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RESEARCH

Fathers' Facial Dominance Predicts First-Born Sons in Parent Dyads

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Abstract

Purpose The Trivers-Willard hypothesis (TWH) states that offspring sex should vary depending on parent condition, and TWH effects have been studied extensively. Findings have been equivocal, however, and recent work has challenged the TWH's theoretical predictions. One possible reason for variation in TWH findings is that few studies have investigated effects of mate selection for condition on offspring sex. Here we tested whether more dominant parents ($N=104$ dyads from Prolific) would be more likely to share a first-born son than a first-born daughter.

Methods Parent couples completed a survey of family demographics and dominance measures then submitted facial photographs. Photographs were standardized and rated by undergraduates for perceived facial dominance. Facial width-to-height ratio (fWHR) was also measured.

Results We found that rated paternal facial dominance, but not rated maternal facial dominance or their interaction, predicted the likelihood of having a first-born son. Self-reported dominance was not a reliable predictor of offspring sex, and fWHR did not predict OSR.

Conclusion These results suggest that fathers' facial dominance might influence the likelihood of a couple producing male offspring. We propose a plausible mechanism through which maternal personality, hormones, and mate preferences influence the sex of offspring. Relationships between facial cues of dominance and offspring sex warrant further investigation.

Keywords Trivers-Willard hypothesis · Maternal dominance hypothesis · Offspring sex ratio · Assortative mating

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Introduction

Effects of parental condition on offspring sex have been studied extensively. Most work has aimed to test the Trivers-Willard hypothesis (TWH), which states that because male reproductive success is highly variable, inheritance of "good" parental condition should improve a son's reproductive success more than a daughter's (Trivers & Willard, 1973). In other words, parents can maximize their own reproductive success by varying the sexes of their offspring based on their own condition. Parents in "good" condition should therefore have more sons, while parents in "poor" condition should have more daughters. Despite the elegance of this hypothesis, support for TWH remains equivocal (Thouzeau et al., 2023).

Challenges to the Trivers-Willard Hypothesis

Recent studies have attempted to reconcile the disparity in TWH study results. In a meta-analysis of data for humans, Thouzeau et al. (2023) found small enough effects that between-parent effects on offspring sex would be very unlikely (meta-regression average $r = 0.037$). They also found that TWH effects tended to decrease as sample size increased, which they interpreted as being the results of less precise measurement in larger-scale studies. However, Harper & Zietsch (2024) argued that since Zietsch et al. (2020) found null effects in population-level studies of OSR heritability—a tacit auxiliary assumption for the TWH—between-person variability in condition might not relate to offspring sex at all. Further, the authors suggested that rather than larger studies being limited by imprecise measurement, declining effect sizes with increased samples (e.g., Ellis & Bonin, 2002; Kolk & Schnettler, 2016) might actually represent greater power, leading to increasingly robust tests of TWH. Although larger-scale studies undoubtedly do lead to greater power, such studies do not assess within-person changes in parent condition that could influence offspring sex.

The Maternal Dominance Hypothesis

The Maternal Dominance Hypothesis (MDH; Grant, 1998) predicts that more dominant women should have mores sons than daughters. Supporting this hypothesis, Grant found that women who scored higher in trait dominance, both before (1994) and during (1990) pregnancy, were more likely to give birth to a son than a daughter. The MDH theorizes that dominance is passed on through maternal behaviour and interactions with sons, thus increasing a son's reproductive success by increasing his own dominance.

MDH mechanisms are hypothesized to be hormonal (Grant, 1998). Specifically, MDH predicts that more dominant women should be higher in testosterone (T), and that higher testosterone levels at conception should increase the likelihood that a woman's ovum will accept a Y-chromosome bearing sperm. Two lines of evidence support these predictions. First, both self-reported and observed behavioural dominance have been positively associated with T (Cobey et al., 2015; Grant & France, 2001; van Honk et al., 2014). Second, Grant et al. (2008) and Grant & Irwin (2005) found that, in vitro, bovine ovum follicles with higher levels of T in the follicular fluid were more likely to be fertilized by a Y- compared to an X-bearing spermatozoon. Although this specific fertilization process has not been tested in humans, the proposed biological mechanism is the same.

