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ORIGINAL PAPER

Exploring the Contribution of Gender Roles on Adults' EEG Responses to Infant Faces

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Abstract

Prior research has shown that women tend to be more responsive to infant cues than men. However, the influence of different aspects of social gender, like gender norms associated with femininity and masculinity, on individual responses to infant cues, has received no attention to date. This study is the first to investigate how gender roles, conceptualized as continuous traits of femininity and masculinity, are associated with electrophysiological responses to facial stimuli from infants and adults. Electroencephalography was used to record the neural activity of 60 nonparent adults (50% women) while they completed an emotion recognition task displaying infant and adult faces expressing happy, neutral, or sad emotions. Participants also completed an Italian translation of the Bem Sex Role Inventory to assess levels of femininity and masculinity. Results showed that higher levels of femininity were statistically significantly associated with a larger N170 amplitude in response to infant faces. This finding indicates that individuals who adhere more to sociocultural roles associated with femininity exhibit enhanced perceptual processing of infant faces at a very early stage. Our evidence underscores the potential contribution of cultural norms associated with gender to infant cue processing and highlights the need to consider different aspects of social gender in research in this area.

Keywords Gender roles · Gender differences · Infants · Face processing · N170 · Masculinity-Femininity

Introduction

Infant faces are processed in a unique way compared to other social stimuli like adult faces, given their importance in prompting caregiving behaviors (Lorenz, 1943, 1971). The *Kindchenschema*, described as an innate releasing mechanism for caretaking behavior and affective orientation toward infants, can be activated by features of infant faces, such as protruding cheeks, a large forehead, and large eyes (Lorenz, 1943). In prior research, women were found to be more responsive than men to different characteristics of infants, like those conveyed by their faces (Hahn et al., 2013). Differences between men and women were identified in the sensitivity to infant cuteness (Lobmaier et al., 2010) and in the aversive responses to infant facial deformities (Yamamoto et al., 2009). In a review, Luo et al. (2015) reported that, compared to men, women show a stronger implicit attentional bias and a greater explicit preference for infant faces. Behavioral studies have found that, while both men and women generally perceive infant faces as cute, women tend to be more sensitive to their cuteness (Glocker et al., 2009; Lehmann et al., 2013), exhibit a stronger attentional bias toward them (Cárdenas et al., 2013; Gemignani et al., 2024a), express a greater preference for and liking of them (Charles et al., 2013; Maestripieri & Pelka, 2002; Parsons et al., 2011, 2017), and show more effort and motivation to view them (Hahn et al., 2013).

Even though a number of cultural, experiential and physiological factors could potentially contribute to differences between men and women in the responses to infant faces, there is a substantial body of evidence for hormonal influences in responding to infant cues. Specifically, a study reported that young women (19–26 years) were more sensitive to infant cuteness than men aged 19–26 and 53–60 years old. Women aged 45–51 years were the same as younger women, whereas those aged 53–60 years old showed a reduced cuteness sensitivity that was equivalent to men (Sprengelmeyer et al., 2009). Together with other evidence

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(e.g., Lobmaier et al., 2015; Sprengelmeyer et al., 2010), this study suggests that female reproductive hormones can play an important role in increasing perceived cuteness towards infant faces. Moreover, women can undergo significant hormonal changes during pregnancy, childbirth, and the postpartum period, which support the rapid development of maternal bonding (Carmona & Vilarroya, 2025; Grattan, 2011; Levine et al., 2007; Rilling, 2013). However, the formation of nurturing bonds is not exclusive to women and biological mothers. Many fathers, as well as adoptive and stepfathers, develop deep emotional connections with their child linked to experience-dependent neural and physiological changes (Abraham et al., 2014; Gettler et al., 2011). This suggests that female hormones represent only one of the multiple factors influencing caregiving behaviors (Rilling, 2013). Moreover, conflicting behavioral evidence not finding a female advantage in responding to infant cues (Arteche et al., 2016; Brosch et al., 2007; Gemignani et al., 2024c; Oliveira et al., 2017) suggests that additional variables should be taken into account.

Given their optimal temporal resolution, Event-related potentials (ERPs) have been adopted to investigate individual differences occurring at different stages of elaboration of infant faces (Luck, 2014). ERPs are EEG signal waveforms obtained by averaging neural response across multiple presentations of the same stimulus. They are characterized by their polarity (positive = “P”, negative = “N”) and the time window in which they occur, measured in milliseconds (ms). The amplitude of ERPs, in microvolts (μV), can vary depending on the experimental conditions, indicating the strength and cognitive resources required for processing a stimulus. Among various ERPs, previous studies on infant face processing have examined the N170, P300, and Late Positive Potential (LPP) components (Vuoriainen et al., 2022). The N170, which peaks around 170 ms after stimulus onset in temporal-occipital regions, is associated with the perceptual processing and structural encoding of faces (Eimer & Holmes, 2007). The P300 and LPP, positive deflections beginning around 300 ms after stimulus onset in parietal/centroparietal regions, are linked to attentional processes for motivationally relevant stimuli and top-down cognitive processes (Hajcak & Foti, 2020). Because different studies do not always use consistent definitions of the P300 and LPP components, a recent meta-analysis interpreted them together as a P300/LPP complex (Vuoriainen et al., 2022).

Regarding gender or sex differences, Proverbio et al. (2006) demonstrated that mothers, compared to fathers, have an advantage in the perceptual processing of infant faces, as evidenced by a larger N170 amplitude response toward them. In these studies, a larger N170 amplitude is interpreted as reflecting increased perceptual processing in response to a specific stimulus, like a face of an infant. Differently, a smaller P300 amplitude was found in mothers compared to fathers in response to infant facial expressions of distress (Proverbio et al., 2006). Colasante et al. (2017) found that the LPP amplitude was larger in response to infant faces in women compared to men, suggesting a unique advantage of women in the sustained attention to infant faces. Jia et al. (2021) demonstrated that the N170 amplitude in response to infant sad expressions was larger, in the left hemisphere, in women compared to men, possibly indicating that women put more cognitive resources in response to infants’ negative emotions. Differently, Hahn et al. (2016) found that neither N170 nor LPP waves in response to infant faces were modulated by adult gender. Consistent with this, Young et al. (2017) highlighted that whether gender or sex differences were found in prior research on adult response to infant cues, the effect sizes were generally small. In addition, because of the scarcity of ERP studies on men, a recent meta-analysis (Kuzava et al., 2020) could not examine adult gender as a potential moderator of the N170 amplitude response to infant emotional faces. Overall, although gender or sex are often described as a salient factors, particularly in the early stages of infant face processing, the findings remain inconclusive. Unexplored or overlooked variables may contribute to these inconsistencies.

