Facial Emotion Recognition during Pregnancy:

Examining the Effects of Facial Age and Affect

Declarations of Interest

Conflicts of Interest: None

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Abstract

It is vital that new mothers quickly and accurately recognize their child's facial expressions. There is evidence that during pregnancy women develop enhanced processing of facial features associated with infancy and distress, as these cues signal vulnerability and are therefore biologically salient. In this study, 51 pregnant women at 17-36 weeks' gestation watched neutral infant and adult faces gradually morph into either happy or sad expressions. We measured the speed and accuracy with which participants were able to recognize facial affect (happy vs. sad) across facial ages (infant vs. adult). Participants were faster and more accurate at recognizing happy versus sad faces and adult versus infant faces. We discuss how prior exposure to a certain face type may explain faster recognition. We also consider these results in the context of evidence indicating positive affect is recognised more quickly, but associated with slower attention and detection.

Key words: pregnancy, face recognition, emotion recognition, infant, adult.

1. Introduction

It is vital that new mothers quickly and accurately recognize their child's facial expressions, as this is a primary means for infants to communicate with their caregiver. There is evidence that during the latter stages of pregnancy, women undergo a transition period in preparation for motherhood (e.g., Mayes, Rutherford, Suchman, & Close, 2012). This transition is marked by shifts in hormone levels and neurobiological re-organization, which are believed to increase a mother's sensitivity to emotional cues (Hoekzema et al., 2017; Kim, 2016; Mayes et al., 2012). For example, the release of oxytocin during pregnancy is associated with neurobiobehavioral adaptation (e.g., Kim & Strathearn, 2016; Leng, Meddle, & Douglas, 2008). These changes are hypothesized to enhance processing of infant facial features (e.g., Pearson, Lightman, & Evans, 2009). There is evidence that mothers develop enhanced processing for distressed and infant faces, as these facial cues signal vulnerability of their offspring (e.g., Thompson-Booth et al., 2014a). By contrast, it has been found that typical adults of both sexes show a preferential bias for the recognition of own-age faces (e.g., Rhodes & Anastasi, 2012) and happy faces (e.g., Leppanen, Tenhunen, & Hietanen, 2003). In this study, we examined whether these biases observed in typical adults are altered during pregnancy, specifically in relation to the speed and accuracy in recognizing facial affect (sad vs. happy) and facial age (infant vs. adult).

Infant cues are argued hold incentive value which promotes caregiving responses (e.g., Ferrey et al., 2016). Infant faces are thought to contain key schema or features that enhance their salience and attraction (Lorenz, 1943). Mothers have preferential processing of facial cues associated with infancy and distress, as these cues signal vulnerability of their offspring and are therefore *biologically salient*. Specifically, studies have found that mothers allocated more attention to infant versus older faces, particularly when these faces expressed distress or emotion (Thompson-Booth et al., 2014a; Thompson-Booth et al., 2014b). Roos et al. (2012) also reported that new mothers showed increased selective attention to fearful faces when compared to non-pregnant controls, particularly when the women themselves were distressed. Pearson, Cooper, Penton-Voak, Lightman, and Evans (2010) found non-depressed pregnant women took longer to disengage attention from distressed compared to non-distressed infant faces. Only one study has examined emotion recognition during pregnancy. Pearson et al. (2009) found that late pregnancy was associated with enhanced ability to encode emotional faces displaying fear, anger, and disgust compared to early pregnancy. They concluded that the greater hormone levels associated with pregnancy increased sensitivity to recognize threat or distress. This is consistent with findings that greater estrogen levels during the menstrual cycle are associated with enhanced recognition of negative emotions (e.g., Guapo et al., 2009; Pearson & Lewis, 2005). These findings are also consistent with studies demonstrating that the administration of oxytocin to non-parent women increases allocation of attention towards infant, but not adult, facial cues (e.g., Rutherford et al., 2017). Taken together, these studies suggest there may be enhanced cognitive processing of facial cues associated with infancy and distress during pregnancy.