In sum, the MDH may be able to explain both between- and within-women influences on the conception of sons. Whereas women who are higher in trait dominance should have more sons than women low in trait dominance overall, T will also vary at each conception for each woman depending on environmental circumstances (e.g., stress, triumph). While Harper & Zietsch, (2024) and Zietsch et al. (2020) have ruled out between-women effects, within-woman effects are much harder to assess, and undoubtedly introduce considerable variability, in large scale studies.

Maternal Mate Choice and Offspring Sex

If MDH is true, mothers may choose mates based on characteristics that enhance the condition of their offspring. Palmer-Hague & Watson (2016a) hypothesized that more dominant women, who should be more likely to conceive sons, would prefer more dominant male mates. They found that fathers' self-reported dominance positively predicted the likelihood of having a first-born son. In addition, when fathers' facial photographs provided from around the time of conception were rated high in facial dominance, mothers' rated facial dominance positively predicted the likelihood of having a first-born son. This suggests that one mechanism by which parents might facultatively influence offspring sex is through a dominant mate. Interestingly, Palmer-Hague & Watson (2016b) found that women who predicted they would have a male first-born child were more likely to prefer a high dominance compared to a low dominance male face as a potential mate. Processes by which these individual differences in mate choice take place remain unknown, but the possibility that men and women choose mates based on characteristics associated with the mating success of their future offspring warrants further study.

Facial Width-to-Height Ratio as Facial Cue of Dominance

If parental facial dominance is indeed associated with mate preferences that influence offspring sex, the cues that signal facial dominance to potential mates warrant further investigation. One possibility is facial width-to-height ratio (fWHR), which cues threat to others (Geniole et al., 2015; but see Palmer-Hague et al., 2015; Palmer-Hague et al., 2018; Palmer-Hague & Geniole, 2022 for studies on women). Although the validity of fWHR as a sexually dimorphic craniofacial metric has been questioned (e.g., Dixson, 2018), recent evidence supports the notion that fWHR is associated with dominance and fighting ability (Caton & Dixson, 2022; Caton et al., 2022a, b, 2024). We therefore explored whether fWHR would be associated with offspring sex in parents.

The Present Study

Here, we assessed the effects of psychological, behavioural, and facial characteristics of parental dominance on offspring sex ratio. We hypothesized that the likelihood of having a first-born son would increase when mothers high in dominance—whether self-report or perceived facial dominance—were partnered with fathers high in dominance. We also hypothesized that fWHR would be positively associated with the likelihood of having a male offspring.

Methods

Participants and Procedure

Participants were recruited via Prolific (https://www.prolific.com). In Phase 1, we identified participants (group A; $N=382$, female $n=201$, 52.6%) who were heterosexual, had a first-born child born between 2014 and 2023, and had a romantic partner who would also participate. In Phase 2, romantic partners of group A (group B) were invited to complete the study (invited $N=382$; completed $n=175$). They provided demographic information and the ages and sexes of each of their children before completing three dominance measures and submitting a facial photograph. In Phase 3, we invited group A back to participate if their partner in group B completed the study (and they had not already[1]; invited $n=124$; completed $n=93$). Two hundred and sixty-eight individuals completed the study, and 42 individuals were excluded.[2] This resulted in 113 dyads, but 10 were removed: 3 for acting as their own romantic partner, 1 because partners were the same sex, and 6 for not reporting a first-born child with the same sex and age.

The total sample included 104[3] mated pairs (mother age, $M(SD)=32.8(4.6)$; father age $M(SD)=35.4(5.3)$; sex of first-born child $n=63$ (61%) male). Participants were mostly from the United Kingdom (mothers $n=48$ (46%); fathers $n=52$ (50%)), South Africa (both parents $n=21$ (20%)) and the United States (mothers $n=9$ (9%); fathers $n=10$ (10%). Participants were mostly white/Caucasian (mothers $n=62$ (60%); fathers $n=66$ (64%)) or African (both $n=21$ (20%)).