To date, study methods have rarely accounted for the different dimensions of social gender (i.e., roles, behaviors, and expressions linked to gender that are shaped by societal and cultural norms; Lindqvist et al., 2021); indeed, many studies in this area have not explicitly distinguished between sex and gender. This is the reason why we referred to gender or sex differences in the above section. Notably, differential responses to infant cues in men and women can be influenced by cultural norms and expectations (Lytton & Romney, 1991), although this has not been systematically investigated in the context of infant cue processing. Gender norms (Eagly, 1987) and gender schemas (Bem, 1981) provide scripts for enacting one’s gender through personality traits and behaviors within specific social contexts. Bem (1974, 1995) described gender roles related to femininity and masculinity as two independent dimensions, arising from internalized standards of social desirability. Femininity, for instance, has been culturally associated with warm and nurturing behaviors, while masculinity to personality traits like competitiveness. Previous research has shown that traditionally gender-linked behaviors can even influence certain biological mechanisms. Specifically, gender-related socialization may help account for some observed “sex” differences in adult testosterone levels, as engagement with masculine stereotypes has been associated with greater increases in testosterone compared to engagement with feminine ones (van Anders et al., 2015). Despite prior acknowledgment of the importance of Bem’s work (e.g., Morgenroth & Ryan, 2018), no research to date has considered the association between the adherence to gender roles related to femininity and masculinity and adults’ EEG response to infant cues. Investigating gender norms could offer valuable insights for empirical research in this area. This approach could help scholars to move beyond biological essentialism, which focuses exclusively on biological aspects of sex, and toward biological contextualism, which considers biological factors as one of many possible influences on, and outcomes of, social dynamics, alongside other types of factors (van Anders, 2024).

The present study aims to explore the contribution of gender roles related to femininity and masculinity on adults' ERPs in response to facial stimuli from both infants and adults. While prior research has focused on gender or sex differences (Colasante et al., 2017; Hahn et al., 2016; Jia et al., 2021; Proverbio et al., 2006), this work seeks to broaden the understanding of factors related to social gender (Lindqvist et al., 2021), that is gender roles and norms, which have thus far been overlooked. Given the scarcity of prior literature on the topic, we favored an exploratory approach over formulating a priori hypotheses.

Method

Participants

In total, 64 nonparent adults (31 men; 33 women) were recruited to complete an emotion recognition task during an EEG registration, along with some online questionnaires. The sample size was consistent with that of previous studies on the topic (Lowell et al., 2023 [$N=59$]; Peoples et al., 2022 [$N=68$]; Rutherford et al., 2021 [$N=63$]; Rutherford et al., 2017 [$N=63$]; Weisman et al., 2012 [$N=65$]). Participants were mainly undergraduate students from the University of Trento. To be included in the final sample, they were required to meet the following criteria: (1) no neurological or psychiatric disorders and no use of psychotropic medication; (2) normal or corrected-to-normal vision; (3) aged between 18 and 30 years and Italian native speaker; (4) no children and no daily contact with children. Four participants were excluded based on these criteria: one participant reported being diagnosed with Tourette Syndrome, two participants reported having a psychiatric disorder or taking psychotropic medication, and one participant was outside the 18–30 age range. The final sample was composed of 60 nonparent adults (50% women). Six out of 60 participants were left-handed. While 27 participants reported to have a normal vision, 33 had corrected-to-normal vision. All participants self-identified as White and cisgender. Regarding sex assigned at birth, none of the participants reported intersex conditions. All participants except for two were Italian; one participant identified as Romanian, while the other reported holding dual nationality (Italian and German). This study was primarily designed to address the research questions presented in Gemignani et al. (2024). The analyses reported in the current manuscript were conducted for exploratory purposes.

Procedure

Participants were fitted with an electroencephalogram (EEG) after answering questions related to their handedness, vision, physical and mental health. An Emotion Recognition Task, adapted from Peltola et al. (2018), was implemented using Opensesame (Mathôt et al., 2012) and presented during the EEG recording. The session began with a short set of practice trials (8 trials) to familiarize participants with the task. Each trial started with the presentation of a fixation cross at the center of the screen with a jittered duration of 550–850 ms (ms). A stimulus display was then presented for 1000 ms, followed by a response display until the participants' response (time-out response: 5000 ms), then a blank screen for 750 ms. Participants were instructed to look at each face and, only after its offset, to indicate whether the face showed a happy, neutral, or sad expression. Participants completed 4 test blocks of 72 trials. In total, 48 trials were displayed for each condition (i.e., adult happy, adult neutral, adult sad, infant happy, infant neutral, infant sad). A self-paced break followed each block. The trial order was randomized within each block. The six experimental conditions were balanced within the block. The completion of the task took around 16 min. Experimental stimuli included 36 faces of infants (50% females) aged 4–12 months taken from the Tromso Infant Faces Database (TIF; Maack et al., 2017) and 36 faces of adults (50% females) from the Karolinska Directed Emotional Faces (KDEF; Lundqvist et al., 1998). The stimuli were cropped into an oval shape, converted to grayscale, matched for size and luminance using Photoshop, and displayed against a uniform grey background. An example of the trial structure is displayed in Gemignani et al. (2024).

Continuous EEG activity was recorded using an eego sports system (ANT Neuro) at a sampling frequency of 1000 Hz. Data were collected from 64 Ag/AgCl shielded electrodes, referenced to CPz, and positioned according to the standard 10–10 system on an elastic cap (Brain Products). The impedance in each electrode was kept below 20 KΩ. Data pre-processing was performed with MATLAB toolboxes EEGLAB v2022.0 (Delorme & Makeig, 2004) and ERPLAB (Lopez-Calderon & Luck, 2014). EEG data were re-referenced offline to the average of electrodes; mastoids and EOG were excluded. Data were then band-pass filtered, with cutoffs of 0.1 and 30 Hz (Endendijk et al., 2018a; Schiano Lomoriello et al., 2022). Epochs were segmented for each trial, starting from – 1000 to 2000 ms from the stimulus onset. A long baseline correction (– 1000 ms) was performed to have a more accurate estimate of the voltage offsets. For one participant, the F8 channel was classified as bad and interpolated. The electrode stopped functioning during the

EEG, after which the EEG cap was repaired. Artifacts related to eye movements, head movements and muscle contractions were first rejected by eye inspection. Independent Component Analysis (ICA; RUNICA algorithm) was also performed to remove noise components from the signal, especially those related to eye-blinks (Porcaro et al., 2013). ICA components were visually inspected and selected for deletion only when their topography indicated a source of noise. The IClabel tool was also used for this purpose (Pion-Tonachini et al., 2019). After excluding incorrect trials, accepted epochs were averaged for each condition. The number of epochs retained across participants, on average, was 44.5 for the adult happy condition, 44.8 for adult neutral condition, 44.2 for adult sad condition, 45.1 for infant happy condition, 44.8 for infant neutral condition, and 44.9 for infant sad condition. ERPs were computed, only for correct trials, in discrete time windows and electrode groups (Di Dona et al., 2022; Proverbio et al., 2006). In addition to being informed by prior literature, the decision to include only correct trials was conceptually grounded, as it ensured that the neural (implicit) response to a given stimulus (e.g., a happy infant face) could be meaningfully interpreted in relation to a consistent explicit evaluation of that same stimulus. The N170 component was defined as the average activity within the 170–230 ms time window following stimulus onset, measured across the parieto-occipital electrodes P7, P8, PO7, PO8 (Rossion & Jacques, 2008). The LPP component was defined as the mean activity within the 300–700 ms time window post-stimulus onset (Endendijk et al., 2018a). The LPP was averaged over the parietal electrodes Pz, P1, P2, POz, PO3, PO4, which exhibited the most prominent waveform (Peltola et al., 2014, 2018).

