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Perceptions of inferred parental ability through sexually dimorphic facial features

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Abstract

In addition to providing robust cues diagnostic of prospective mates' heritable fitness, various physical features could be similarly utilized in inferring individuals' parental abilities. This study sought to explore how variations in sexually dimorphic facial features inform perceptions of social targets as motivated to provide parental care. American undergraduates ($N = 244$) viewed a series of 12 total male and female faces manipulated at varying degrees of sex-typicality (i.e., masculinized versus feminized versus unaltered controls) on a within-subjects basis, and rated the perceived motivation of each target to nurture and protect a child using items derived from the Parental Care and Tenderness Scale. Female targets were perceived as more motivated by parental care than male targets, $F(1, 240) = 14.86, p < .001, \eta_p^2 = 0.058$, whereas male targets were perceived as specifically motivated to protect offspring, $F(1, 240) = 177.32, p < .001, \eta_p^2 = 0.425$. Feminized targets were additionally perceived as more motivated by nurturance, though such inferences were apparent for both male and female targets, F

Statement of Relevance: This study investigated different perceived parental motivations based on facial features, and found women were perceived as generally more motivated by parental care, men were perceived to be motivated to protect children, and all feminine faces were perceived as more motivated to nurture children. These findings provide a novel contribution to literature regarding social perception and parental care systems, as well as grounds for a more nuanced insight into potential biases held toward individual parents.

$(1, 240) = 7.36$, $p < .001$, $\eta_p^2 = 0.058$. Findings represent an understanding of perceivers use of functional heuristics of sexual dimorphism in identifying optimal parents.

KEYWORDS

interpersonal perceptions, mate preferences, stereotypes

The identification of a mate capable of fulfilling one's reproductive goals is crucial in ensuring offspring survive into adulthood. This adaptive problem necessitated the evolution of a perceptual system to detect cues diagnostic of another's ability to improve reproductive outcomes. Although one's behavioral repertoire provides a reliable basis for identifying these abilities (e.g., Brown & Sacco, 2019), physical cues could afford the perceiver a more efficient opportunity to generate a preliminary representation of another's reproductive intentions, broadly construed (Sng et al., 2020). The basis for many of these perceptions is through recognizing various facial and bodily cues diagnostic of a prospective mate's heritable fitness, which would satisfy short-term mating goals that prioritize healthy mates capable of producing offspring better able to survive into adulthood (e.g., Brown & Sacco, 2018; Frederick & Haselton, 2007; Li et al., 2013). Beyond heritable fitness, these features may provide additional information about concomitant behavioral repertoires typical of people exhibiting these cues that connote men and women's abilities to facilitate long-term mating goals through extensive parental investment (Brown, Boykin, & Sacco, 2022).

Within this information about a prospective mate's long-term value is likely information regarding an individual's motivation for parental care in specific domains. A growing area of research has begun to investigate how bodily features appear diagnostic of specific parental abilities, partially rooted in an understanding of the hormonal underpinnings of various body types. For example, when considering testosteronization (or lack thereof), higher levels of body fat appear indicative of men's interest in fostering care for children (Khaw & Barrett-Connor, 1992; Sacco et al., 2020), whereas upper body strength provides a basis for perceptions of men's capabilities to protect their offspring (Brown, Donahoe, & Boykin, 2022). These inferences may translate to facial features associated with similar hormonal underpinnings from which one could identify a social target's motivation to provide care to offspring, namely through sexually dimorphic features (e.g., estrogen's association with maternal interest; Smith et al., 2012) in addition to potential disinterest in other components of parenting (e.g., masculinity's perceived association with hostility; Borras-Guevara et al., 2017). The current study sought to identify the signal value of sexually dimorphic facial structures in shaping inferences of men and women's specific parental motivations.

1 | SOCIAL VALUE OF SEXUALLY DIMORPHIC FEATURES

The primacy of face-to-face communication throughout evolutionary history could have positioned facial features to provide more immediate social information in complement to bodily features about a target's parental motivations. Given both the relatively immediate perceptual salience and the historic difficulty in the alteration of facial features compared to other bodily features (e.g., body fat), it could be possible that facial structures typically regarded as sexually dimorphic are especially informative for assessments of parental motivation. Facial features are informative of a social target's bodily composition and could provide reliable information for heuristic judgments of a prospective parent's social value (e.g., Holzleitner & Perrett, 2016).

