



# Father–daughter relationship as a moderator of sexual imprinting: a facialmetric study

Agnieszka Wiszewska<sup>a</sup>, Boguslaw Pawlowski<sup>a,b,\*</sup>, Lynda G. Boothroyd<sup>c,\*</sup>

<sup>a</sup>Department of Anthropology, University of Wrocław, Wrocław, Poland

<sup>b</sup>Institute of Anthropology, Polish Academy of Sciences, Wrocław, Poland

<sup>c</sup>Department of Psychology, University of Durham, Durham, UK

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## Abstract

This study investigated sexual imprinting in human females. Facial proportions of fathers were compared to the proportions of stimulus faces the participants found attractive. Women who rated their childhood relationships with their father highly showed a significantly stronger relationship between the proportions of their father's face and their chosen stimulus than other women, primarily concerning the central face area. Women who rated their fathers less highly did not show similarity between fathers' and stimulus' faces. This supports previous research using photographs of parents' and spouses' faces.

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## 1. Introduction

Sexual imprinting, which is the sexual preference for individuals possessing parental characteristics, has been a subject of study in nonhuman vertebrates for many years (see, e.g., Pfau, Kippin, & Centeno, 2001, for a review). More recently, there has also been research showing evidence for sexual imprinting in humans. Several papers have suggested that opposite-sex parental phenotypes may be reflected in the idealised and actual mate choices made by both men and women (e.g., race: Jedlicka, 1980; parental age: Perrett et al, 2002; Wilson & Barrett, 1987; colouring: Little, Penton-Voak, Burt, & Perrett, 2003). So long as mechanisms exist to prevent inbreeding depression (e.g., the Westermarck effect, see Lieberman, Tooby, & Cosmides, 2003), it has long been considered that it may be adaptive to mate with those who bear some resemblance to ourselves and/or our family as this increases relatedness between parents and offspring and may preserve co-adapted gene complexes (see, e.g., Bateson, 1978, for a discussion of optimal outbreeding). More recently, it has been suggested

that imprinting may serve to increase genetic compatibility between mates (Tregenza & Wedell, 2000) or to assist offspring in successfully finding a mate (by using their successfully mated parents as models; Todd & Miller, 1993). Alternatively, imprinting may be the result of learning, without any adaptive function. For instance, it may be that one side effect of developmental plasticity in the face processing regions of the brain is to bias beliefs about what makes a desirable face towards those faces seen most often in early development [i.e., the parents'; see, e.g., Perrett et al, 2002, for discussion; although Todd & Miller, 1993, claim, based on their modelling research, that imprinting is indeed adaptive].

Berezkei et al. found further evidence to suggest that sexual imprinting in humans is not a passive process, but rather is moderated by the quality of the parent–child relationship in both males (Berezkei, Gyuris, Koves, & Bernath, 2002) and females (Berezkei, Gyuris, & Weisfeld, 2004). This may be adaptive because a partner who bears resemblance to a distant parent may be less likely to be a good parent himself/herself. There may also be an element of straightforward conditioning, with children who did not have good relationships with their parents developing an aversion to parental features and vice versa. Berezkei et al. (2002) found that the resemblance between men's wives and

\* Corresponding authors.

E-mail addresses: bogus@antropo.uni.wroc.pl (B. Pawlowski), l.g.boothroyd@dur.ac.uk (L.G. Boothroyd).