Measures

Participants completed self-report measures via Qualtrics (Qualtrics, Provo, UT). A set of items was developed to collect socio-demographic information. The Bem Sex-Role Inventory (BSRI; Bem, 1974) was translated into Italian and back-translated into English to measure gender roles in terms of personality traits and behaviors linked to femininity and masculinity. The two dimensions, femininity and masculinity, were scored as continuous, non-mutually exclusive scales. This means that individuals could score high on one dimension and low on the other, high on both, or low on both. The full measure consisted of 60 adjectives: 20 feminine, 20 masculine, and 20 gender-neutral. Participants rated how well each adjective described their own personality on a Likert scale from 1 to 7. The scoring of the scale was derived from the work of Salvati et al. (2016), with only 10 adjectives for femininity and 10 for masculinity summed to calculate the total scores (Table 1). The scale associated with gender neutral adjectives was not used in this study. For the femininity scale, one item, i.e., “Gentle”, was negatively correlated with the other items, and therefore it was removed from the total score. Inter-item correlations for the femininity scale are reported in the Supplementary Material. After the exclusion, both scales demonstrated satisfactory reliability: Masculinity α = .76; Femininity α = .89.

Table 1 Bem Sex-Role Inventory items (adjectives) for femininity and masculinity scales

Masculinity	Femininity
Self-reliant	Affectionate
Defends own beliefs	Sympathetic
Independent	Sensitive to others’ needs
Assertive	Understanding
Strong personality	Compassionate
Leadership ability	Eager to soothe hurt feelings
Willing to take risks	Warm
Dominant	Tender
Willing to take a stand	Loves children
Aggressive	Gentle

Statistical Analysis

All the statistical analyses were conducted using R studio 2022.12.0. Descriptive statistics were run to examine mean scores, frequencies, percentages and distributions of the considered variables. Preliminary comparisons between men and women were tested through two-tailed t-tests. Participants demonstrated a high level of accuracy in performing the task, with an average accuracy rate of approximately 90%. Accuracy rates by condition were as follows: 88% for infant happy, 74% for infant neutral, 94% for infant sad, 98% for adult happy, 92% for adult neutral, and 92% for adult sad. Linear mixed models (LMMs; Bates et al., 2015) were employed to examine the effects of face age (adult vs. infant), emotional valence (happy vs. neutral vs. sad), and the interactions between face age and emotional valence, face age and femininity, face age and masculinity, and face age and gender/sex (women vs. men) on N170 and LPP amplitudes. Gender/sex was treated as a categorical variable with only two levels, since participants did not report other identities. For clarity, because participants’ gender and sex were aligned based on self-reports, it was not possible to disentangle whether observed effects are attributable to sex or gender. Therefore, we refer to this variable as gender/sex (van Anders, 2013, 2015, 2024). The LMMs included random intercepts for participants. The effects of LMMs were checked using the Type III analysis of variance with Satterthwaite’s method. Fixed effects and their interactions were specified based on the aim of the study.

Results

Descriptive and Preliminary Analyses

Details of the participants' characteristics are reported in Table 2. No differences in terms of age and masculinity scores emerged between men and women ($p > .05$). Women displayed higher femininity scores than men, $t(58) = 3.98$, $p < .001$.

Main Analyses

The model predicting the N170 amplitude included face age and emotional valence as fixed terms, and the interaction between the two terms. It also included the interactions between face age and masculinity, face age and femininity, and face age and gender/sex. The model evidenced a statistically significant interaction between face age and femininity, $F(2, 86.38) = 5.03$, $p = 0.009$. In particular, higher levels of femininity scores were associated with a larger (negative) N170 amplitude in response to infant faces. No comparable effect was observed for masculinity scores ($p > .05$) (Fig. 1). Full numerical details of the effects can be found in Table 3. To verify that the interaction between face age and femininity was not driven by differences in the distribution of femininity scores across gender/sex, we repeated the analysis using *z*-scores computed separately within each group. The interaction was confirmed as statistically significant using the standardized scores, $F(2, 86.38) = 7.74$, $p < .001$, suggesting that the effect was not due to between-group differences in score scaling.

Table 2 Characteristics of the study participants

Variable	Women ($n = 30$; 50%)		Men ($n = 30$; 50%)	
	n	*M* (SD) or %	*n*	*M* (SD) or %
Nationality	30		30	
Italian	28	93%	30	
Non-Italian	2	7%	30	100%
Education	30		30	
Middle school	0	0%	1	3.5%
High school	18	60%	13	43.5%
Bachelor's degree	8	27%	10	33%
Master's degree	3	10%	3	10%
Postgraduate/doctorate	1	3%	3	10%
Age	30	22.0 (3.0)	30	23.2 (3.2)
BRSI femininity	30	49.9 (7.1)	30	40.7 (10.4)
BRSI masculinity	30	46.0 (6.8)	30	45.1 (7.6)

The model predicting the LPP amplitude included face age and emotional valence as fixed terms, and the interaction between the two terms. The interactions between face age and masculinity, face age and femininity, and face age and gender/sex were included. This model outlined a main effect of emotional valence, $F(2, 272.00) = 9.36$, $p < .001$, and a statistically significant interaction effect between face age and emotional valence, $F(2, 272.00) = 5.11$, $p = .006$. As already discussed in Gemignani et al. (2024), sad faces elicited a greater LPP amplitude then happy and neutral faces, particularly when displayed by an infant. Full numerical details of the effects can be found in Table 4. The same results were corroborated using z-scores for femininity and masculinity.

Additional analyses excluding the "Loves children" item from the femininity scale did not alter the findings. These analyses ruled out the possibility that the effects related to femininity were solely driven by explicit preference and motivation to care for children. Two-way interactions between emotional valence and masculinity, emotional valence and femininity, and emotional valence and gender/sex were also examined. In addition, three-way interactions between face age, emotional valence, and femininity, as well as face age, emotional valence, and masculinity, were tested. None of these interactions were found to be statistically significant in predicting the N170 or LPP amplitude. Detailed results of these additional analyses are provided in the Supplementary Material.