Sexual dimorphism (i.e., femininity versus masculinity) is one feature that informs social affordance judgments. Facial femininity is indicative of developmentally appropriate levels of reproductive hormones in women (Jones et al., 2015; Law Smith et al., 2006; Marcinkowska et al., 2021). This potential cue to fertility heightens men's interest in feminized faces in the service of identifying optimal reproductive opportunities (Marcinkowska et al., 2014, 2017). In addition to the connotation of heritable fitness, highly feminized women are perceived as highly motivated to provide optimal parental care (Moore et al., 2011). This inference appears to have a kernel of truth, as women with feminized features exhibit greater interpersonal warmth and maternal interest (Little et al., 2014; Smith et al., 2012). Conversely, facial masculinization connotes developmentally appropriate levels of testosterone in men that would have also afforded advantages in physical conflict through increased upper body strength (Puts, 2010; Whitehouse et al., 2015). Recent research suggests various components of masculinized facial features are a veridical cue to men's actual physical prowess and sexually selected for the competitive advantage they connote for male combatants (Caton et al., 2022; Caton & Dixson, 2022). Women's interest in short-term mating strategies further heightens their interest in masculinized male faces in the service of identifying optimal reproductive opportunities (Sacco et al., 2012). This corresponds with the physical advantage men with heightened androgenic features (i.e., muscularity) experience in conflict (Gallup et al., 2007; Price et al., 2017).

When considering a more expansive view of physical features' connotations of relationship affordances, differences in sex-typical hormones could have fostered different behavioral repertoires in men and women and thus expectations of sex-specific parental roles. Women also prioritize men's ability to protect their offspring when identifying long-term mates (Kokko et al., 2003). Although such aggression would be beneficial in preventing harm to men's offspring, masculinized features are dually implicated as costly in long-term relationships, ostensibly due to the potential threat of aggression toward offspring that becomes especially salient through masculine features (Brown, Tracy, & Boykin, 2022; Frederick & Haselton, 2007; Geniole & McCormick, 2013; Sacco et al., 2020). Within harsher environments, women are averse to interpersonally dominant men given the increased hostility in such environments (Allen et al., 2016). These context-dependent judgments of masculinity are further evidenced cross-culturally, particularly in environments when the benefits of heritable fitness could outweigh the costs of competition (e.g., Marcinkowska et al., 2019; Scott et al., 2014). Highly masculinized men could therefore be implicated as disinterested or costly in several parenting roles.

2 | PARENTING MOTIVES

Given human infants are highly underdeveloped at birth, extensive parental investment is required to facilitate their survival. This adaptive challenge could have led to the evolution of parental care systems that would motivate such investment (Schaller, 2020). Indeed, adults exhibit considerable sensitivity toward neotenous features and infants (e.g., Kringelbach et al., 2016; Woo & Schaller, 2020), with activation of parental motives additionally heightening monogamous intent (Beall & Schaller, 2019). This motivational system appears comprised of motivations to protect and nurture offspring, wherein individuals exhibit varying levels of motivation to provide both dimensions of care (Buckels et al., 2015; Hofer et al., 2018). Evidence for these systems has emerged, for example, through work demonstrating that the visual appearance of babies fosters feelings of warmth (Glocker et al., 2009) and greater vigilance toward potential threats (Hahn-Holbrook et al., 2011).

Given the perceptual acuity toward preferred reproductive strategies in social targets through physical features (e.g., Brown 2022), selection could have favored similar acuity toward features connoting men and women's capabilities to provide nurturance and protection. For example, women with large breasts are perceived as particularly effective at nurturance, namely through breastfeeding (Dixson et al., 2015). Similarly, high levels of body fat further implicate both male and female targets as especially adept at caring for offspring, ostensibly due to greater access to resources available to invest in offspring (Sacco et al., 2020). In men, facial hair, a highly masculine trait, seems to connote the ability to provide offspring with extensive care (Dixson et al., 2019). Though facial hair is not consistently found to be rated as more attractive within extant literature, attractiveness ratings have been found to increase among women when considering parental abilities (see Clarkson et al., 2020; Gray et al., 2020). This perhaps offers further evidence of such masculine traits connoting positive parental abilities and thus desirability as a mate (Stower et al., 2020).