However, these results run counter to research predicting faster recognition for own-age faces and happy faces. A robust finding is that there is faster emotion recognition for happy faces compared to other expressions, referred to as the *happy face advantage* (e.g., Leppanen & Hietanen, 2003; Lipp, Craig, & Dat, 2015). For example, Kirita and Endo (1995) found that participants more rapidly categorized upright, happy schematic faces, compared to sad faces. If the faces were inverted, they found this effect reversed. They concluded that happy faces are processed more holistically, whereas sad faces are processed more analytically, using the spatial characteristics of facial features. Similarly, Adolphs (2002) argued that unhappy expressions engage a variety of different emotions, take longer to differentiate and require broader facial analysis, whereas happiness can be categorized rapidly solely based on the shape of the mouth.

There is also evidence that individuals typically have better recognition for faces of similar age, referred to as the *own-age bias* (e.g., Rhodes & Anastasi, 2012). This bias is argued to be at least partly explained by more frequent encounters with individuals of similar age, which may result in better developed and maintained schemas for similar age faces (e.g., Harrison & Hole, 2009; He, Ebner, & Johnson, 2011). There has been some interest in whether the own-age bias would result in better recognition memory for facial expressions associated with faces of a similar age. While the results were mixed, Ebner and Johnson (2009) found that self-reported frequency of contact with an age group played a role in expression identification and memory for younger and older adults.

Early interactions between mother and child are critical for healthy development, therefore, understanding maternal emotion recognition is important, even before the child's arrival. While most cognitive studies in pregnant populations have focused on attention, few have examined emotion recognition. Yet efficient emotion recognition is arguably just as important, as it could influence the development of postpartum bonding and attachment security (e.g., Ainsworth, 1979). In this study, we used a novel facial morphing task, whereby participants were measured as to how quickly they could identify a facial emotion as it morphed from a neutral expression into a happy or sad expression for either infants or adults. Unlike more specific forms of negative affect, such as anger or fear, sadness describes a more general form of negative affect (e.g., Pearson et al., 2009). Extant studies lend weight to two competing hypotheses: 1) maternal attention literature would support faster recognition of sad and infant faces in line with heightened biological vulnerability, and 2) results from the typical adult literature would support faster recognition of happy and own-age faces.

2. Methods and Materials

2.1. Participants

Fifty-one pregnant women participated in the study (*M* age = 27.63, *SD* = 5.31). They were at 17-36 weeks of gestation (*M* gestation weeks = 26.35, *SD* = 9.25). Women were recruited through flyers and brochures posted in the local community as part of a short-term longitudinal study of changes in emotional processing during pregnancy and postpartum. Participants classified their ethnicity as White/Caucasian (n = 24), African American/Black (n = 16), Hispanic/Latino (n = 6), Asian American (n = 2), American Indian (n = 2) or no data (n = 1). The sample comprised of 24 first-time mothers and 26 experienced mothers (n = 1 did not provide data). The university's Human Investigation Committee approved all procedures prior to recruitment. All participants provided written consent prior to the study and were compensated for their participation.

2.2. Design

Procedure: All procedures were completed in a laboratory room in a research centre at the institution. Participants first completed self-report and demographic measures. They then completed a facial morph task, where a face on a computer screen morphed from neutral into happy or sad, for either an adult or an infant face. They clicked on the screen to commence the task. They then clicked on screen buttons labelled "Happy" or "Sad" when they recognized the emotion. They were able to change their response during the task. Participants had a practice trial to familiarize themselves with the task under the supervision of a research assistant. The entire experiment took approximately 10 minutes.

Face Stimuli Description: The stimuli were presented on a Dell Optiplex 7010 computer, with a 17-inch LCD monitor which had a screen resolution of 1280 × 1024. The program for running the experiment was E-Prime 2.0 (Schneider, Eschman, & Zuccolotto, 2012). There were 14 trials for each of the four conditions (happy adult, sad adult, happy infant and sad infant) and 56 trials in total. Faces were randomly presented and there were seven adult and seven infant facial identities used. The morphs were created using MorphAge software (MorphAge version 4.0, Creaceed, at http://www.creaceed.com). Adult faces were retrieved from the NimStim Set of Facial Expressions (Tottenham et al., 2009). The open mouth NimStim models used for this experiment (with kappa for neutral expression) were 01 (.56), 02 (.15), 09 (-.56), 23 (.82), 24 (.74), 34 (-.32) and 36 (.21; Tottenham et al., 2009). Infant faces were provided from a former study by Strathearn and McClure (2002). Four neutral, unfamiliar male faces and three female faces were used. All faces were Caucasian. All faces were approximately 8cm × 11cm and were centrally presented in grey scale in black boxes within a white screen. Each frame involved a 5% incremental increase in percentage of emotion expressed, until 100% expression was reached. After an initial face presentation, the morphing took place across 20 frames, with each frame presented for 500 ms, therefore, each trial could take at least 10,000ms (10 seconds). However, the trial could last longer than 10,000 ms if participants did not respond until the final face presentation. An example of an adult condition morphing from neutral to happy is presented in Figure 1.