Discussion

The aim of this study was to examine the association between gender roles, in terms of femininity and masculinity, and the N170 and LPP amplitudes in response to facial stimuli from infants and adults. Overall, greater adherence to gender roles related to femininity was associated with enhanced early processing of infant faces, as reflected by increased N170 amplitude. Beyond various factors that may contribute to differences between men and women in responding to infant cues, our findings suggest that the frequently observed female advantage in processing infant stimuli may be partially influenced by adherence to sociocultural gender norms.

First of all, preliminary analyses showed that femininity scores were significantly higher in women than in men. Differently, no statistically significant differences emerged in masculinity scores between the groups; on average, women reported slightly higher levels of masculinity than men. It should be noted that gender roles are dynamic and prone to be influenced by societal changes. In recent years, women have begun to adopt more roles traditionally held by men, and to develop novel roles linked to femininity. For instance, instrumental traits such as competitiveness and leadership have become more socially desirable for women. Differently, men

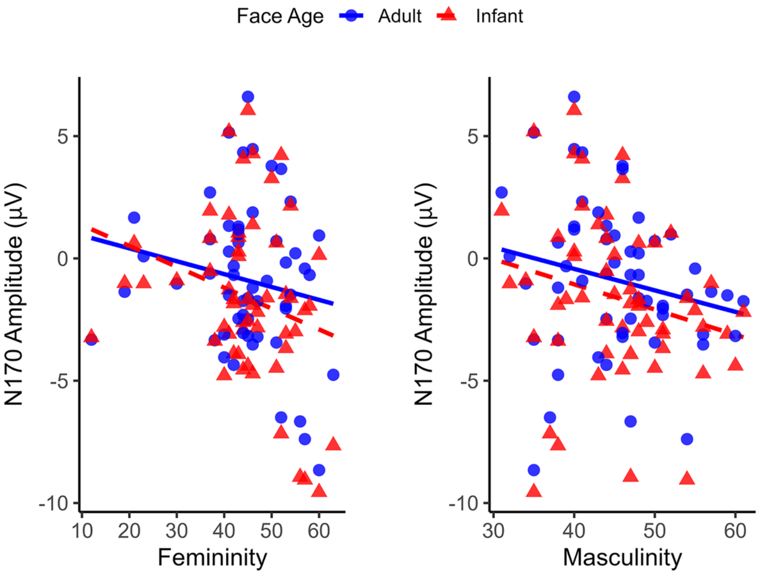

Fig. 1 Interaction between face age and femininity (statistically significant) and face age and masculinity (not statistically significant) in predicting N170 amplitude

have been giving up on their traditional roles more slowly (Diekman & Eagly, 2000; Donnelly & Twenge, 2017; Swazina et al., 2004; Vandello et al., 2013). Our findings may also reflect the influence of shifting standards (Biernat & Manis, 1994); that is, women may evaluate their masculinity relative to other women, and men relative to other men. As a result, average scores of femininity and masculinity may not be directly comparable across these groups. This consideration supports our methodological decision to further calculate standardized z-scores within each group.

For the first time, we found that the N170 amplitude in response to infant faces was associated with the adherence to gender roles linked to femininity. Specifically, individuals who reported higher levels of femininity, independently whether they identified as women or men, showed a larger N170 negativity in response to infant faces. This finding may indicate that adults endorsing more traditionally feminine traits exhibit enhanced perceptual processing of infant faces at a very early stage. No comparable effect was found for the masculinity score. Consistent with our results, behavioral responses to infant cues have been shown to be influenced by social expectations related to adults' gender (Ding et al., 2020). Using the BRSI measure in a sample of 300 childless adults (154 women and 146 men), Ding et al. found that femininity scores were positively correlated with adults' preference for infants across verbal and visual tasks. Ding et al. emphasized the importance of considering not only biological sex differences in parenting research, but also the internalization of gender roles. Consistent with previous findings reported by Gemignani et al. (2024) and the established evidence of a negativity bias in adults (Jia et al., 2022), we also found that sad faces elicited a larger LPP amplitude compared to happy and neutral faces. In particular, crying infant expressions were associated with greater LPP positivity than other conditions. This finding aligns with prior research suggesting that infant distress expressed through crying triggers heightened salience and focused attention in adults (Bornstein et al., 2017; Doi & Shinohara, 2012; Guida et al., 2025). Differently, no significant associations emerged

Table 3 Effects of fixed terms and interactions in the model predicting N170 amplitude

Effects	Degree of freedom	*F* value	*p* value
Face age	(1, 272.00)	1.36	0.24
Emotional valence	(2, 272.00)	1.16	0.32
Face age × Emotional valence	(2, 272.00)	2.08	0.13
Face age × Femininity	(2, 86.38)	5.03	0.008**
Face age × Masculinity	(2, 86.38)	1.06	0.35
Face age × Gender/sex	(2, 86.38)	0.78	0.46

Note: Degrees of freedom are reported as numerator and denominator values. ***$p < .001$; **$p < .01$; *$p < .05$

Table 4 Effects of fixed terms and interactions in the model predicting LPP amplitude

Effects	Degree of freedom	*F* value	*p* value
Face age	(1, 272.00)	0.05	0.81
Emotional valence	(2, 272.00)	9.36	< 0.001***
Face age × Emotional valence	(2, 272.00)	5.11	0.007***
Face age × Femininity	(2, 86.38)	0.03	0.97
Face age × Masculinity	(2, 86.38)	1.30	0.28
Face age × Gender/sex	(2, 86.38)	0.78	0.46

Note: Degrees of freedom are reported as numerator and denominator values. ***$p < .001$; **$p < .01$; *$p < .05$

between the LPP amplitude and scores on the femininity or masculinity scales.

Previous research has documented gender or sex differences in the N170 amplitude in response to infant faces, typically showing stronger responses in women than in men (Colasante et al., 2017; Jia et al., 2021; Proverbio et al., 2006). However, these earlier studies have overlooked the variability related to different dimensions of social gender. In light of our results, the advantage often observed in women's processing of infant stimuli might be partly explained by their adherence to gender norms, which reinforce culturally expected roles, such as caregiving, rather than being solely attributed to gender or sex differences. Endendijk et al., (2017, 2018b) highlighted that adherence to gender roles can become stronger in adults after becoming parents, suggesting that the overlap between gender, sex and gender norms may be even more pronounced in studies focusing on infant cue processing in parent samples. Another factor contributing to the evidence that mothers may appear more sensitive to infant cues than fathers is the traditionally unbalanced division of childcare responsibilities within different-gender parent couples (Farr & Patterson, 2013; Patterson et al., 2004). Since, in these couples, mothers are typically more involved (and therefore more experienced) with childcare than fathers, the conflation of gender or sex with culturally prescribed parenting roles may act as a significant confounding factor in research in this field. In an effort to disentangle these contributions, a recent study by Gemignani et al. (2022) demonstrated that parents who were more involved in early childcare, regardless of whether they were mothers or fathers, showed stronger attentional bias to infant faces compared to adult faces. This evidence further underscores the need to distinguish between the effects of gender or sex and those of other sociocultural norms and roles. Overall, variables associated with cultural and gender norms should be measured and incorporated as key predictors in future research on infant cue processing and, more broadly, caregiving. This would allow for a more nuanced exploration of the complex and dynamic contributions of social gender in these domains.

