the aforementioned theoretical reasoning that females may be particularly susceptible to any effects of cuteness on behavior or perception. The dependent variable for all analyses was accuracy of emotional recognition.

Results

Full Sample Analysis

There was no main effect of priming (F(1, 51) = 1.5, p = .226, η^2_G = .004), indicating that viewing cute images did not increase sensitivity to displays of emotion overall. There was, however, a significant main effect of emotion (F(1, 51) = 93.84, p < .001, η^2_G = .446), whereby non-threatening emotions were recognized *more* accurately than threatening emotions. The interaction between priming and emotion was not significant (F(1, 51) = 3.035, p = .088, η^2_G = .006; see Figure 2), indicating that viewing cuteness did not impact sensitivity to threatening emotions more so than non-threatening, as was predicted. A post-hoc sensitivity analysis performed using the *pwr2ppl* package (Aberson, 2020) in the R statistical system (R Core Team, 2020) for the 2 x 2 ANOVA revealed a power of .16 to detect an effect of priming, .87 to detect an effect of emotion, and .33 to detect an interaction between these two factors in the full sample.

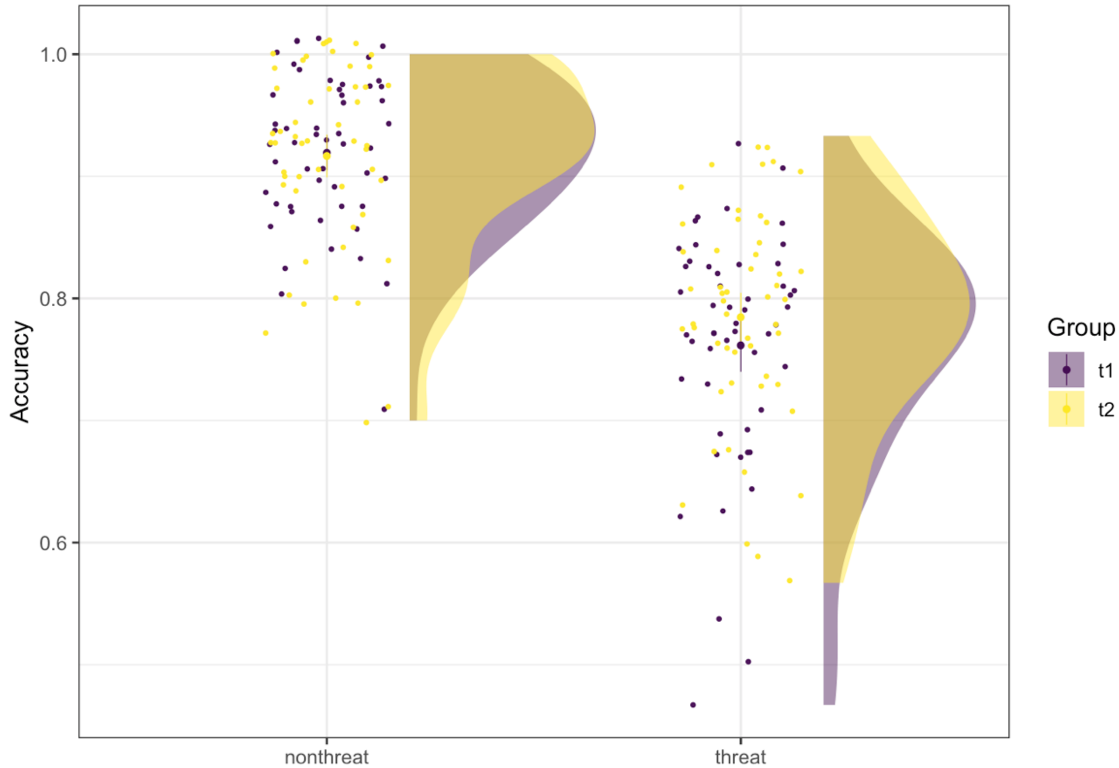

Figure 2 The interaction between emotion type and the effect of priming was not significant (p = .088).