[INSERT FIGURE 1]

2.3. Self-Report Measures

Demographic Questions: Participants reported their age, weeks' gestation, whether they had children and their ethnicity.

Beck Depression Inventory – Second Edition: The BDI-II (Beck, Steer, & Brown, 1996) was completed by participants prior to the experiment. The BDI-II is a 21-item self-report measure of depressive symptoms experienced during the past two weeks. Participants can score between 0 (minimal depression) to 63 (severe depression) on this measure.

Respondents level of depression could be classified as minimal (0-13), mild (14-19), moderate (20-28) and severe (29-63; Beck et al., 1996). Extensive reliability and validity data have been reported for this measure (e.g., Beck et al., 1996).

Analysis Strategy

Mean reaction times (RTs) were calculated for each condition (happy adult, sad adult, happy infant and sad infant) in milliseconds (ms). The RT for correct trials only for each participant's first response to the morphing face was measured. The mean proportion of correct responses was calculated for each participant's first response in each condition, where a score of 1.00 equates to 100% correct across trials. As a preliminary analysis, we examined whether the participant's age, stage of pregnancy, ethnicity or childrearing experience influenced the speed or accuracy of recognition for each condition. The mean BDI-II score was reported as well as the proportion of participants with moderate or greater levels of depression. For the main analyses, mean RTs and accuracy scores were examined using a 2 × 2 repeated measures ANOVA, with within-subject factors of facial age (infant vs. adult) and facial affect (sad vs. happy). To examine the effects of elevated depression, a sensitivity analysis was conducted, running the same main analysis, but excluding participants with moderate or greater levels of depression.

3. Results

3.1. Preliminary Analysis

See Figure 2 for mean RTs for each condition. Accuracy was greatest for adult happy faces (M = .96, SD = .11), followed by infant happy (M = .93, SD = .09), adult sad (M = .91, SD = .14) and infant sad faces (M = .79, SD = .21).

[INSERT FIGURE 2]

There were no statistically significant relationships between RTs for any facial condition and the women's age (all *r's* ≤ .11 all *p's* ≥ .43) or weeks' gestation (all *r's* ≤ .07, all *p's* ≥ .65). Across the conditions, RTs did not differ between white and non-white women (all *t's* ≤ .79, all *p's* ≥ .44) or primiparous and multiparous women (all *t's* ≤ 1.45, all *p's* ≥ .14).

Similar to the RT analysis, there were no statistically significant relationships between accuracy scores for any facial condition and the women's age (all *r's* ≤ .13, all *p's* ≥ .38) or weeks' gestation (all *r's* ≤ .18, all *p's* ≥ .21). Across the conditions, accuracy did not differ between white and non-white women (all *t's* ≤ 1.49, all *p's* ≥ .14) or primiparous and multiparous women (all *t's* ≤ 1.48, all *p's* ≥ .15).

The mean score on the BDI-II was 11.33 (*SD* = 6.76), indicating the sample was generally experiencing minimal levels of depression. Of the sample, four participants reported moderate levels of depression and one reported severe depression.

3.2. Main Analyses

Reaction Time: The 2 × 2 repeated measures ANOVA demonstrated a main effect of facial age on RT, where participants were faster to recognize adult faces than infant faces, $F(1, 50) = 105.13$, $p < .001$, $\eta_p^2 = .68$. There was a main effect of facial affect, whereby participants were faster to recognize happy faces than sad faces, $F(1,50) = 85.51$, $p < .001$, $\eta_p^2 = .63$. There was an interaction between facial affect and age for RT, $F(1,50) = 10.37$, $p < .01$, $\eta_p^2 = .17$. Specifically, there was greater difference in RT between adult and infant happy faces, as compared to adult and infant sad faces. A test of simple effects revealed RTs for adult happy faces were significantly faster than for adult sad faces, $F(1, 50) = 89.69$, $p < .001$, $\eta_p^2 = .48$. Furthermore, RTs for infant happy faces were significantly faster than infant sad faces $F(1, 50) = 58.59$, $p < .001$, $\eta_p^2 = .37$.