3 | CURRENT RESEARCH

This study sought to clarify competing predictions for how various facial features might connote parental motivations. We considered male and female faces that were orthogonally manipulated to connote masculinity or femininity while assessing the extent to which they were perceived as motivated to provide nurturance or protection for their offspring. Our first prediction was that feminized female and male targets would be perceived as more motivated in nurturing offspring due to the association between estrogen, phenotypically displayed through femininized features, and interpersonal or maternal warmth (Law Smith et al., 2006; Smith et al., 2012). However, given that selection favored parental investment more heavily for women compared to men, perceptions of a female target's willingness to invest in offspring would likely be more salient for perceivers. (Puts, 2010; Trivers, 1972). Thus, we predicted this effect would be especially pronounced for feminized female faces in comparison to male faces.

Conversely, we predicted masculinized male faces would be perceived as more motivated to protect offspring in comparison to other male faces. Given testosterone's association with physical advantage in conflict, traits indicative of higher levels of testosterone (e.g., masculinized facial features; Frederick & Haselton, 2007) should facilitate this inferred motivation. However, we did not predict for this to be the case among masculinized female targets. Given the different selection pressures related to physical conflict, where women would have historically been less likely to engage in such conflict the signal value of masculinization would largely be rendered irrelevant for women (Griskevicius et al., 2009; Palmer-Hague et al., 2018). Lastly, we expected opposite-sex valuations of targets to be more pronounced compared to same-sex valuations as they would be considered more critical for reproductive success. This study was approved by the Institutional Review Board. Data and materials are available at https://osf.io/6a59u/?view_only=38f2b6d2d6c54b2e9e3c35c17c1eddb4

4 | METHOD

4.1 | Participants

A sample of 244 undergraduates from a public university in Southeastern United States were recruited online in exchange for partial course credit during Fall 2020. No data were excluded

from final analyses (152 women, 90 men; $M_{Age} = 20.57$, SD = 5.72; 66.4% White, 27.4% Black, 2% Asian, 1.2% Hispanic; 84.4% Heterosexual, 10.7% Bisexual, 3.3% Homosexual, 0.8% identifying as Other; see Tables 1 and 2 for full demographic information). A sensitivity analysis indicated we were sufficiently powered to detect small effects with our experimental design (Cohen's $f = 0.05$, 1-β = 0.80).

4.2 | Materials and procedures

Participants viewed a series of female and male faces that varied in their communication of sexual dimorphism. Within this array of stimuli, they viewed various versions of each facial target, including the original face, and two additional versions of each identity digitally manipulated to appear either more masculine or feminine. The masculinized and feminized version of each face was created through a transformation procedure that uses the linear difference between feature points of a series of composite male and female faces to either appear more masculine or feminine (Little et al., 2014). This resulted in 12 unique stimuli (i.e., six female, six male). Participants viewed and rated each of the 12 faces on their perceived motivation to nurture and

TABLE 1 Participant gender, race, and sexuality

	n	%
Gender		
Female	152	62.3
Male	90	36.9
Missing	2	0.8
Race		
African American	67	27.5
Asian/Asian American	5	2.0
Caucasian	162	66.5
Hispanic/Latin	3	1.2
Other	4	1.6
Missing	3	1.2
Sexuality		
Heterosexual	206	84.4
Homosexual	8	3.3
Bisexual	26	10.7
Other	2	0.8
Missing	2	0.8

TABLE 2 Participant age

	M (SD)	Range
Age	20.57 (5.72)	36

protect offspring. All targets were presented in a randomized and counterbalanced order. Figure 1 provides examples of each face category used.