[1] Some group A participants were dyads. Therefore, in some cases, both members of a couple from group A completed the full survey during Phase 2, which explains why $n=175$ completed Phase 2 and only $n=124$ were invited to Phase 3.

[2] 42 were excluded: 9 for reporting a first-born child > 9 years old, 1 for reporting an implausible number of children, and 32 because their partner did not complete the study.

[3] We also recruited participants via email through a US school district. Ten participated, but only 1 dyad submitted facial photographs and was included.

Self-Reported Dominance

We used 3 dominance measures, presented in random order: the Simple Adjective Test (SAT; Grant, 1998), the Dominance subscale of the International Personality Item Pool (IPIP Dominance; https://ipip.ori.org/newCPIKey.htm#Dominance; Goldberg et al., 2006), and the dominance subscale of the dominance and prestige scale (Cheng et al., 2010). The SAT consists of 64 personal adjectives which participants check off if they "often feel" them. The IPIP Dominance consists of 11 items that measure dominance behaviour in the context of social interactions. Finally, the dominance subscale of the dominance and prestige scale consists of 8 items that measure dominance status that is obtained through force or threat of force.

Facial Photographs

Participants used their computer or phone's camera to obtain a photograph of their face according to the following criteria: (1) face should take up most of the image and be centered; (2) face should be at the same height level as the camera; (3) face and area around it should be well-lit and free from obstruction; and (4) face should depict a neutral facial expression. A pilot study on quality of participant facial photographs submitted online indicated that images ($N = 30$) were generally (26/30, 86.7%) useable for our subsequent rating procedure. Images were excluded if they were too dark to perceive the face ($n = 1$), the entire face was not in the photograph ($n = 1$), or a large portion of the face was covered ($n = 2$). Thirty-five faces depicted non-neutral facial expressions ($n = 22$ for at least one partner in a dyad), so we retained them and tested for differences between neutral and non-neutral faces in all subsequent analyses. Welch's t-tests between individuals of complete couples and incomplete couples showed no differences in measured personality or facial ratings in our sample (all $p > 0.05$). To prepare photographs for the rating procedure, we straightened and gray-scaled the images, used Webmorph (DeBruine & Tiddeman, 2017) to delineate and mask each face, and resized each with a height of 400 pixels and the face's natural aspect ratio.

Face Measurements

Faces were rated by 189 undergraduate students (age $M(SD) = 19.7$ (± 2.78) years, 33% male) in 6 batches, 3 for female faces (faces $n = 50$, 45, and 47) and 3 for male faces (faces $n = 50$, 38, and 41). The number of raters differed between each survey (range = 37–76). Faces were rated for dominance, attractiveness, and masculinity/femininity using 7-point Likert items asking, "How [characteristic] is this person?" Facial stimuli and each rating item were presented in random order. There was strong inter-rater agreement for each characteristic (all $ICC(3,k) \geq 0.98$), so we took the mean rating of each.

fWHR was measured as per Carré & McCormick (2008) using Fiji (Schindelin et al., 2012) by two independent raters. Faces were excluded from fWHR measurement ($N=25$) if the facial markers were obstructed (mothers $n=10$, fathers $n=7$), the angle of the face adjusted the distance between the markers (mothers $n=2$, fathers $n=4$), or both (mothers $n=2$). These measurements also had strong inter-rater agreement (*ICC(3,k)*=0.98), so they were averaged to provide a single indicator of fWHR.

Data Analyses

Data were analysed with R (Ihaka & Gentleman, 1996). We were interested in capturing perceived variability in facial dominance as such, so to remove potential confounding effects of facial attractiveness, facial masculinity/femininity, and age on ratings of facial dominance, we regressed facial dominance ratings on these variables within parent sex and calculated standardized residuals. These standardized residuals were used as the indicator of facial dominance in all analyses (as in, e.g., Cornwell & Perrett, 2008; Palmer-Hague & Watson, 2016a), and ensured that any effect of facial dominance on offspring sex was not confounded by other characteristics, e.g., facial masculinity. Correlations between age, dominance measures, and facial ratings are displayed within sex in Table 1 (mothers) and Table 2 (fathers).