Accuracy: The 2 × 2 repeated measures ANOVA demonstrated a main effect of facial age on accuracy, where participants were more accurate for adult faces than infant faces, $F(1, 50) = 36.29$, $p < .001$, $\eta_p^2 = .42$. There was a main effect of facial affect, whereby participants were more accurate in recognizing happy faces, than sad faces, $F(1, 50) = 21.78$, $p < .001$, $\eta_p^2 = .30$. There was an interaction between facial affect and age for accuracy scores, $F(1,50) = 13.71$, $p < .01$, $\eta_p^2 = .22$. Specifically, there was greater difference in accuracy between infant happy and sad faces, as compared to adult happy and sad faces. A test of simple effects revealed accuracy was greater for adult happy faces than adult sad faces, $F(1, 50) = 7.05$, $p < .01$, $\eta_p^2 = .07$. Furthermore, accuracy for infant happy faces were significantly greater than for infant sad faces, $F(1, 50) = 30.27$, $p < .001$, $\eta_p^2 = .24$.

Excluding the five participants with moderate or greater levels of depression did not alter any of the main effects or interactions for RT or accuracy (RT interaction $p < .01$; all other *p's* < .001).

4. Discussion

In this study, we used a facial morphing task to examine the speed and accuracy with which pregnant women were able to recognize facial affect across facial age groups. We found pregnant women were faster and more accurate at recognizing adult faces compared to infant faces. We found they were also faster and more accurate at recognizing happy faces compared to sad faces. These results are consistent with the pattern of findings observed in typical adults, indicating a role for recognition biases towards own-age and happy faces. In other words, these findings demonstrate that even in this biologically primed sample, these biases were stronger mediators of recognition than biologically salient variables associated with infancy and distress. It is also noteworthy there was no speed-accuracy trade-off in recognition scores, suggesting the effects are robust: greater response time did not necessarily improve accuracy. There were also interactions between facial age and affect for both recognition speed and accuracy, suggesting facial age had a variable effect on recognition scores, depending on facial affect.

The faster recognition for adult faces is consistent with an own-age bias, which is believed to be at least partly explained by greater levels of prior exposure participants had to other adults faces (e.g., Ebner & Johnson, 2010). Hence, if greater levels of sex hormones and neurobiological organization does enhance emotion recognition during pregnancy, it may be less influential than the effects of prior exposure and/or work in combination with these effects. The faster recognition for happy faces is consistent with the well-documented happy face advantage (e.g., Leppanen et al., 2003; Lipp et al., 2015). These results are consistent with evidence that tasks involving processing of negative emotion have increased latencies compared to positive emotion (e.g., Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Leppanen et al., 2003), whereas tasks involving attention capture show lower latencies for negative emotion compared to positive emotions (e.g., Roos et al., 2012; Thompson-Booth et al., 2014a). In other words, negative affect may be more salient and significant: it needs to be detected quickly and then processed more slowly and carefully.

The interaction between facial affect and age for recognition speed was driven by a greater difference in RT between adult happy and sad faces, compared to infant happy and sad faces. While speculative, the relatively faster response for the adult happy condition may reflect that adult happy faces are more readily encountered, and less biologically significant, therefore they only require faster and more superficial processing. By contrast, the interaction for accuracy scores appears to be associated with the relatively lower accuracy for sad infant faces (the condition diametrically opposed to adult happy). In this case, the combination of low exposure to infant faces, requiring more complex facial analysis of negative affect, may further reduce accuracy.