4.2.1 | Parental perceptions

Participant assessed the perceived parental motivations of each target along dimensions of tenderness (e.g., "A newborn baby would curl its hand around this person's finger"), caring (e.g., "Babies melt this person's heart"), and protection (e.g., "This person would hurt anyone who was a threat to a child"). We employed items derived from the Parental Care and Tenderness Scale, with five items included for each dimension, resulting in a total of 15 items per target (PCAT; Buckels et al., 2015). Participants indicated their agreement with each item using 7-point Likert-type scales (1 = *Strongly Disagree*, 7 = *Strongly Agree*). Items for protection were averaged into a single variable for each target. Given the significant conceptual overlap, subscales for tenderness and caring were averaged into a single nurturance variable for each target (Hofer et al., 2018). Tables 3 and 4 provide relevant descriptive statistics for protection and nurturance respectively.
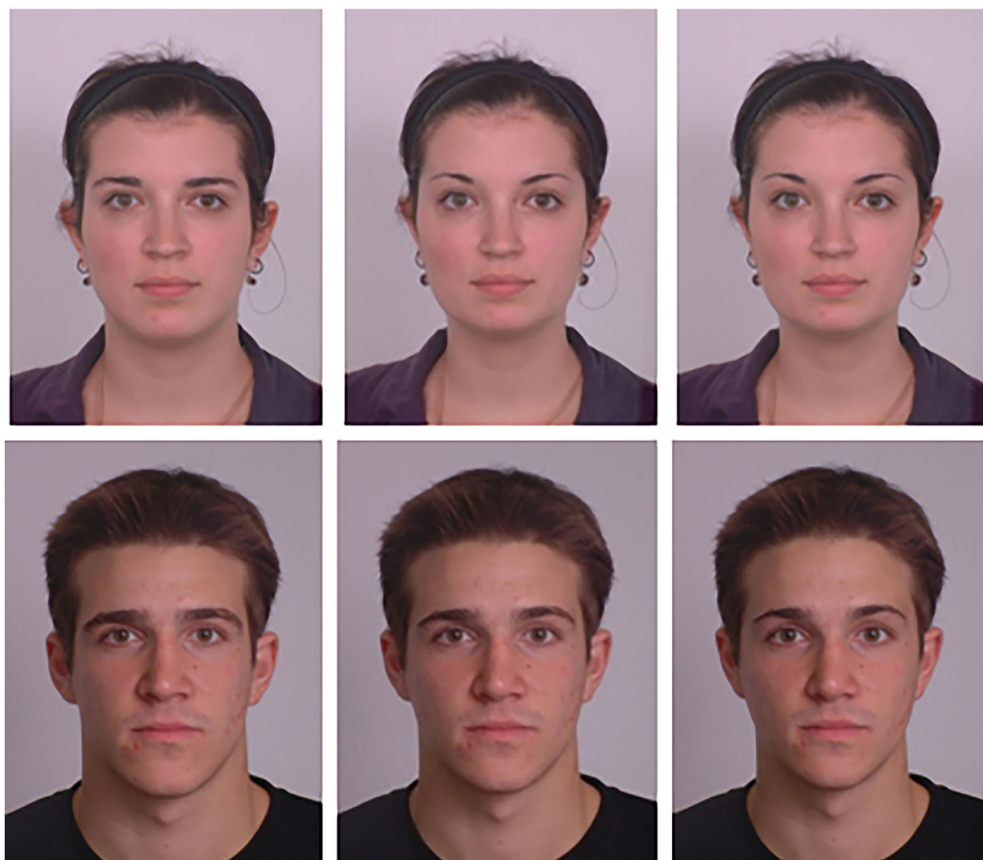

FIGURE 1 Example female (top row) and male targets with masculinized (left column), original (center column), and feminized morphs (right column)

TABLE 3 Descriptive statistics for nurturance variables among female and male targets whose faces were unaltered (original), feminized, or masculinized

	α	M_{Grand} (SD)
Original female target	0.90	4.89 (0.81)
Feminized female target	0.88	4.91 (0.79)
Masculinized female target	0.92	4.80 (0.90)
Original male target	0.82	3.99 (0.87)
Feminized male target	0.83	4.07 (0.85)
Masculinized male target	0.83	4.00 (0.92)

TABLE 4 Descriptive statistics for protection variables among female and male targets whose faces were unaltered (original), feminized, or masculinized

	α	M_{Grand} (SD)
Original female target	0.89	4.83 (0.92)
Feminized female target	0.90	4.80 (0.93)
Masculinized female target	0.90	4.77 (0.96)
Original male target	0.92	4.71 (0.95)
Feminized male target	0.90	4.70 (0.93)
Masculinized male target	0.93	4.71 (0.99)