An important conceptual consideration concerns whether the femininity scale of the BSRI truly captures femininity or rather reflects communality (Eagly, 1987; Helgeson, 1994). Many traits traditionally labeled as feminine also reflect characteristics of communality, including emotional expressiveness, warmth, and a caring disposition. Differently, traits associated with masculinity often align with agency, reflecting an instrumental, goal-directed orientation that includes characteristics such as assertiveness and dominance. Therefore, it is possible that enhanced processing of infant cues is not necessarily linked to adherence to feminine gender roles, which, as noted, have evolved over time, but rather to individual characteristics related to communality. Gaining a deeper and more nuanced understanding of how femininity and masculinity are defined and expressed in contemporary cultural contexts and specific settings would help advance future discussions in this field.

In conclusion, our findings shed light on factors linked to social gender (Lindqvist et al., 2021), like gender roles and norms, which appear to be associated with infant face processing at a very early stage. Our preliminary evidence suggests that relying solely on adult sex or gender as predictors may lead to incomplete conclusions in this field. Given that individuals embody both evolutionary and social influences, examining the complex interplay of biology and multiple aspects of socialization can provide a more comprehensive perspective (van Anders, 2024). Integrating diverse facets of individual identity into research not only aligns our empirical work with the current theoretical frameworks but also helps explain variance that might otherwise remain unexplained.

Limitations and Future Directions

Some limitations of the present study should be acknowledged. First, the study was exploratory and initially designed to address different research questions. Therefore, the results should be interpreted as preliminary and replicated in future studies. Additionally, we did not calculate effect sizes for our findings. In the context of mixed models, the computation and interpretation of effect size estimates is still a matter of debate. For this reason, power analyses for mixed models are often based on simulation approaches rather than on predefined effect sizes (Kumle et al., 2021). Another limitation is that, during the ERP preprocessing, we used longer epochs than those typically reported in previous research. This may have introduced additional noise into the data (Luck, 2014). Moreover, our sample was very limited in terms of ethnic diversity, highlighting the need for more diverse samples in future studies.

Methodologically, the BSRI is a relatively simple and well-known measure. Its reliability and validity have been tested over time, which gives it credibility in research contexts. However, the BSRI was developed in the 1970s in the United States, and thus reflects the prevailing conceptions of femininity and masculinity from that particular time and culture (Hoffman & Borders, 2001). In light of ongoing cultural changes, certain items may no longer have a clear or exclusive association with specific gender roles. For example, in our study, the adjective "Gentle" did not positively correlate with other adjectives of the femininity scale. This highlights the need for future research to update the BSRI in ways that better reflect current conceptions of gender norms and roles. In the same vein, a further limitation of the present study is the lack of cross-validation with more recent and psychometrically validated measures of femininity and masculinity, such as the one proposed by Kachel et al. (2016). Overall, considering the complex mosaics of gender norms and behaviors would better reflect the experiences of different identities in the current society (Crenshaw, 1989; Hyde et al., 2019), making this an important goal for the future.

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Data Availability The data that support the findings of this study are not openly available; they are available from the corresponding author upon reasonable request.

Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

Informed Consent All the participants signed the written consent before participating.

Institutional Review Board The study was approved by the ethical committee of the University of Trento (Italy) and complied with the Helsinki declaration.

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References

Abraham, E., Hendler, T., Shapira-Lichter, I., Kanat-Maymon, Y., Zagoory-Sharon, O., & Feldman, R. (2014). Father's brain is sensitive to childcare experiences. *Proceedings of the National Academy of Sciences of the United States of America, 111*(27), 9792–9797. https://doi.org/10.1073/pnas.1402569111

Arteche, A. X., Vivian, F. A., Dalpiaz, B. P. Y., & Salvador-Silva, R. (2016). Effects of sex and parental status on the assessment of infant faces. *Psychology and Neuroscience, 9*(2), 176–187. https://doi.org/10.1037/h0101552

Bates, D., Kliegl, R., Vasishth, S., & Baayen, H. (2015). *Parsimonious mixed models*. arXiv Preprint arXiv:1506.04967

Bem, S. L. (1974). The measurement of psychological androgyny. *Journal of Consulting and Clinical Psychology, 42*(2), 155–162. https://doi.org/10.1037/h0036215

Bem, S. L. (1981). Gender schema theory: A cognitive account of sex typing. *Psychological Review, 88*(4), 354–364. https://doi.org/10.1037/0033-295X.88.4.354

Bem, S. L. (1995). Dismantling gender polarization and compulsory heterosexuality: Should we turn the volume down or up? *Journal of Sex Research, 32*(4), 329–334. https://doi.org/10.1080/00224499509551806

Biernat, M., & Manis, M. (1994). Shifting standards and stereotype-based judgments. *Journal of Personality and Social Psychology, 66*(1), 5–20. https://doi.org/10.1037/0022-3514.66.1.5

Bornstein, M. H., Putnick, D. L., Rigo, P., Esposito, G., Swain, J. E., Suwalsky, J. T. D., Su, X., Du, X., Zhang, K., Cote, L. R., De Pisapia, N., & Venuti, P. (2017). Neurobiology of culturally common maternal responses to infant cry. *Proceedings of the National Academy of Sciences of the United States of America, 114*(45), E9465–E9473. https://doi.org/10.1073/pnas.1712022114

Brosch, T., Sander, D., & Scherer, K. R. (2007). That baby caught my eye... Attention capture by infant faces. *Emotion, 7*(3), 685–689. https://doi.org/10.1037/1528-3542.7.3.685

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

Carmona, S., & Vilarroya, O. (2025). The transition to parenthood: Linking hormones, brain, and behavior. *Psychoneuroendocrinology, 172*, Article 107247. https://doi.org/10.1016/j.psyneuen.2024.107247

Charles, N. E., Alexander, G. M., & Saenz, J. (2013). Motivational value and salience of images of infants. *Evolution and Human Behavior, 34*(5), 373–381. https://doi.org/10.1016/j.evolhumbehav.2013.06.005

Colasante, T., Mossad, S. I., Dudek, J., & Haley, D. W. (2017). The special status of sad infant faces: Age and valence differences in adults' cortical face processing. *Social Cognitive and Affective Neuroscience, 12*(4), 586–595. https://doi.org/10.1093/scan/nsw166

Crenshaw, K. (1989). Demarginalizing the intersection of race and sex: A Black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. *The University of Chicago Legal Forum, 1989*. https://chicagounbound.uchicago.edu/uclf/vol1989/iss1/8