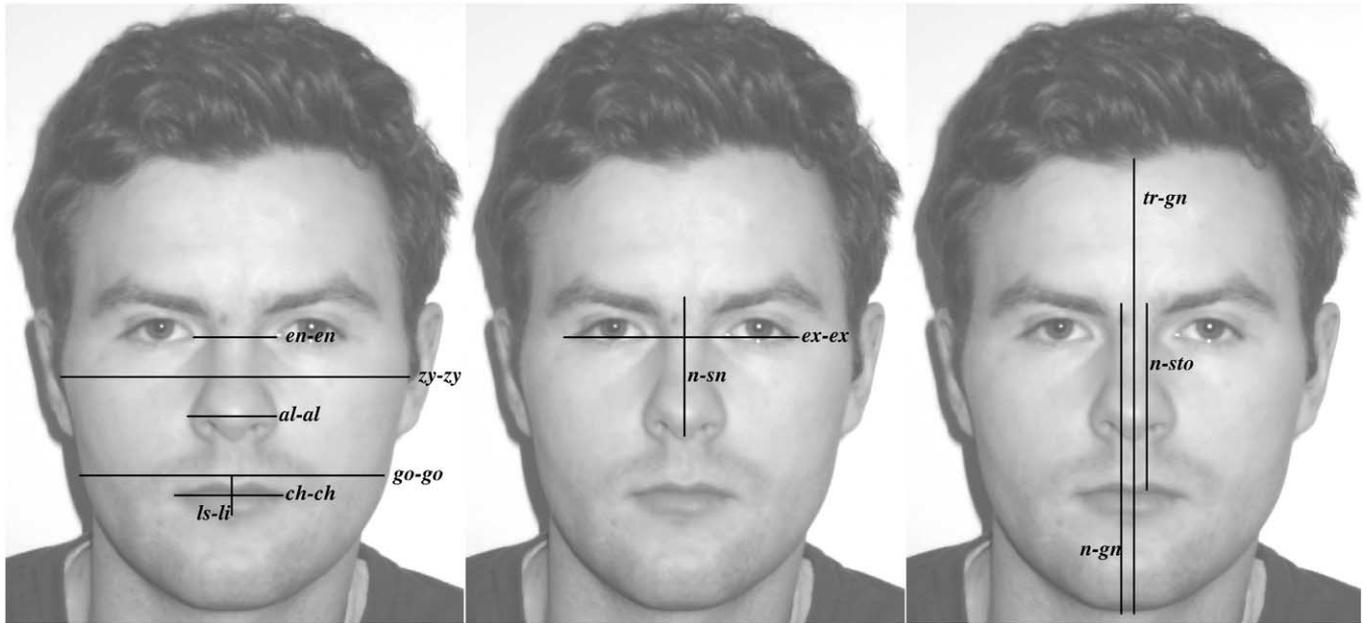


Fig. 1. Measurements taken of fathers' and stimulus faces.

their mothers was stronger if the men had had positive relationships with their mothers. Similarly, Berezkei et al. (2004) found that the degree to which women's adoptive fathers bore resemblance to their husbands was significantly related to how well the women got on with their adoptive fathers. Importantly, this effect cannot be genetically mediated as the women were all adopted and, furthermore, cannot be influenced by any similarity between the daughters and adoptive fathers (perhaps brought about through environmental factors) because self-husband similarity was much weaker than father-husband similarity. It is possible, however, that those participants in the research of Berezkei et al. who were judging resemblance between parents and spouses (by attempting to match the correct spouse, out of a group of 4, to the parent) used cues such as clothes, head position, and expression to match the in-laws, rather than any physiognomic features.

The aim of this study therefore was to investigate evidence of parental imprinting in women using facialmetric data. Doing so allows a clear view of how fathers' facial features relate directly to the features of faces their daughters find attractive.

## 2. Methods

### 2.1. Participants

Eighty-one women and their fathers were recruited from the community in and around Wroclaw, Poland. Five women were excluded because they only lived with their stepfather, while 7 were excluded because they failed to fully complete the study, leaving 69 women. To avoid pseudoreplication, where more than one sister volunteered for the study, only the

eldest daughters were included, leaving a final sample of 49 women aged 15 to 34 (mean,  $24.3 \pm 5.2$ ).

### 2.2. Data collection: faces

#### 2.2.1. Stimuli

Facial photographs were taken of 31 men. Of these, 6 were excluded because they had beards, while 9 were excluded because they were all very close to average in their facial proportions (all facial measurements were within 1 S.D. of the mean; see below). The remaining 16 faces were shown to 20 raters (10 male, aged 19–25 years) who assessed them for similarity. Only two faces were judged to be very similar (19/20 judges agreed) and so one of these two faces was removed at random. This left 15 stimuli representing a wide range of distinct faces that were used in this study. All facial stimuli were masked, such that ears, hair, and neck/shoulders were not visible.

#### 2.2.2. Facial measurements

All stimuli and the faces of participants' fathers were measured on 11 cephalofacial dimensions by a trained anthropologist (AW) using callipers, from which 15 key proportions were calculated based on comparing each feature dimension to the height or width of the face (see Fig. 1 for dimensions measured, and Table 1 for all proportions; dimensions chosen based on Farkas, 1981).