These results should be considered in light of some limitations. First, it is worth noting that these results may not necessarily reflect an expecting mother's emotion recognition in real life: there is typically more time and multiple cues to make judgements regarding the emotional state of others. A potential limitation of this study was that all the facial stimuli were Caucasian, while many of the participants were not. While there were no apparent racial differences for recognition in this study, other research has found evidence for this (e.g., Hodsoll, Quinn, & Hodsoll, 2010). There were no differences in recognition between primiparas versus multiparous women, indicating that prior experience with infants did not improve recognition. The addition of a non-pregnant control condition will be useful to further examine these effects, as will measures of exposure and experience with infants across the lifetime. Similarly, sex differences in recognition may also be a useful means to examine these effects. If recognition biases do indeed exist, it would be valuable to determine if they alter during pregnancy, postpartum, and with greater experience as a mother. Future research may wish to examine recognition of more specific forms of negative affect, such as sadness, anger or disgust, as has been done in attention paradigms (e.g., Pearson et al., 2009)

5. Conclusions

Notwithstanding its limitations, this is one of the first studies to examine emotion recognition in a pregnant sample. Results suggest biases for own age and happy faces are more influential mediators for emotion recognition than variables associated with biological developmental vulnerability. These results indicate there are intrinsic differences between adult and infant facial cues that mediate recognition and further research is needed to examine these effects. For example, Lorenz (1943) argued differences in the schematic features of infant faces may confer an adaptive advantage to attract caregiving behaviour. These results suggest there are most likely different biases and cognitive processes associated with facial recognition versus attention. Comparing between and controlling for attention versus recognition using a within-subjects design may be valuable, as results may vary depending on the type of cognitive task (e.g., Leppanen et al., 2003).

Impairments in emotion recognition could have significant implications in caregiving postpartum. While this methodology is novel and may need refining, it could be useful for identifying women who have difficulty with emotion recognition, including those experiencing elevated levels of depression, anxiety, or stress. Performance on this paradigm may also be valuable to ascertain the effects of interventions designed to improve emotion recognition, whether through cognitive, behavioural, or pharmacological approaches. For example, this paradigm could be useful for examining the effects of intranasal oxytocin (e.g., Rutherford et al., 2017). Further research in this area will hopefully uncover how these biases influence outcomes relevant to the dyad, including postpartum bonding, socio-emotional development, and child attachment security.

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References

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

Ainsworth, M. D. (1979). Infant-mother attachment. *American Psychologist, 34*, 932-937.

Baumeister, R., Bratslavsky, E., Finkenauer, C., & Vohs, K. (2001). Bad is stronger than good. *Review of General Psychology, 5*, 323-370.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Manual for the Beck Depression Inventory-II*. San Antonio, TX: Psychological Corporation.

Ebner, N., & Johnson, C. (2009). Young and Older Emotional Faces: Are there Age-Group Differences in Expression Identification and Memory. *Emotion, 9*, 329-339.

Ebner, N., & Johnson, M. (2010). Age-group differences in interference from young and older emotional faces. *Cognition and Emotion, 24*, 1095-1116.

Ferrey, A., Santascoy, N., McCrory, E., Thompson-Booth, C., Mayes, L.C. &. Rutherford, H. J. V. (2016) Motivated Attention and Reward in Parenting, *Parenting, 16*, 284-301,

Guapo, G., Greff, F., Zani, R., Labate, C., Reis, R., & Del-Ben, C. (2009). Effects of sex hormonal levels and phases of the menstrual cycle in the processing of emotional faces. *Psychoneuroendocrinology, 34*, 1087-1094.

Harrison, V., & Hole, G. (2009). Evidence for a contact-based explanation of the own-age bias in face recogniton. *Psychonomic Bulletin and Review, 16*, 264-269.

He, Y., Ebner, N., & Johnson, C. (2011). What predicts the own-age bias in face recognition memory. *Social Cognition, 29*, 97-109.

Hodsoll J., Quinn K. A., & Hodsoll, S. (2010). Attentional Prioritization of Infant Faces Is Limited to Own-Race Infants, *PLoS ONE, 5*, 9.

Hoekzema E, Barba-Müller E, Pozzobon C, Picado M, Lucco F, García-García D, Soliva JC, …., Ballesteros A. (2017). Pregnancy leads to long-lasting changes in human brain structure. *Nature Neuroscience, 20*, 287.

Kim, P. (2016). Human Maternal Brain Plasticity: Adaptation to Parenting. *New Directions for Child and Adolescent Development, 153*, 47-58.

Kim, S., & Strathearn, L. (2016). Oxytocin and Maternal Brain Plasticity. *New Directions for Child and Adolescent Development*, 153, 59–72.