Analysis for Women Only

Given the theoretical prediction that women should outperform men on this task, the above analysis was repeated on the subset of the data that included only women (*n* = 43). These results suggest that after being exposed to the prime, participants were more accurate in recognizing emotions of all types, (significant main effect of prime, $F(1, 42) = 9.17$, $p = .004$, $\eta^2_G = .022$; see Figure 3). However, contrary to the initial hypothesis, participants were actually more accurate in detecting non-threatening emotions compared to threatening ones ($F(1, 42) = 77.63$, $p < .001$, $\eta^2_G = .461$; see Figure 4). Again, the interaction between emotion and priming was not significant ($F(1, 42) = 1.774$, $p = .19$, $\eta^2_G = .005$; see Figure 5), indicating that priming did not have a differential effect on threatening versus non-threatening emotions. A post-hoc sensitivity analysis performed using the *pwr2ppl* package (Aberson, 2020) in the R statistical system (R Core Team, 2020) for the 2 x 2 ANOVA revealed a power of .36 to detect an effect of priming, .82 to detect an effect of emotion, and .02 to detect an interaction between these two factors among women.

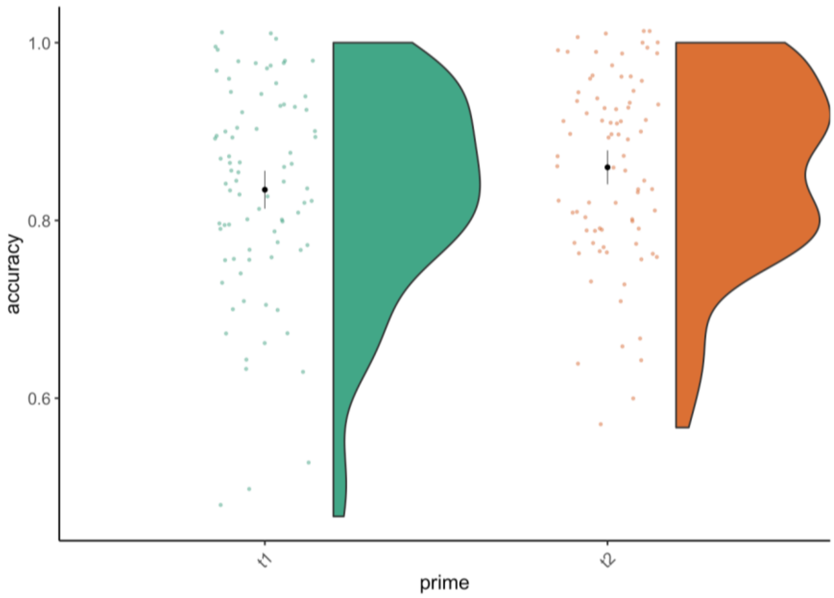

Figure 3 This graph represents the significant main effect of priming on emotional recognition accuracy. p = .004

Figure 4 There was a significant main effect for non-threatening emotions. p < .001