Delorme, A., & Makeig, S. (2004). EEGLAB: An open source toolbox for analysis of single-trial EEG dynamics including independent component analysis. *Journal of Neuroscience Methods, 134*(1), 9–21. https://doi.org/10.1016/j.jneumeth.2003.10.009

Di Dona, G., Scaltritti, M., & Sulpizio, S. (2022). Formant-invariant voice and pitch representations are pre-attentively formed from constantly varying speech and non-speech stimuli. *European Journal of Neuroscience, 56*(3), 4086–4106. https://doi.org/10.1111/ejn.15730

Diekman, A. B., & Eagly, A. H. (2000). Stereotypes as dynamic constructs: Women and men of the past, present, and future. *Personality and Social Psychology Bulletin, 26*(10), 1171–1188. https://doi.org/10.1177/0146167200262001

Ding, F., Cheng, G., Jia, Y., Zhang, W., Lin, N., Zhang, D., & Mo, W. (2020). The role of sex and femininity in preferences for unfamiliar infants among Chinese adults. *PLoS ONE, 15*(11), e0242203. https://doi.org/10.1371/journal.pone.0242203

Doi, H., & Shinohara, K. (2012). Event-related potentials elicited in mothers by their own and unfamiliar infants' faces with crying and smiling expression. *Neuropsychologia, 50*(7), 1297–1307. https://doi.org/10.1016/j.neuropsychologia.2012.02.013

Donnelly, K., & Twenge, J. M. (2017). Masculine and feminine traits on the Bem Sex-Role Inventory, 1993–2012: A cross-temporal meta-analysis. *Sex Roles, 76*(9–10), 556–565. https://doi.org/10.1007/s11199-016-0625-y

Eagly, A. H. (1987). *Sex differences in social behavior: A social-role interpretation*. Lawrence Erlbaum Associates Inc.

Eimer, M., & Holmes, A. (2007). Event-related brain potential correlates of emotional face processing. *Neuropsychologia, 45*(1), 15–31. https://doi.org/10.1016/j.neuropsychologia.2006.04.022

Endendijk, J. J., Derks, B., & Mesman, J. (2018b). Does parenthood change implicit gender-role stereotypes and behaviors? *Journal of Marriage and Family, 80*(1), 61–79. https://doi.org/10.1111/jomf.12451

Endendijk, J. J., Groeneveld, M. G., van der Pol, L. D., van Berkel, S. R., Hallers-Haalboom, E. T., Bakermans-Kranenburg, M. J., & Mesman, J. (2017). Gender differences in child aggression: Relations with gender-differentiated parenting and parents' gender-role stereotypes. *Child Development, 88*(1), 299–316. https://doi.org/10.1111/cdev.12589

Endendijk, J. J., Spencer, H., van Baar, A. L., & Bos, P. A. (2018a). Mothers' neural responses to infant faces are associated with activation of the maternal care system and observed intrusiveness with their own child. *Cognitive, Affective and Behavioral Neuroscience, 18*(4), 609–621. https://doi.org/10.3758/s13415-018-0592-6

Farr, R. H., & Patterson, C. J. (2013). Coparenting among lesbian, gay, and heterosexual couples: Associations with adopted children's outcomes. *Child Development, 84*(4), 1226–1240. https://doi.org/10.1111/cdev.12046

Gemignani, M., & de Falco, S. (2024). EEG responses to infant faces in young adults can be influenced by the quality of early care experiences with caregivers. *Child Abuse and Neglect, 154*, Article 106874. https://doi.org/10.1016/j.chiabu.2024.106874

Gemignani, M., Giannotti, M., & de Falco, S. (2024a). The perceived quality of maternal care during childhood shapes attentional bias to infant faces in parents and nonparents. *Journal of Family Psychology, 38*(5), 797–807. https://doi.org/10.1037/fam0001198

Gemignani, M., Giannotti, M., Rigo, P., Venuti, P., & de Falco, S. (2024b). Neither parents' sex nor the type of family modulates attentional bias toward infant faces: A preliminary study in different-sex and same-sex parents. *Archives of Sexual Behavior, 53*(6), 2053–2061. https://doi.org/10.1007/s10508-024-02875-9

Gemignani, M., Giannotti, M., Schmalz, X., Rigo, P., & De Falco, S. (2022). Attentional prioritization of infant faces in parents: The influence of parents' experiences of care. *International Journal of Environmental Research and Public Health, 20*(1), 527. https://doi.org/10.3390/ijerph20010527

Gettler, L. T., McDade, T. W., Agustin, S. S., & Kuzawa, C. W. (2011). Short-term changes in fathers' hormones during father-child play: Impacts of paternal attitudes and experience. *Hormones and Behavior, 60*(5), 599–606. https://doi.org/10.1016/j.yhbeh.2011.08.009

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

Grattan, D. (2011). A mother's brain knows. *Journal of Neuroendocrinology, 23*(11), 1188–1189. https://doi.org/10.1111/j.1365-2826.2011.02175.x

Guida, E., Addabbo, M., & Turati, C. (2025). Baby don't cry: Unconscious sensitivity to sad baby faces. *Biological Psychology, 195*, 109005. https://doi.org/10.1016/j.biopsycho.2025.109005

Hahn, A. C., Symons, L. A., Kredel, T., Hanson, K., Hodgson, L., Schiavone, L., & Jantzen, K. J. (2016). Early and late event-related potentials are modulated by infant and adult faces of high and low attractiveness. *Social Neuroscience, 11*(2), 207–220. https://doi.org/10.1080/17470919.2015.1059361

Hahn, A. C., Xiao, D., Sprengelmeyer, R., & Perrett, D. I. (2013). Gender differences in the incentive salience of adult and infant faces. *Quarterly Journal of Experimental Psychology, 66*(1), 200–208. https://doi.org/10.1080/17470218.2012.705860

Hajcak, G., & Foti, D. (2020). Significance?... Significance! Empirical, methodological, and theoretical connections between the late positive potential and P300 as neural responses to stimulus significance: An integrative review. *Psychophysiology, 57*(7). https://doi.org/10.1111/psyp.13570

Helgeson, V. S. (1994). Relation of agency and communion to wellbeing: Evidence and potential explanations. *Psychological Bulletin, 116*, 412–428. https://doi.org/10.1037/0033-2909.116.3.412

Hoffman, R. M., & Borders, L. D. (2001). Twenty-five years after the Bem Sex-Role Inventory: A reassessment and new issues regarding classification variability. *Measurement and Evaluation in Counseling and Development, 34*, 39–55. https://doi.org/10.1080/07481756.2001.12069021

Hyde, J. S., Bigler, R. S., Joel, D., Tate, C. C., & van Anders, S. M. (2019). The future of sex and gender in psychology: Five challenges to the gender binary. *American Psychologist, 74*(2), 171–193. https://doi.org/10.1037/amp0000307