5 | RESULTS

For primary analyses, we conducted a 2 (Participant Sex: Male vs. Female) × 2 (Target Sex: Female vs. Male) × 3 (Target Dimorphism: Original vs. Femininized vs. Masculinized) × 2 (Parenting Motive: Nurturance vs. Protection) mixed-model ANOVA with repeated factors over the latter three factors. Our decision to include Participant Sex in this model was predicated upon an interest in identifying potential same-and cross-sex perceptions. Additionally, the added complexity of this model through four factors led us to report interactive effects exclusively to reduce the likelihood of reporting Type I Errors rooted in ambiguous main effects. Three superordinate 2-way interactions emerged in this analysis.

5.1 | Same-sex and cross-sex perceptions

Effects were first qualified by a Participant Sex × Target sex interaction, $F(1, 240) = 8.40$, $p = .004$, $\eta_p^2 = 0.034$. Simple effects indicated male participants perceived female targets ($M = 4.77$, SE = 0.08) as more effective parents than male targets ($M = 4.47$, SE = 0.08), indexed by both nurturing and protection motivations, $F(1, 240) = 14.86$, $p < .001$, $\eta_p^2 = 0.058$. Female participants similarly found female targets ($M = 4.87$, SE = 0.06) to be more effective parents compared to male targets, though at a larger magnitude ($M = 4.29$, SE = 0.06), $F(1, 240) = 95.31$, $p < .001$, $\eta_p^2 = 0.284$. No other significant interactions emerged, Fs <3.46, ps >.064.

5.2 | Sex differences in perceptions of parenting motives

A Target Sex $\times$ Parenting Motive interaction also emerged, $F(1, 240) = 212.15$, $p < .001$, $\eta_p^2 = 0.469$. Simple effects indicated that female targets were perceived as more motivated in nurturance ($M = 4.85$, SE $= 0.05$) than male targets ($M = 4.02$, SE $= 0.05$), $F(1, 240) = 178.80$, $p < .001$, $\eta_p^2 = 0.427$. No differences emerged in motivations for protection in female ($M = 4.79$, SE $= 0.06$) and male targets ($M = 4.74$, SE $= 0.06$), $F(1, 240) = 1.46$, $p = .229$, $\eta_p^2 = 0.006$. However, male targets were perceived to be more highly motivated by protection ($M = 4.74$, SE $= 0.06$) in comparison to nurturance ($M = 4.02$, SE $= 0.05$), $F(1, 240) = 177.32$, $p < .001$, $\eta_p^2 = 0.425$. No other significant effects emerged, $Fs < 2.00$, $ps > .229$.

5.3 | Interactive effects of dimorphism and parenting motives

Finally, effects were qualified by a Target Dimorphism $\times$ Parenting Motive interaction, $F(1, 240) = 10.04$, $p < .001$, $\eta_p^2 = 0.040$. Simple effects indicated no difference in perceptions of protection, $F(1, 240) = 1.44$, $p = .239$, $\eta_p^2 = 0.012$; however, an effect emerged for perceptions of nurturance, $F(1, 240) = 7.36$, $p < .001$, $\eta_p^2 = 0.058$. LSD tests indicated that feminized faces were perceived as better at providing nurturance ($M = 4.49$, SE $= 0.04$), followed by original faces ($M = 4.43$, SE $= 0.05$), then masculinized ($M = 4.37$, SE $= 0.05$). All perceptions were significantly different from each other ($ps < .034$, $ds > 0.27$), and all faces were perceived as more motivated by nurturance as opposed to protection ($ps < .001$, $ds > 0.42$). No other superordinate interactions occurred, $Fs < 2.03$, $ps > .133$.

6 | DISCUSSION

The current results were able to offer support for several of our hypotheses. First, we found participants found female targets to be more effective parents than male targets. This perceived advantage appears rooted in an understanding of the historically larger minimal investment from women into their offspring compared to men (Trivers, 1972), wherein this investment asymmetry would inform perceptions of women being more involved in parental roles. In the subsuming interaction, and in support of our hypotheses, we further found female targets were perceived as more motivated to nurture offspring compared to male targets. Importantly, this perception of motivations for nurturance was moderated by target dimorphism such that this effect was particularly strong for feminized female faces and weakest for masculinized faces. This finding offers further evidence that feminine facial features serve as a cue to heightened motivation for nurturing offspring (Smith et al., 2012; Moore et al., 2011).