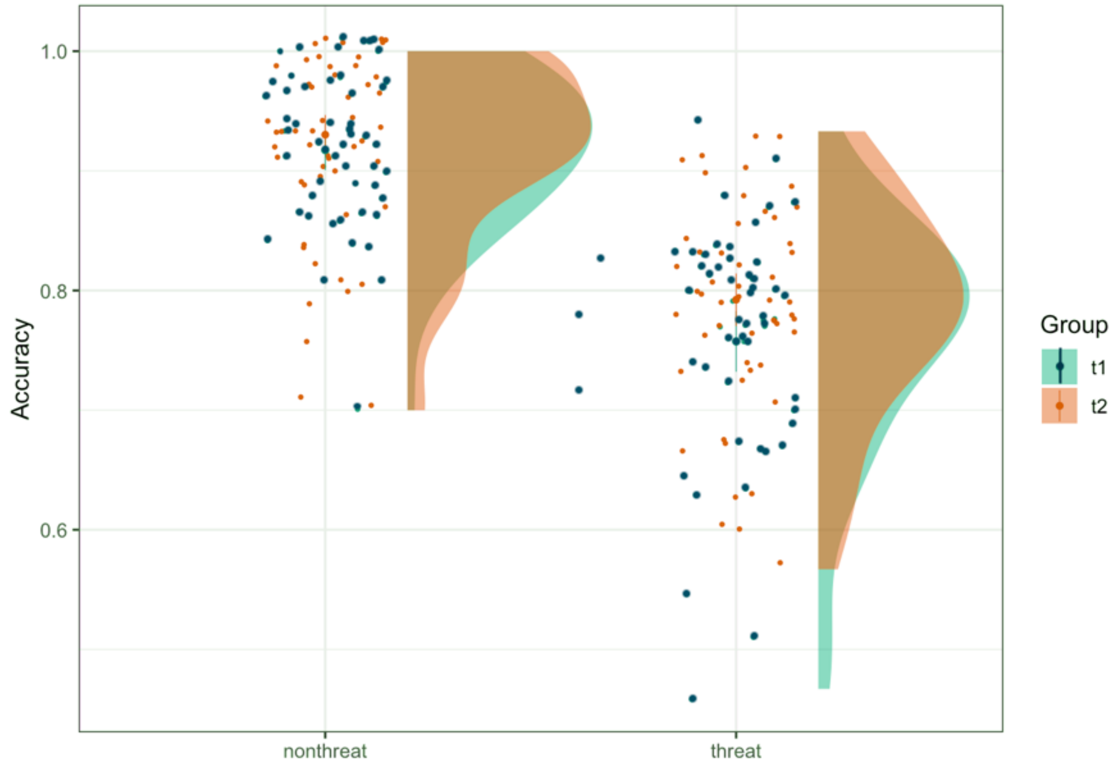

Figure 5. The interaction between emotion and the effect of priming was not significant. p = .19

Discussion

This study investigated whether priming a caretaking mentality by viewing cute images of babies (human and non-human) influenced emotional recognition accuracy. Participants viewed images of people displaying various emotions and were asked to identify the corresponding emotion. Subsequent to the first recognition task, participants were primed with cute images of babies, kittens, puppies, etc. Following the prime, participants then again viewed faces depicting different emotions and were asked to select the corresponding emotion. Previous research has demonstrated that viewing cute images increases behavioral carefulness, makes one's role as a caretaker more salient, and increases overall accuracy and response time in visual search tasks. It was predicted that participants would be more accurate in detecting emotions indicative of threat following a cuteness prime. Additionally, it was predicted that women would be more accurate than men in their emotion recognition accuracy, particularly so for threat related emotions due to their historical role as primary caretaker. Surprisingly, the results indicated that threatening emotions were detected *less* accurately than non-threatening emotions, a finding that does not align with the initial hypothesis. An effect of priming was observed among women, but not the full sample, whereby emotion recognition generally increased following the cuteness prime (note that although this effect was not significant in the full sample, it was in the same direction as the significant result among women). There was no interaction between priming and emotion, suggesting that priming did not influence sensitivity to threatening emotions in particular.

Previous studies have shown that making one's role as a caretaker more salient increases how carefully one behaves on fine motor tasks and how their visual acuity is enhanced following cuteness primes (Sherman et al., 2009; Nittono et al., 2012) . These behaviors related to how carefully one interacts with their environment and how well they are able to detect subtle visual differences are important for caretaking when considering the vulnerable nature of young offspring and the recognition of nuanced emotions associated with them as well. The current study adds to these findings, suggesting that priming a caretaking mentality also increases sensitivity to emotional displays generally, at least among women.

Although the previous studies investigating the impact of priming caretaking mentality did not explore sex differences (Sherman et al., 2009; Nittono et al., 2012), other work has indicated that women may be more sensitive to emotional displays than men (Hampson et al., 2006). Additionally, women in general are more sensitive to cuteness cues than men (Hildebrandt & Fitzgerald, 1978). Given these findings, it was predicted that these phenomena would align with the results of the current study. As a result of the small number of male participants, the current study was not able to directly test for these sex differences. That the effect of priming was observed among women but not in the larger sample, including men and non-binary participants, warrants further investigation into potential sex differences with samples large enough to meaningfully analyze.