Jia, Y. C., Ding, F. Y., Cheng, G., Chen, J., Zhang, W., Lin, N., & Zhang, D. J. (2021). Adults' responses to infant faces: Neutral infant facial expressions elicit the strongest baby schema effect. *Quarterly Journal of Experimental Psychology, 74*(5), 853–871. https://doi.org/10.1177/1747021820981862

Jia, Y. C., Ding, F. Y., Cheng, G., Liu, Y., Yu, W., Zou, Y., & Zhang, D. J. (2022). Infants' neutral facial expressions elicit the strongest initial attentional bias in adults: Behavioral and electrophysiological evidence. *Psychophysiology, 59*(1), e13944. https://doi.org/10.1111/psyp.13944

Kachel, S., Steffens, M. C., & Niedlich, C. (2016). Traditional masculinity and femininity: Validation of a new scale assessing gender roles. *Frontiers in Psychology, 7*, 956. https://doi.org/10.3389/fpsyg.2016.00956

Kumle, L., Võ, M. L., & Draschkow, D. (2021). Estimating power in (generalized) linear mixed models: An open introduction and tutorial in R. *Behavior Research Methods, 53*(6), 2528–2543. https://doi.org/10.3758/s13428-021-01546-0

Kuzava, S., Frost, A., Perrone, L., Kang, E., Lindhiem, O., & Bernard, K. (2020). Adult processing of child emotional expressions: A meta-analysis of ERP studies. *Developmental Psychology, 56*(6), 1170–1190. https://doi.org/10.1037/dev0000928

Lehmann, V., Huis in't Veld, E. M., & Vingerhoets, A. J. (2013). The human and animal baby schema effect: Correlates of individual differences. *Behavioural Processes, 94*, 99–108. https://doi.org/10.1016/j.beproc.2013.01.001

Levine, A., Zagoory-Sharon, O., Feldman, R., & Weller, A. (2007). Oxytocin during pregnancy and early postpartum: Individual patterns and maternal-fetal attachment. *Peptides, 28*(6), 1162–1169. https://doi.org/10.1016/j.peptides.2007.04.016

Lindqvist, A., Sendén, M. G., & Renström, E. A. (2021). What is gender, anyway: A review of the options for operationalising gender. *Psychology and Sexuality, 12*(4), 332–344. https://doi.org/10.1080/19419899.2020.1729844

Lobmaier, J. S., Probst, F., Perrett, D. I., & Heinrichs, M. (2015). Menstrual cycle phase affects discrimination of infant cuteness. *Hormones and Behavior, 70*, 1–6. https://doi.org/10.1016/j.yhbeh.2015.02.001

Lobmaier, J. S., Sprengelmeyer, R., Wiffen, B., & Perrett, D. I. (2010). Female and male responses to cuteness, age and emotion in infant faces. *Evolution and Human Behavior, 31*(1), 16–21. https://doi.org/10.1016/j.evolhumbehav.2009.05.004

Lopez-Calderon, J., & Luck, S. J. (2014). ERPLAB: An open-source toolbox for the analysis of event-related potentials. *Frontiers in Human Neuroscience, 8*, Article 213. https://doi.org/10.3389/fnhum.2014.00213

Lorenz, K. (1943). Die angeborenen Formen möglicher Erfahrung. *Zeitschrift Für Tierpsychologie, 5*(2), 235–409.

Lorenz, K. (1971). *Studies in animal and human behavior* (Vol. 2). Methuen.

Lowell, A. F., Dell, J., Potenza, M. N., Strathearn, L., Mayes, L. C., & Rutherford, H. J. (2023). Adult attachment is related to maternal neural response to infant cues: An ERP study. *Attachment & Human Development, 25*(1), 71–88. https://doi.org/10.1080/14616734.2021.1880057

Luck, S. J. (2014). *An introduction to the event-related potential technique*. MIT Press.

Lundqvist, D., Flykt, A., & Öhman, A. (1998). *The Karolinska Directed Emotional Faces - KDEF* [CD-ROM]. Department of Clinical Neuroscience, Psychology Section, Karolinska Institutet.

Luo, L., Ma, X., Zheng, X., Zhao, W., Xu, L., Becker, B., & Kendrick, K. M. (2015). Neural systems and hormones mediating attraction to infant and child faces. *Frontiers in Psychology, 6*, Article 970. https://doi.org/10.3389/fpsyg.2015.00970

Lytton, H., & Romney, D. M. (1991). Parents' differential socialization of boys and girls: A meta-analysis. *Psychological Bulletin, 109*(2), 267–296. https://doi.org/10.1037/0033-2909.109.2.267

Maack, J. K., Bohne, A., Nordahl, D., Livsdatter, L., Lindahl, Å. A., Øvervoll, M., Wang, C. E., & Pfuhl, G. (2017). The Tromso Infant Faces Database (TIF): Development, validation and application to assess parenting experience on clarity and intensity ratings. *Frontiers in Psychology, 8*, Article 409. https://doi.org/10.3389/fpsyg.2017.00409

Maestripieri, D., & Pelka, S. (2002). Sex differences in interest in infants across the lifespan: A biological adaptation for parenting? *Human Nature, 13*(3), 327–344. https://doi.org/10.1007/s12110-002-1018-1

Mathôt, S., Schreij, D., & Theeuwes, J. (2012). OpenSesame: An open-source, graphical experiment builder for the social sciences. *Behavior Research Methods, 44*(2), 314–324. https://doi.org/10.3758/s13428-011-0168-7

Morgenroth, T., & Ryan, M. K. (2018). Gender trouble in social psychology: How can Butler's work inform experimental social psychologists' conceptualization of gender? *Frontiers in Psychology, 9*, 1320. https://doi.org/10.3389/fpsyg.2018.01320

Oliveira, V., Goulart, M., Nobre, J. C., Lucion, M. K., Silveira, P. P., & Bizarro, L. (2017). Emotional interference of baby and adult faces on automatic attention in parenthood. *Psychology and Neuroscience, 10*(2), 144–153. https://doi.org/10.1037/pne0000085

Parsons, C. E., Young, K. S., Jegindoe Elmholdt, E. M., Stein, A., & Kringelbach, M. L. (2017). Interpreting infant emotional expressions: Parenthood has differential effects on men and women. *Quarterly Journal of Experimental Psychology, 70*(3), 554–564. https://doi.org/10.1080/17470218.2016.1141967

Parsons, C. E., Young, K. S., Kumari, N., Stein, A., & Kringelbach, M. L. (2011). The motivational salience of infant faces is similar for men and women. *PLoS ONE, 6*(5), e20632. https://doi.org/10.1371/journal.pone.0020632

Patterson, C. J., Sutfin, E. L., & Fulcher, M. (2004). Division of labor among lesbian and heterosexual parenting couples: Correlates of specialized versus shared patterns. *Journal of Adult Development, 11*(3), 179–189. https://doi.org/10.1023/B:JADE.0000035626.90331.47