Additionally, men were perceived as more motivated to protect than to nurture offspring. This finding aligns with the physical size and strength asymmetries between men and women that would facilitate men's greater advantage in physical conflicts and therefore greater ability to provide protection (Brown, Sacco, et al., 2022; Gallup et al., 2007; Puts, 2010; Sell et al., 2012). This physical size asymmetry has been argued to inform women's interest in selecting a mate capable of protecting their offspring (Kokko et al., 2003).

No differences emerged for participant's perceptions of male and female targets' motivation for protection, though targets overall were seen as more motivated to nurture as opposed to protect offspring. Perhaps men and women are perceived as more motivated to protect offspring

through various methods (e.g., attitudes versus actions toward others), hindering the ability to effectively tease apart perceptions of protective motivations in the current study. For example, those who take a parental caregiving role adopt harsher moral judgments of norm violations and become more risk-averse (Eibach et al., 2009; Eibach & Mock, 2011; for a synthesis of these ideas, see Schaller, 2018). Such attitudes are not necessarily physically aggressive but nonetheless serve to protect offspring. It could be possible that women are more likely to engage in this form of protection, while men would be more likely to engage in physical protection. It could also be the case, with dimorphism being less apparent than in other primates, that slight femininity in male faces was selected to connote parental concern (Plavcan, 2001). This nuance in protection motives could be further investigated in future studies.

6.1 | Limitations and future directions

Although the current study was able to provide additional insight into the apparent signal value of sexually dimorphic facial features regarding parental abilities, it had several limitations. Future research would benefit from teasing apart perceptions of protective motivations across male and female targets using additional items for varying forms of protection (e.g., moral judgments; Eibach et al., 2009). Additionally, stimuli in future studies might consider additional dimensions, such as facial adiposity, to further understand how physical features inform mate preferences. For example, past work has found that greater levels of body-fat implicate targets as higher in positive parental abilities (Sacco et al., 2020). Greater facial adiposity might similarly render targets to be perceived as more motivated to nurture offspring, and, consequently, more favorable as parents.

Although previous research has demonstrated a link between sexually dimorphic features and behaviors related to parental ability (e.g., Smith et al., 2012), results from the current study nonetheless reflect stereotypes of sex-typical features. It remains less clear whether these inferences of parental motives have a kernel of truth. Future research would benefit from assessing individual differences in parenting motives among social targets with varying levels of masculinized and feminized features. Perceivers could then assess whether they exhibit acuity toward actual parental motives through these features.

Further, many of our findings are consistent with a complementary understanding of evolutionary and social roles frameworks (e.g., Drea et al., 2021). It could be possible that reinforced social roles through descriptive differences during humans' evolutionarily history could additionally be driving these perceptions. Lastly, the current study offers limited generalizability to the broader population as our sample was largely college-aged students. Effects might be more pronounced among those with more salient roles as parental caregivers, such as individuals from an older population that are more likely to themselves be parents (Kerry & Murray, 2020). However, future studies might alternatively prime parenting motives to make parental goals more salient to both those with or without their own children (e.g., Woo & Schaller, 2020).

7 | CONCLUSION

Given the extensive care human infants require to survive, the ability to identify others capable of rearing offspring into adulthood becomes crucial. This adaptive problem led to the evolution of a perceptual acuity to physical features that connote such ability. Indeed, we found that feminized facial targets were perceived to possess a greater ability to nurture offspring.

Conversely, male targets were perceived as more motivated to protect, as opposed to nurture, offspring. However, the extent to which sexually dimorphic features signal protective capabilities should be further explored in future research.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

DATA AVAILABILITY STATEMENT

The data and materials used in the research are available and can be obtained at: https://osf.io/6a59u/?view_only=4d6fbb71a95e449badb197f34d3227eb or by emailing Kaitlyn.boykin@usm.edu.

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