#### 2.2.3. Factor analysis

Facial proportions of all faces (all fathers and all 15 facial stimuli) were entered into a principal components analysis using SPSS 12.0 (correlations less than 0.4 and eigenvalues below 1 were suppressed and varimax rotation was used). Four significant factors emerged, as shown in Table 1. Factor 1

Table 1

Factor structure of the facial proportion factors, and the correlations between women's father and their chosen male faces on those factors

Proportion	Calculation	Factor 1	Factor 2	Factor 3	Factor 4
		Central face	Nose width	Lip width	Jaw width
1 Brow height/face height	n-gn/tr-gn	0.452			
2 Nose height/width	n-sn/al-al	0.665	0.701		
3 Mouth-brow height/cheekbone width	n-sto/zy-zy	0.830			
4 Mouth-brow/face height	n-sto/tr-gn	0.831			
5 Nose height/face width	n-sn/zy-zy	0.913			
6 Nose/face height	n-sn/tr-gn	0.928			
7 Nose width/face width	al-al/zy-zy		−0.880		
8 Nose width/jaw width	al-al/go-go		−0.824		0.492
9 Lip width/nose width	ch-ch/al-al		0.881	0.433	
10 Lip width/face height	tr-gn/ch			−0.885	
11 Lip width/face width	ch-ch/zy-zy			0.961	
12 Cheekbone prominence	go-go/zy-zy				−0.881
13 Brow height/jaw width	n-gn/go-go				0.848
14 Lip fullness/width	lsli/ch				
15 Eye width/cheekbones	zy/(ex)-(en)/2				
Eigenvalue		3.913	3.055	2.264	1.897
Variance explained (%)		26.084	20.364	15.092	12.647
Correlation between father and chosen male factor scores	All women ( $df=48$ )	0.204	0.011	0.100	−0.109
	Low positivity ( $df=24$ )	−0.163	−0.094	−0.032	−0.102
	High positivity ( $df=23$ )	0.551**	0.094	0.268	−0.119
	Z (difference in $r$ between low and high groups)	2.537*	0.609	0.994	0.056

\*  $P = .016$ .\*\*  $P = .005$ .

consisted of proportions all relating to the size/shape of the nose and the central region of the face. Factors 2, 3, and 4 consisted of proportions all relating to the width of particular features (the nose, lips, and jaw, respectively). Each face was calculated a score for each factor. It was then possible to calculate the extent to which the father's facial proportions correlated with those of their daughter's preferred face, for each factor (see below).

### 2.3. Data collection: daughters

Daughters completed a questionnaire giving their demographic information [age, type of settlement of birth (village, small town, large town, or city) and level of education (broadly translatable as primary, lower secondary, upper secondary/high school, vocational training, some post-secondary, bachelor's degree, master's degree)] and rated their relationships with their fathers during their childhood (birth to 7 years of age). They rated 'how much [their] father engaged in bringing [them] up', 'how much his leisure time he spent with [her]', and 'how much emotional investment [they] received' from their father on 1–9 Likert scales (see Appendix A for actual questions); all three scales were strongly correlated (mean  $r_s = 0.708$ , all  $P < .001$ ) and were averaged together to produce a single positivity to father score. Women were divided by a median split into two groups: those with lower positivity scores ( $n = 25$ ) and those in the higher positivity group ( $n = 24$ ). Women were also asked to report whether their fathers had been absent from

the family home for periods during their childhood (responses were 'never', 'sporadically', 'often for long periods', and 'often for short periods').

High vs. low positivity scores did not relate to participant's age ( $t_{47} = 1.327$ ), frequency/duration of father's absences from the home ( $\chi^2 = 5.975$ ,  $df = 3$ ) during daughter's childhood, settlement of birth ( $\chi^2 = 2.341$ ,  $df = 3$ ), or level of education ( $\chi^2 = 8.241$ ,  $df = 6$ ; all  $P > .1$ ). Both father and daughter reported whether father had had facial hair during her childhood ('yes' or 'no'; which did not relate to high or low positivity ratings either; beard:  $\chi^2 = 1.380$ ; moustache:  $\chi^2 = 1.007$ ; both  $df = 1$ ,  $P > .1$ ).

The women were shown all 15 facial stimuli and asked to rate the faces for attractiveness; the face they considered the most attractive (henceforth referred to as their 'chosen face') was then selected. Where a participant had rated more than one face as the most attractive, the mean of those faces' factor scores was calculated to give their chosen face factor scores. None of the factors, for father's face or for chosen face, correlated with participant's age (all  $P < .1$ , all  $r < 0.1$ ) with the exception of a trend for participant's age to correlate negatively with father's Factor 1 score ( $r_{48} = -0.272$ ,  $P = .058$ ).