Due to the potential of stopping rules biasing OSR (Stansfield & Carlton, 2007), we used the sex of the first-born child as our outcome variable for all analyses. To test our hypotheses, two binary logistic regression models with son as the target category were fit for each dominance operationalization—one with the main effects of

Table 1 Correlations with confidence intervals for mothers' age, dominance, and facial ratings

Variable	1	2	3	4	5	6
1. Age						
2. Dominance Subscale	-0.18					
	[-0.36, 0.01]					
3. SAT Dominance	-0.27**	0.30**				
	[-0.44, -0.08]	[0.12, 0.47]				
4. IPIP Dominance	-0.10	0.58**	0.20*			
	[-0.29, 0.09]	[0.44, 0.69]	[0.00, 0.37]			
5. Facial Dominance	-0.00	-0.04	0.06	-0.05		
	[-0.20, 0.19]	[-0.23, 0.15]	[-0.13, 0.25]	[-0.24, 0.14]		
6. Facial Attractiveness	-0.31**	0.20*	0.10	0.14	0.30**	
	[-0.47, -0.12]	[0.01, 0.38]	[-0.09, 0.29]	[-0.05, 0.33]	[0.11, 0.46]	
7. Facial Masc/Fem	0.16	-0.22*	0.01	-0.17	0.00	-0.75**
	[-0.04, 0.34]	[-0.40, -0.03]	[-0.18, 0.21]	[-0.35, 0.02]	[-0.19, 0.19]	[-0.83, -0.66]

Values in square brackets indicate the 95% confidence interval for each correlation. * indicates $p<0.05$. ** indicates $p<0.01$. Higher scores on masculinity/femininity indicate more masculinity, and vice versa

Table 2 Correlations with confidence intervals for fathers' age, dominance, and facial ratings

Variable	1	2	3	4	5	6
1. Age						
2. Dominance Subscale	-0.24*					
	[-0.41, -0.05]					
3. SAT Dominance	-0.18	0.21*				
	[-0.36, 0.01]	[0.02, 0.39]				
4. IPIP Dominance	-0.17	0.62**	0.11			
	[-0.35, 0.02]	[0.48, 0.72]	[-0.08, 0.30]			
5. Facial Dominance	-0.01	-0.03	0.03	-0.12		
	[-0.21, 0.18]	[-0.22, 0.17]	[-0.16, 0.22]	[-0.31, 0.07]		
6. Facial Attractiveness	-0.40**	0.08	0.18	0.03	0.35**	
	[-0.55, -0.22]	[-0.12, 0.27]	[-0.01, 0.36]	[-0.17, 0.22]	[0.17, 0.51]	
7. Facial Masc/Fem	0.02	0.02	-0.05	-0.05	0.77**	0.25*
	[-0.18, 0.21]	[-0.18, 0.21]	[-0.24, 0.15]	[-0.24, 0.14]	[0.67, 0.84]	[0.06, 0.42]

Values in square brackets indicate the 95% confidence interval for each correlation. * indicates $p<0.05$. ** indicates $p<0.01$. Higher scores on masculinity/femininity indicate more masculinity, and vice versa

mothers' and fathers' dominance and one with the main effects plus their interaction. Then, we used mothers' and fathers' fWHR to predict offspring sex both together and in simple logistic regression models. Predictors were standardized, and interactions were probed with Johnson-Neyman analyses using the *interactions* package (Long, 2021).

Results

Self-Reported Dominance

Statistics for the self-reported dominance models (all $N=104$) are shown in Table 3. We found no effects for SAT scores in the main effects (*-2LL* = 139.34, $\chi2(2)=0.14$, $p=0.931$) or the interaction model (*-2LL* = 139.06, $\chi2(3)=0.42$, $p=0.934$). Similarly, no effects of IPIP dominance were observed in the main effects (*-2LL* = 138.14, $\chi2(2)=1.34$, $p=0.512$) or the interaction model (*-2LL* = 138.14, $\chi2(3)=1.34$, $p=0.718$), and no effects of dominance from the dominance and prestige scale were observed in the main effects (*-2LL* = 138.23, $\chi2(2)=1.26$, $p=0.533$) or the interaction model (*-2LL* = 136.91, $\chi2(3)=2.57$, $p=0.462$). Johnson-Neyman analyses indicated no values of fathers' dominance for which the slope of mothers' dominance was significant in any of the three models (all $p>0.05$).