Kirita, T., & Endo, M. (1995). Happy face advantage in recognizing facial expressions. *Acta Psychologica, 89,* 149-163. Leppanen, J., & Hietanen, J. (2003). Affect and face perception: Odors modulate the recognition of happy faces. *Emotion, 3*, 315-326.

Leng, G., Meddle, L. & Douglas, A. (2008). Oxytocin and the maternal brain. Current Opinion in Pharmacology, 8, 731-734.

Leppanen, J., Tenhunen, M., & Hietanen, J. (2003). Faster choice reaction times to positive than negative facial expressions: The role of cognitive and motor processes. *Emotion, 3,* 315-326.

Lipp, O., Craig, B., & Dat, M. (2015). A Happy Face Advantage with Male Caucasian Faces: It Depends on the Company You Keep. *Social Psychological and Personality Science, 6*, 109-115.

Lorenz, K. (1943). Die angeborenen Formen mo glicher Erfahrung [The innate forms of potential experience]. Zeitschrift fur Tierpsychologie, *5*, 233–519.

Mayes, L.C, Rutherford, H. J. V., Suchman, N., & Close, N. (2012). The Neural and Psychological Dynamics of Adults' Transition to Parenthood. *Zero to three, 33*, 83-84.

Pearson, Cooper, R., Penton-Voak, I., Lightman, S., & Evans, J. (2010). Depressive symptoms in early pregnancy disrupt attentional processing of infant emotion. *Psychological Medicine, 40*, 621-631.

Pearson, & Lewis, M. (2005). Fear recognition across the menstrual cycle. *Hormones and Behavior, 47,* 267-271.

Pearson, Lightman, S., & Evans, J. (2009). Emotional sensitivity for motherhood: Late pregnancy is associated with enhanced accuracy to encode emotional faces. *Hormones and Behavior, 56,* 557-563.

Rhodes, M. G., & Anastasi, J. S. (2012). The own-age bias in face recognition: A meta-analytic and theoretical review. *Psychological Bulletin, 138*, 146.

Roos, A., Lochner, C., Kidd, M., Van Honk, J., Vythilingum, B., & Stein, D. J. (2012). Selective attention to fearful faces during pregnancy. *Progress in Neuro-Psychopharmacology and Biological Psychiatry, 37*, 76-80.

Rutherford, H.J.V, Guo, X., Graber, K.M., Hayes, N.J., Pelphrey, K.A., & Mayes, L.C. (2017). Intranasal oxytocin and the neural correlates of infant face processing in non-parent women. Biological psychology, 129, 45-48.

Schneider, W., Eschman, A., & Zuccolotto, A. (2012). *E-Prime User's Guide*. Pittsburgh: Psychology Software Tools, Inc.

Strathearn, L., & McClure, S. M. (2002). *A functional MRI study of maternal responses of infant facial cues.* Paper presented at the Annual Scientific Meeting of the 26. Society for Neuroscience, Washington DC.

Thompson-Booth, C., Viding, E., Mayes, L. C., Rutherford, H. J.V, Hodsoll, S., & McCrory, E. (2014a). I Can't Take My Eyes Off of You: Attentional Allocation to Infant,Child, Adolescent and Adult Faces in Mothers and Non-Mothers. *PLoS ONE, 9,* 1-8.

Thompson-Booth, C., Viding, E., Mayes, L. C., Rutherford, H. J.V, Hodsoll, S., & McCrory, E. J. (2014b). Here's looking at you, kid: attention to infant emotional faces in mothers and non-mothers. *Devevlopmental Science, 17,* 35-46.

Tottenham, N., Tanaka, J., Leon, A., McCarry, T., Nurse, M., Hare, T., . . . Nelson, C. (2009). The NimStim set of facial expressions: Judgments from untrained research participants. *Psychiatry Research*, *168*, 242-249.

Figure captions

Figure 1. Examples of the face stimuli for a single trial in the happy adult condition. Participants are presented with an initial neutral face that morphs into a final happy or sad face over 21 face stimuli. Faces shown here are after 7, 14 and 21 morphs, as well as intermediate morphs. Participants respond as soon as they recognize the emotional expression.

Figure 2. Mean emotion recognition reaction time for infant and adult faces with happy or sad expressions during morph trials. Error bars represent 1 Standard Error of the Mean.