Surprisingly, I found that participants were *more* accurate in recognizing non-threatening emotions than threatening emotions. While these results suggest that participants are better at recognizing non-threatening emotions compared to threatening ones, it is worth noting that individuals performed well above chance for all six emotions (mean accuracy for the individual emotions ranged from 68% - 99%). This high accuracy in particular has been demonstrated in previous studies examining emotional recognition accuracy (Hampson et al., 2006). A possible difference may have emerged if participants were asked to categorize emotions into threat versus non-threat rather than identifying specific emotions, however that effect would be difficult to infer beyond speculation. It is also worth noting that neutral faces were used rather than surprised faces, following previous studies (Hampson et al., 2006). Participant's lower accuracy for threatening emotions could mean that in applied settings, they may not be able to attend to potential threats in their environment as effectively as would be desired.

Limitations to this study may have resulted from having participants viewing static images displaying emotions which would not have been present throughout human evolutionary history. Perhaps viewing videos of dynamic emotional expressions would have influenced the results in a more ecologically valid direction. However, previous research has used a similar paradigm with larger samples and found significant results. An additional limitation is that as a result of the pandemic, this study was conducted at the home of the participant on a digital device without any oversight from researchers. This eliminates the possibility of knowing whether or not there were any distractions present for each participant. It is important to keep in mind that the sample size of this study was small and these results may lack sufficient statistical power to determine more meaningful outcomes, particularly so for examining sex differences. Post hoc sensitivity analyses confirmed sufficient power to detect an effect of emotion and prime, but relatively limited power to detect the predicted interaction (0.33 full sample, 0.02 women only).

In conclusion, the current study demonstrated that priming a caretaking mentality may increase emotional sensitivity generally among women. This is an important social skill to have when verbal communication is not possible, such as in the relationship between caretakers and offspring. Future research should attempt to reexamine these factors with a larger and more balanced sample in order to better elucidate the possible relationships that exist here.

References

Aberson, C. L. (2020). Pwr2ppl: Power Analyses for Common Designs (Power to the People) R package version 0.1.2. Retrieved from https://cran.r-project.org/web/packages/pwr2ppl/index.html.

Adolphs, R. (2002). Recognizing emotion from facial expressions: Psychological and neurological mechanisms. *Behavioral and Cognitive Neuroscience Reviews*, *1*(1), 21-62. https://doi.org/10.1177/1534582302001001003

Aleman, A., & Swart, M. (2008). Sex differences in neural activation to facial expressions denoting contempt and disgust. *PloS one*, *3*(11), e3622. https://doi.org/10.1371/journal.pone.0003622

Alley, T. R. (1983). Infantile head shape as an elicitor of adult protection. *Merrill-Palmer Quarterly*, *29*(4) 411-427.

Babchuk, W. A., Hames, R. B., & Thompson, R. A. (1985). Sex differences in the recognition of infant facial expressions of emotion: The primary caretaker hypothesis. *Ethology and Sociobiology*, *6*(2), 89-101. https://doi.org/10.1016/0162-3095(85)90002-0

Birns, B. (1976). The emergence and socialization of sex differences in the earliest years. *Merrill-Palmer Quarterly of Behavior and Development*, *22*(3), 229-254. http://www.jstor.org/stable/23084603

Borgi, M., Cogliati-Dezza, I., Brelsford, V., Meints, K., & Cirulli, F. (2014). Baby schema in human and animal faces induces cuteness perception and gaze allocation in children. *Frontiers in Psychology*, *5*, 411. https://doi.org/10.3389/fpsyg.2014.00411

Boyatzis, C. J., Chazan, E., & Ting, C. Z. (1993). Preschool children's decoding of facial emotions. *The Journal of Genetic Psychology*, *154*(3), 375-382. https://doi.org/10.1080/00221325.1993.10532190

Brecher, W. P. (2015). Precarity, kawaii (cuteness), and their impact on environmental discourse in Japan. *Visions of Precarity in Japanese Popular Culture and Literature* (pp. 25-63). Routledge.