## 3. Results

### 3.1. Similarity between father and chosen face

Facial factors of fathers were correlated with the chosen faces. When analysing all participants, there were no

significant correlations (all  $P > .1$ , see Table 1). When daughters were split into two groups based on positivity to father, those in the group with lower positivity scores still did not show any significant correlations (all  $r_{24} < 0.17$ ,  $P > .1$ , see Table 1). However, those in the higher positivity group showed significant positive correlations between father's and chosen face's proportions for Factor 1 ( $r_{23} = 0.551$ ,  $P = .005$ ; correlation remained if participant's age was controlled for in partial correlations). Furthermore, when the correlation coefficients of the two groups were compared using Fisher's  $z$ -score transformation, women in the high positivity group showed a significantly higher correlation between fathers and chosen faces for Factor 1 than women in the lower positivity group ( $z = 2.537$ ,  $P = .016$ ). There were no other significant differences in correlations (see Table 1).

### 3.2. Differences between high and low positivity women in chosen faces and fathers' faces

The facial factors of chosen face and father's face were entered as dependant variables into a multiple ANCOVA where positivity group of daughters was a between-subjects factor and daughter's age was a covariate. There were no significant differences between the two groups on any of the factors either for their father's facial dimensions or those of the faces they found most attractive (all  $F_{1,44} < 1$ ).

## 4. Discussion

This study was designed to test whether facialmetric characteristics of fathers' faces were related to the facialmetric characteristics of faces their daughters found attractive, and whether father–daughter relationships (as assessed retrospectively by the daughter) moderated this association. It was found that there was no overall concordance between fathers' faces and the faces which the female participants found most attractive; however, women who rated their fathers most positively showed significantly stronger concordance between father's and chosen faces in terms of the central features and shape of the face (Factor 1) than women who rated their fathers least positively.

These results support those of Berezkei et al (2002, 2004) who found that better parent–child relationships were associated with higher similarity between opposite sex parents (or adoptive parents in the latter study) and spouses. Furthermore, the present results suggest that the data of Berezkei et al. cannot be solely explained by the clothes and posture of the parents and spouses. It would appear that there may be genuine imprinting of parental facial features.

The fact that the features which showed concordance between fathers and chosen faces were related to the central section of the face may suggest that either the women in the study paid most attention to this area of the face (it would be interesting to repeat this using an eye-tracker), or perhaps this was the most distinctive

aspect of the fathers' and/or the stimuli faces. Alternatively, it may be that these areas of the face are least prone to change over time (e.g., due to weight changes), and so only these areas of the fathers' faces (as measured now) accurately reflect their facial proportions during their daughters' childhoods.

Unlike Berezkei et al (2004), this study cannot rule out genetic effects or self-similarity effects as (for instance) women with good relationships with their fathers may have inherited the same partner preferences as their mothers to a greater degree than other women, or women who have more positive relationships with their fathers may be more physically similar to them and select self-similar partners. However, given that research into imprinting-like effects tends to find that attraction to opposite sex parental features is stronger than attraction to self-similarity (colouring: Little et al, 2003) or remains after controlling for self-similarity (age: Perrett et al, 2002), and that Berezkei et al (2004) showed the effect seen here in an adoptive sample, it seems likely that the present results are due to imprinting. The next step is therefore to repeat this work with an adoptive sample and to measure both fathers' and daughters' facial features.

Furthermore, measurements of the fathers' faces in the current study represent their present facial features, rather than their features at the time of their daughters' childhood. It is therefore not possible to determine whether the apparent imprinting effects seen here occurred during early years, or whether fathers' faces continue to influence partner choice into adulthood. Another development of this research therefore would be to conduct longitudinal research in which parental faces are measured at the time of their children's birth and those same children are later followed up in adulthood. This design would also allow for prospective family relationship data to be gathered, which would further enhance the quality of the research.

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## Appendix A. Questions asked regarding daughter–father relationship

1. Jak duże było zaangażowanie Pani obecnego ojca w Pani wychowanie (proszę określić w skali 1–9, gdzie 1 oznacza brak zaangażowania, 9—bardzo duże)
2. Ile swojego wolnego czasu - Pani zdaniem - Pani obecny ojciec poświęcał Pani (proszę określić w skali 1–9, gdzie 1 oznacza wcale, 9—bardzo dużo)
3. Jak duże wsparcie emocjonalne - Pani zdaniem - otrzymała Pani od obecnego ojca (proszę określić w skali 1–9, gdzie 1 oznacza brak wsparcia, 9—bardzo dużo)

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