Table 3 Binary logistic regression results with self-reported dominance

Model (N = 104)	*B (SE)*	*OR*	*z*	*p*
SAT Dominance				
Main Effects				
Mother dominance	-0.07 (0.20)	0.93	-0.38	0.705
Father dominance	0.02 (0.21)	1.02	0.10	0.923
Interaction				
Mother dominance	-0.09 (0.21)	0.92	-0.42	0.677
Father dominance	0.01 (0.21)	1.01	0.05	0.961
Mother X Father dominance	0.10 (0.19)	1.12	0.53	0.598
IPIP Dominance				
Main Effects				
Mother dominance	0.17 (0.21)	1.18	0.79	0.430
Father dominance	-0.21 (0.21)	0.81	-0.99	0.320
Interaction				
Mother dominance	0.16 (0.21)	1.18	0.79	0.428
Father dominance	-0.21 (0.21)	0.81	-1.00	0.319
Mother X Father dominance	0.01 (0.21)	1.02	0.07	0.944
Dominance Subscale				
Main Effects				
Mother dominance	0.25 (0.23)	1.29	1.10	0.274
Father dominance	-0.12 (0.22)	0.89	-0.55	0.586
Interaction				
Mother dominance	0.36 (0.25)	1.43	1.40	0.161
Father dominance	-0.11 (0.23)	0.90	-0.47	0.641
Mother X Father dominance	-0.26 (0.23)	0.77	-1.14	0.255

Facial Dominance

Welch's t-tests revealed that for both mothers ($t(13.45) = 2.66$, $p = 0.019$, $d = -0.89$) and fathers ($t(12.22) = 2.22$, $p = 0.047$, $d = -0.96$) participants with a neutral facial expression were rated significantly higher in facial dominance than faces with a non-neutral expression. Therefore, we analysed data from both the full sample and neutral faces only. Regression results are shown in Table 4. First, for the full sample ($N = 103$), neither the main effects ($-2LL = 135.15$, $\chi 2(2) = 3.33$, $p = 0.189$) nor the interaction ($-2LL = 132.53$, $\chi 2(3) = 5.94$, $p = 0.114$) models were significant. Fathers' facial dominance, in contrast, was marginally significant ($B(SE) = 0.38(0.22)$, $OR = 1.46$, $z = 1.73$, $p = 0.082$) and became significant when the interaction term was added to the model ($B(SE) = 0.46(0.23)$, $OR = 1.57$, $z = 1.99$, $p = 0.047$). Higher fathers' facial dominance was associated with a higher likelihood of a first-born son. Johnson-Neyman analyses indicated null results for mothers' facial dominance at all values of fathers' facial dominance.

Table 4 Binary logistic regression results with facial dominance

Model	*B (SE)*	*OR*	*z*	*p*
All Faces ($N = 103$)				
Main Effects				
Mother dominance	0.02 (0.20)	1.02	0.112	0.911
Father dominance	0.37 (0.22)	1.46	1.74	0.082
Interaction				
Mother dominance	0.10 (0.22)	1.10	0.44	0.658
Father dominance	**0.46 (0.23)**	**1.58**	**1.99**	**0.047**
Mother X Father dominance	0.41 (0.26)	1.50	1.55	0.122
Neutral Faces ($n = 81$)				
Main Effects				
Mother dominance	0.16 (0.24)	1.17	0.67	0.500
Father dominance	**0.60 (0.27)**	**1.83**	**2.26**	**0.024**
Interaction				
Mother dominance	0.25 (0.25)	1.28	0.97	0.334
Father dominance	**0.70 (0.29)**	**2.01**	**2.44**	**0.015**
Mother X Father dominance	0.33 (0.27)	1.39	1.23	0.220