Peltola, M. J., Strathearn, L., & Puura, K. (2018). Oxytocin promotes face-sensitive neural responses to infant and adult faces in mothers. *Psychoneuroendocrinology, 91*, 261–270. https://doi.org/10.1016/j.psyneuen.2018.02.012

Peltola, M. J., Yrttiaho, S., Puura, K., Proverbio, A. M., Mononen, N., Lehtimäki, T., & Leppänen, J. M. (2014). Motherhood and oxytocin receptor genetic variation are associated with selective changes in electrocortical responses to infant facial expressions. *Emotion, 14*(3), 469–477. https://doi.org/10.1037/a0035959

Peoples, S. G., Lowell, A. F., Bunderson, M., Bartz, C., Yip, S. W., & Rutherford, H. J. V. (2022). The effects of prenatal stress on neural responses to infant cries in expectant mothers and fathers. *Developmental Psychobiology, 64*(5), e22280. https://doi.org/10.1002/dev.22280

Pion-Tonachini, L., Kreutz-Delgado, K., & Makeig, S. (2019). ICLabel: An automated electroencephalographic independent component classifier, dataset, and website. *NeuroImage, 198*, 181–197. https://doi.org/10.1016/j.neuroimage.2019.05.026

Porcaro, C., Coppola, G., Pierelli, F., Seri, S., Di Lorenzo, G., Tomasevic, L., Salustri, C., & Tecchio, F. (2013). Multiple frequency functional connectivity in the hand somatosensory network: An EEG study. *Clinical Neurophysiology, 124*(6), 1216–1224. https://doi.org/10.1016/j.clinph.2012.12.004

Proverbio, A. M., Brignone, V., Matarazzo, S., Del Zotto, M., & Zani, A. (2006). Gender and parental status affect the visual cortical response to infant facial expression. *Neuropsychologia, 44*(14), 2987–2999. https://doi.org/10.1016/j.neuropsychologia.2006.06.015

Rilling, J. K. (2013). The neural and hormonal bases of human parental care. *Neuropsychologia, 51*(4), 731–747. https://doi.org/10.1016/j.neuropsychologia.2012.12.017

Rossion, B., & Jacques, C. (2008). Does physical interstimulus variance account for early electrophysiological face sensitive responses in the human brain? Ten lessons on the N170. *NeuroImage, 39*(4), 1959–1979. https://doi.org/10.1016/j.neuroimage.2007.10.011

Rutherford, H. J. V., Bunderson, M., Bartz, C., Haitsuka, H., Meins, E., Groh, A. M., & Milligan, K. (2021). Imagining the baby: Neural reactivity to infant distress and mind-mindedness in expectant parents. *Biological Psychology, 161*, 108057. https://doi.org/10.1016/j.biopsycho.2021.108057

Rutherford, H. J. V., Maupin, A. N., Landi, N., Potenza, M. N., & Mayes, L. C. (2017). Parental reflective functioning and the neural correlates of processing infant affective cues. *Social Neuroscience, 12*(5), 519–529. https://doi.org/10.1080/17470919.2016.1193559

Salvati, M., Ioverno, S., Giacomantonio, M., & Baiocco, R. (2016). Attitude toward gay men in an Italian sample: Masculinity and sexual orientation make a difference. *Sexuality Research and Social Policy, 13*, 109–118. https://doi.org/10.1007/s13178-016-0218-0

Schiano Lomoriello, A., Sessa, P., Doro, M., & Konvalinka, I. (2022). Shared attention amplifies the neural processing of emotional faces. *Journal of Cognitive Neuroscience, 34*(6), 917–932. https://doi.org/10.1162/jocn_a_01841

Sprengelmeyer, R., Perrett, D. I., Fagan, E. C., Cornwell, R. E., Lobmaier, J. S., Sprengelmeyer, A., et al. (2009). The cutest little baby face: A hormonal link to sensitivity to cuteness in infant faces. *Psychological Science, 20*(2), 149–154. https://doi.org/10.1111/j.1467-9280.2009.02272.x

Sprengelmeyer, R., Perrett, D., & Young, A. (2010). Reproductive hormones modulate cuteness processing. *Psychological Science, 21*(5), 750–752. https://doi.org/10.1177/0956797610368065

Swazina, K. R., Waldherr, K., & Maier, K. (2004). Geschlechtsspezifische Ideale im Wandel der Zeit [Prescriptive gender stereotypes through the ages]. *Zeitschrift für Differentielle und Diagnostische Psychologie, 25*(3), 165–176. https://doi.org/10.1024/0170-1789.25.3.165

van Anders, S. M. (2013). Beyond masculinity: Testosterone, gender/sex, and human social behavior in a comparative context. *Frontiers in Neuroendocrinology, 34*(3), 198–210. https://doi.org/10.1016/j.yfrne.2013.07.001

van Anders, S. M. (2015). Beyond sexual orientation: Integrating gender/sex and diverse sexualities via sexual configurations theory. *Archives of Sexual Behavior, 44*(5), 1177–1213. https://doi.org/10.1007/s10508-015-0490-8

van Anders, S. M. (2024). Gender/sex/ual diversity and biobehavioral research. *Psychology of Sexual Orientation and Gender Diversity, 11*(3), 471–487. https://doi.org/10.1037/sgd0000609

van Anders, S. M., Steiger, J., & Goldey, K. L. (2015). Effects of gendered behavior on testosterone in women and men. *Proceedings of the National Academy of Sciences of the United States of America, 112*(45), 13805–13810. https://doi.org/10.1073/pnas.1509591112

Vandello, J. A., Hettinger, V. E., Bosson, J. K., & Siddiqi, J. (2013). When equal isn't really equal: The masculine dilemma of seeking work flexibility. *Journal of Social Issues, 69*(2), 303–321. https://doi.org/10.1111/josi.12016

Vuoriainen, E., Bakermans-Kranenburg, M. J., Huffmeijer, R., van IJzendoorn, M. H., & Peltola, M. J. (2022). Processing children's faces in the parental brain: A meta-analysis of ERP studies. *Neuroscience and Biobehavioral Reviews, 136*, 104604. https://doi.org/10.1016/j.neubiorev.2022.104604

Weisman, O., Feldman, R., & Goldstein, A. (2012). Parental and romantic attachment shape brain processing of infant cues. *Biological Psychology, 89*(3), 533–538. https://doi.org/10.1016/j.biopsycho.2011.11.008

Yamamoto, R., Ariely, D., Chi, W., Langleben, D. D., & Elman, I. (2009). Gender differences in the motivational processing of babies are determined by their facial attractiveness. *PLoS ONE, 4*(6), e6042. https://doi.org/10.1371/journal.pone.0006042

Young, K. S., Parsons, C. E., Stein, A., Vuust, P., Craske, M. G., & Kringelbach, M. L. (2017). The neural basis of responsive caregiving behaviour: Investigating temporal dynamics within the parental brain. *Behavioural Brain Research, 325*(Pt B), 105–116. https://doi.org/10.1016/j.bbr.2016.09.012

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