Cárdenas, R. A., Harris, L. J., & Becker, M. W. (2013). Sex differences in visual attention toward infant faces. *Evolution and Human Behavior*, *34*(4), 280-287. https://doi.org/10.1016/j.evolhumbehav.2013.04.001

Caria, A., de Falco, S., Venuti, P., Lee, S., Esposito, G., Rigo, P., Birbaumer, N., & Bornstein, M. H. (2012). Species-specific response to human infant faces in the premotor cortex. *NeuroImage*, *60*(2), 884-893. https://doi.org/10.1016/j.neuroimage.2011.12.068

Cisler, J. M., & Koster, E. H. (2010). Mechanisms of attentional biases towards threat in anxiety disorders: An integrative review. *Clinical Psychology Review*, *30*(2), 203-216. https://doi.org/10.1016/j.cpr.2009.11.003

Conway, C. A., Jones, B. C., Debruine, L. M., Welling, L. L. M., Smith, M. L., Perrett,

D. I., ... & Al-Dujaili, E. A. (2007). Salience of emotional displays of danger and contagion in faces is enhanced when progesterone levels are raised. *Hormones and Behavior*, *51*(2), 202-206. https://doi.org/10.1016/j.yhbeh.2006.10.002

Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. *Journal of Personality and Social Psychology*, *17*(2), 124–129. https://doi.org/10.1037/h0030377

Fessler, D. M., Eng, S. J., & Navarrete, C. D. (2005). Elevated disgust sensitivity in the first trimester of pregnancy: Evidence supporting the compensatory prophylaxis hypothesis. *Evolution and Human Behavior*, *26*(4), 344-351. https://doi.org/10.1016/j.evolhumbehav.2004.12.001

Franklin, P., & Volk, A. A. (2018). A review of infants' and children's facial cues' influence on adults' perceptions and behaviors. *Evolutionary Behavioral Sciences*, *12*(4), 296-321. https://doi.org/10.1037/ebs0000108

Glocker, M. L., Langleben, D. D., Ruparel, K., Loughead, J. W., Gur, R. C., & Sachser, N. (2009). Baby schema in infant faces induces cuteness perception and motivation for caretaking in adults. *Ethology*, *115*(3), 257-263. https://doi.org/10.1111/j.1439-0310.2008.01603.x

Hampson, E., van Anders, S. M., & Mullin, L. I. (2006). A female advantage in the recognition of emotional facial expressions: Test of an evolutionary hypothesis. *Evolution and Human Behavior*, *27*(6), 401-416. https://doi.org/10.1016/j.evolhumbehav.2006.05.002

Hansen, C. H., & Hansen, R. D. (1988). Finding the face in the crowd: an anger superiority effect. *Journal of Personality and Social Psychology*, *54*(6), 917. https://doi.org/10.1037/0022-3514.54.6.917

Haselton, M. G., & Buss, D. M. (2000). Error management theory: A new perspective on biases in cross-sex mind reading. *Journal of Personality and Social Psychology*, *78*(1), 81-91. https://doi.org/10.1037/0022-3514.78.1.81

Hildebrandt, K. A., & Fitzgerald, H. E. (1978). Adults' responses to infants varying in perceived cuteness. *Behavioural Processes*, *3*(2), 159-172. https://doi.org/10.1016/0376-6357(78)90042-6

Kret, M. E., Pichon, S., Grèzes, J., & De Gelder, B. (2011). Men fear other men most: gender specific brain activations in perceiving threat from dynamic faces and bodies–an fMRI study. *Frontiers in Psychology*, *2*, 3. https://doi.org/10.3389/fpsyg.2011.00003

LeDoux, J. E. (2014). Coming to terms with fear. *Proceedings of the National Academy of Sciences*, *111*(8), 2871-2878. https://doi.org/10.1073/pnas.1400335111

Lorenz, K. (1943). Die angeborenen formen möglicher erfahrung. *Zeitschrift für Tierpsychologie*, *5*(2), 235-409. https://doi.org/10.1111/j.1439-0310.1943.tb00655.x

Lucion, M. K., Oliveira, V., Bizarro, L., Bischoff, A. R., Silveira, P. P., & Kauer-Sant'Anna, M. (2017). Attentional bias toward infant faces–Review of the adaptive and clinical relevance. *International Journal of Psychophysiology*, *114*, 1-8. https://doi.org/10.1016/j.ijpsycho.2017.01.008

Lundqvist, D., Flykt, A., & Öhman, A. (1998). *The Karolinska Directed Emotional Faces*

-*KDEF*, [CD-ROM]. Department of Clinical Neuroscience, Psychology section, Karolinska Institutet, Stockholm, Sweden.