Significant effects ($p < 0.05$) are shown in boldface

Next, we ran these analyses for neutral-face dyads only ($n = 81$). Both the main effects model (*-2LL* = 103.61, $\chi 2(2) = 6.59$, $p = 0.037$) and the interaction model (*-2LL* = 102, $\chi 2(3) = 8.19$, $p = 0.042$) were significant, and fathers' facial dominance significantly predicted offspring sex in both the main effects model (*B(SE)* = 0.60(0.27), *OR* = 1.83, $z = 2.26$, $p = 0.024$) and interaction model (*B(SE)* = 0.70(0.29), *OR* = 2.02, $z = 2.44$, $p = 0.015$). In the main effects model a one standard deviation increase in fathers' facial dominance was associated with an 83% increase in the likelihood of having a first-born son. Johnson-Neyman analysis indicated no values of fathers' dominance for which the slope of mothers' dominance was significant.

Facial Width-to-Height Ratio

For fathers ($r = 0.21$, $p = 0.040$), but not mothers ($r = 0.09$, $p = 0.406$), fWHR positively correlated with perceived facial dominance. For all dyads with fWHR measurements ($n = 81$), the model predicting offspring sex from both father and mother fWHR was not significant (*-2LL* = 107.52, $\chi 2(2) = 1.97$, $p = 0.372$), and neither was the simple logistic regression for mothers ($n = 90$, *-2LL* = 122.41, $\chi 2(1) = 0.17$, $p = 0.682$) or fathers ($n = 93$, *-2LL* = 122.43, $\chi 2(1) = 1.71$, $p = 0.191$). Regression statistics are shown in Table 5.

Table 5 Binary logistic regression results with mother and father fWHR

Model	*B (SE)*	*OR*	*z*	*p*
Both Variables				
Mother fWHR	-0.25 (0.24)	0.78	-1.04	0.300
Father fWHR	0.25 (0.23)	1.28	1.09	0.278
Mother fWHR Only				
Mother fWHR	-0.09 (0.21)	0.92	-0.41	0.682
Father fWHR Only				
Father fWHR	0.29 (0.22)	1.33	1.28	0.199

Discussion

Contrary to our hypotheses, we found no significant interactions between mothers' and fathers' dominance, whether psychological, behavioural, or facial, on likelihood of having a first-born son. We also found no evidence that fWHR was an indicator of offspring sex. We did find, however, that fathers' facial dominance positively predicted having a first-born son. This could indicate that men's faces communicate important information about their 'condition' as it relates to offspring sex. Although Harper & Zietsch (2024) argue that between-person variability in parental condition (e.g., dominance) could not influence offspring sex due to a lack of heritability—indicating that a direct effect of fathers' facial dominance (i.e., Trivers-Willard effects) may not influence offspring sex—within-person variability could be operating here as the MDH predicts.

Although the MDH requires further study, one possible interpretation of our findings extends the MDH into mate selection. Mating strategies theory posits that individuals adopt different reproductive strategies based on different personal and environmental characteristics to maximize reproductive success (Buss & Schmitt, 1993). The possibility that sexual strategies may vary according to the sex of offspring that a female is likely to have, however, is an underexplored area where personal characteristics may influence strategic mating. If such processes occur, they may explain our effects here. That is, higher within-female T levels may potentially covary with offspring sex *and* with selection of a more dominant male. In short-term and long-term mating contexts, we might observe such an effect if higher maternal testosterone levels around time of conception influences women's preferences for highly dominant mates. Thus, higher within-woman T levels, which would not necessarily influence facial dominance (Dabbs, 1997), particularly if transient, could influence the probability of male offspring and potentially enhance the fitness of sons through selection of good paternal genes.

The plausibility of this hypothesis aligns with the results of Palmer-Hague & Watson (2016b), who showed that women who *predict* they will have a first-born son show stronger preferences for a facial dominance in a potential male mate than women who predict they will have a first-born daughter. However, no work has yet assessed whether women who show stronger preferences for facial dominance tend to give birth to sons in the future, and the literature on mate preferences over the ovulatory cycle has been questioned—with some studies showing altered mating preferences in the peri-ovulatory phase (e.g., Penton-Voak & Perrett, 2000; Penton-Voak et al., 1999) and more recent work showing null effects (e.g., Dixson et al., 2018a, b, 2024; Jones et al., 2018). Future work should assess the sex of offspring in studies testing whether higher female T influences selection of more dominant mates, perhaps by studies of couples' hormonal profiles and dominance characteristics throughout the mating and reproduction process.

While our results generally complement those of Palmer-Hague & Watson (2016a), who found that the probability of a first-born son increased when both mother' and fathers' facial dominance was high, we did not find a significant effect of mothers' facial dominance or an interaction. One possible reason for this discrepancy is that neither their study nor ours utilized a standardized, lab-based photograph protocol, which resulted in both smiling and non-smiling faces being utilized. Indeed, Palmer-Hague & Watson (2016a) demonstrated that when smiling faces were analyzed, fathers' facial dominance predicted a first-born daughter rather than son. In addition to the reduction in power, the smiling faces were also rated as less dominant than non-smiling faces, which could have influenced the pattern of results they found. Ensuring neutral facial expression as well as photography conditions will be crucial in future studies.

In addition, although Palmer-Hague & Watson (2016a) found that fathers' facial dominance *and* fathers' composite self-report dominance positively predicted offspring sex, we found no effect of our self-report dominance measures here, despite using two of the same instruments (i.e., the SAT and IPIP dominance). It is not clear why the present results were constrained to facial indicators of dominance, but it is possible, given our proposed mechanism, that this result is due to dominance in the face being more perceptible in short-term mating contexts than behavioural dominance. It is also possible that because our sample here is cross-cultural, self-report instruments which require mental comparisons with peers are confounded by cross-cultural variability in dominance traits.

In the present study, we measured fWHR and tested it as a predictor of offspring sex based on previous evidence that fWHR signals dominance in males. However, while fathers' facial dominance predicted offspring sex, fathers' fWHR did not. These null results should be contextualized within the debate surrounding fWHR as an indicator of dominance (or threat or fighting ability; Caton et al., 2022a, b) and whether fWHR was sexually selected (Dixson, 2018; but see Caton & Dixson, 2022). If fWHR is not a cue to dominance or was not sexually selected, we would not expect to see a relationship between fWHR and offspring sex.

Limitations

Our study comes with at least one limitation worth noting. Although we attempted to recruit participants as close to when conception occurred for their first child, sampling pool limitations required us to recruit parents with first-borns as old as 9 years of age ($M(SD)=4.07$ (2.11) years). However, statistically controlling for time since birth in facial dominance models showed that the length of this period did not influence our results. Additionally, controlling for the number of children reported by the mother did not influence our results. Nevertheless, future work should aim to collect data throughout the reproductive process from conception to birth to ensure that this latency period after birth does not bias conclusions.

Conclusion

The present work demonstrates an association between fathers' facial dominance and offspring sex and provides a plausible interpretation for such effects. Relationships between facial dominance and offspring sex suggest that mate preferences may be influenced—either directly or indirectly—by fundamental sex determination processes. Relationships between facial cues of dominance, within-person changes in mate choice, and offspring sex warrant further investigation.

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Author Contributions Benjamin J. Zubaly: Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Writing – Original Draft and Reviewing and Editing, Project Administration, Funding Acquisition. Jaime L. Palmer-Hague: Conceptualization, Methodology, Resources, Writing – Reviewing and Editing, Supervision, Project Administration, Funding Acquisition.

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Data Availability Data and code are available at: https://osf.io/c2au4/?view_only=7c792d20e70e407e9c8608afbbeaa657. The linked GitHub repository describes how to reproduce the results reported here.

Declarations

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

Ethics All study procedures were approved by the Trinity Western University Human Research Ethics Board (#22OS31).

Competing Interests The authors declare no competing interests.

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