Mandal, M. K., & Palchoudhury, S. (1985). Perceptual skill in decoding facial affect. *Perceptual and Motor Skills*, *60*(1), 96-98. https://doi.org/10.2466/pms.1985.60.1.96

Mather, M., Lighthall, N. R., Nga, L., & Gorlick, M. A. (2010). Sex differences in how stress affects brain activity during face viewing. *Neuroreport*, *21*(14), 933. doi: 10.1097/WNR.0b013e32833ddd92

Mogg, K., & Bradley, B. P. (1999). Orienting of attention to threatening facial expressions presented under conditions of restricted awareness. *Cognition & Emotion*, *13*(6), 713-740. https://doi.org/10.1080/026999399379050

Nittono, H., Fukushima, M., Yano, A., & Moriya, H. (2012). The power of kawaii: Viewing cute images promotes a careful behavior and narrows attentional focus. *PloS one*, *7*(9), E46362. https://doi.org/10.1371/journal.pone.0046362

Öhman, A., & Mineka, S. (2001). Fears, phobias, and preparedness: toward an evolved module of fear and fear learning. *Psychological Review*, *108*(3), 483. https://doi.org/10.1037/0033-295X.108.3.483

Paul, E. S., Harding, E. J., & Mendl, M. (2005). Measuring emotional processes in animals: the utility of a cognitive approach. *Neuroscience & Biobehavioral Reviews*, *29*(3), 469-491. https://doi.org/10.1016/j.neubiorev.2005.01.002

Proverbio, A. M., Zani, A., & Adorni, R. (2008). Neural markers of a greater female responsiveness to social stimuli. *BMC Neuroscience*, *9*(1), 56. doi:10.1186/1471-2202-9-56

RStudio Team (2020). RStudio: Integrated Development for R. RStudio, Inc., Boston, Ma. URL http://www.rstudio.com/.

Senese, V. P., De Falco, S., Bornstein, M. H., Caria, A., Buffolino, S., & Venuti, P. (2013). Human infant faces provoke implicit positive affective responses in parents and non-parents alike. *PloS one*, *8*(11), e80379. https://doi.org/10.1371/journal.pone.0080379

Sherman, G. D., Haidt, J., & Coan, J. A. (2009). Viewing cute images increases behavioral carefulness. *Emotion*, *9*(2), 282. DOI: 10.1037/a0014904

Tate, A. J., Fischer, H., Leigh, A. E., & Kendrick, K. M. (2006). Behavioural and neurophysiological evidence for face identity and face emotion processing in animals. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *361*(1476), 2155-2172. https://doi.org/10.1098/rstb.2006.1937

Tomasello, M., Hare, B., Lehmann, H., & Call, J. (2007). Reliance on head versus eyes in the gaze following of great apes and human infants: the cooperative eye hypothesis. *Journal of Human Evolution*, *52*(3), 314-320. https://doi.org/10.1016/j.jhevol.2006.10.001

Thompson, A. E., & Voyer, D. (2014). Sex differences in the ability to recognise non-verbal displays of emotion: A meta-analysis. *Cognition and Emotion*, *28*(7), 1164-1195. https://doi.org/10.1080/02699931.2013.875889

Tybur, J. M., Lieberman, D., Kurzban, R., & DeScioli, P. (2013). Disgust: Evolved function and structure. *Psychological Review*, *120*(1), 65. DOI: 10.1037/a0030778

Uskul, A. K., Paulmann, S., & Weick, M. (2016). Social power and recognition of emotional prosody: High power is associated with lower recognition accuracy than low power. *Emotion*, *16*(1), 11. https://doi.org/10.1037/emo0000110

Wicker, B., Keysers, C., Plailly, J., Royet, J. P., Gallese, V., & Rizzolatti, G. (2003). Both of us disgusted in My insula: the common neural basis of seeing and feeling disgust. *Neuron*, *40*(3), 655-664. https://doi.org/10.1016/S0896-6273(03)00679-2

Zeveloff, S. I., & Boyce, M. S. (1982). Why human neonates are so altricial. *The American Naturalist*, *120*(4), 537-542. https://doi.org/10.1086/284010