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1 **Father-daughter relationship as a moderator of sexual imprinting:**
2 **a facialmetric study**

3
4 by

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15
16
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23

24 **Abstract**

25

26

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

34

35 **1.0 Introduction**

36

37 Sexual imprinting, that is the sexual preference for individuals possessing parental
38 characteristics, has been a subject of study in nonhuman vertebrates for many years (see
39 e.g. Pfaus, Kipping & Centeno, 2001, for a review). More recently there has also been
40 research showing evidence for sexual imprinting in humans. Several papers have suggested
41 that opposite-sex parental phenotypes may be reflected in the idealised and actual mate
42 choices made by both men and women (e.g. race: Jedlicka, 1980; parental age: Perrett et al,
43 2002; Wilson & Barrett, 1987; colouring: Little et al, 2003). So long as mechanisms exist
44 to prevent inbreeding depression (e.g. the Westermarck effect, see Lieberman, Tooby &
45 Cosmides, 2003), it has long been considered that it may be adaptive to mate with those
46 who bear some resemblance to ourselves and/or our family as this increases relatedness
47 between parents and offspring and may preserve co-adapted gene complexes (see e.g.
48 Bateson, 1978, for a discussion of optimal outbreeding). More recently it has been
49 suggested that imprinting may serve to increase genetic compatibility between mates
50 (Treganza & Wedell, 2000) or to assist offspring in successfully finding a mate (by using
51 their successfully mated parents as models; Todd & Miller, 1993). Alternatively,
52 imprinting may be the result of learning, without any adaptive function. For instance, it
53 may be that one side effect of developmental plasticity in the face processing regions of the
54 brain, is to bias beliefs about what makes a desirable face towards those faces seen most
55 often in early development (i.e. the parents'; see e.g. Perrett et al, 2002, for discussion;
56 although Todd & Miller (1993) claim, based on their modelling research, that imprinting is
57 indeed adaptive).

58

59 Berezkei and colleagues found further evidence to suggest that sexual imprinting in
60 humans is not a passive process, but rather is moderated by the quality of the parent-child

61 relationship in both males (Berezkei, Gyuris, Koves & Bernath, 2002) and females
62 (Berezkei, Gyuris, & Weisfeld, 2004). This may be adaptive because a partner who bears
63 resemblance to a distant parent may be less likely to be a good parent themselves. There
64 may also be an element of straightforward conditioning, with children who did not have
65 good relationships with their parents developing an aversion to parental features and vice
66 versa. Berezkei et al. (2002) found that the resemblance between men's wives and their
67 mothers was stronger if the men had had positive relationships with their mothers.
68 Similarly, Berezkei et al. (2004) found that the degree to which women's adoptive fathers
69 bore resemblance to their husbands was significantly related to how well the women got on
70 with their adoptive fathers. Importantly, this effect cannot be genetically mediated as the
71 women were all adopted, and furthermore, cannot be influenced by any similarity between
72 the daughters and adoptive fathers (perhaps brought about through environmental factors)
73 because self-husband similarity was much weaker than father-husband similarity. It is
74 possible however, that those participants in Berezkei et al's research who were judging
75 resemblance between parents and spouses (by attempting to match the correct spouse, out
76 of a group of 4, to the parent) used cues such as clothes, head position and expression to
77 match the in-laws, rather than any physiognomic features.

78

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

82

83 **2.0 Methods**

84

85 *Participants*

86 81 women and their fathers were recruited from the community in and around Wroclaw,
87 Poland. 5 women were excluded because they only lived with their stepfather, while 7
88 were excluded because they failed to fully complete the study, leaving 69 women. To
89 avoid pseudoreplication, where more than one sister volunteered for the study, only eldest
90 daughters were included, leaving a final sample of 49 women aged 15 to 34 (mean
91 24.3 ± 5.2).

92

93 *Data collection: Faces*

94 *Stimuli*

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

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

107 FIGURE 1 HERE

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

112 all relating to the size/shape of the nose and the central region of the face. Factors 2, 3 and
113 4 consisted of proportions all relating to the width of particular features (the nose, lips and
114 jaw respectively). Each face was calculated a score for each factor. It was then possible to
115 calculate the extent to which the father's facial proportions correlated with those of their
116 daughter's preferred face, for each factor (see below).

117

118 *Data collection: Daughters*

119 Daughters completed a questionnaire giving their demographic information [age, type of
120 settlement of birth (village, small town, large town or city) and level of education (broadly
121 translatable as: primary, lower secondary, upper secondary/high school, vocational
122 training, some post-secondary, bachelor's degree, master's degree)] and rated their
123 relationships with their fathers during their childhood (birth to 7 years of age). They rated
124 'how much [their] father engaged in bringing [them] up', 'how much his leisure time he
125 spent with [her]' and 'how much emotional investment [they] received' from their father
126 on 1-9 Likert scales (see Appendix A for actual questions); all three scales were strongly
127 correlated (mean $r_s=0.708$, all $p<0.001$) and were averaged together to produce a single
128 Positivity to Father score. Women were divided by a median split into two groups: those
129 with lower Positivity scores ($n=25$) and those in the higher Positivity group ($n=24$).
130 Women were also asked to report whether their fathers had been absent from the family
131 home for periods during their childhood (responses were: never, sporadically, often for
132 long periods and often for short periods).

133

134 High versus low Positivity scores did not relate to participant's age ($t_{47}=1.327$),
135 frequency/duration of father's absences from the home ($\chi^2=5.975$, $df=3$) during daughter's
136 childhood, settlement of birth ($\chi^2=2.341$, $df=3$) or level of education ($\chi^2=8.241$, $df=6$; all
137 $p>0.1$). Both father and daughter reported whether father had had facial hair during her

138 childhood ('yes' or 'no'; which also did not relate to high or low Positivity ratings; beard:
139 $\chi^2=1.380$; moustache: $\chi^2=1.007$; both $df=1$, $p>0.1$).

140

141 The women were shown all 15 facial stimuli and asked to rate the faces for attractiveness;
142 the face they considered the most attractive (henceforth referred to as their Chosen Face)
143 was then selected. Where a participant had rated more than one face as the most attractive,
144 the mean of those faces' factor scores was calculated to give their 'Chosen Face' factor
145 scores. None of the factors, for father's face or for Chosen Face, correlated with
146 participant's age (all $p<0.1$, all $r<0.1$) with the exception of a trend for participant's age to
147 correlate negatively with father's factor 1 score ($r_{48}=-0.272$, $p=0.058$).

148

149 **3.0 Results**

150

151 *Similarity between father and Chosen Face.* Facial factors of fathers were correlated with
152 the Chosen Faces. When analysing all participants, there were no significant correlations
153 (all $p>0.1$, see Table 1). When daughters were split into two groups based on Positivity to
154 Father, those in the group with lower Positivity scores still did not show any significant
155 correlations (all $r_{24}<0.17$, $p>0.1$, see Table 1). However, those in the higher Positivity
156 group showed significant positive correlations between father's and Chosen Face's
157 proportions for Factor 1 ($r_{23}=0.551$, $p=0.005$; correlation remained if participant's age was
158 controlled for in partial correlations). Furthermore, when the correlation coefficients of the
159 two groups were compared using Fisher's z-score transformation, women in the high
160 positivity group showed a significantly higher correlation between fathers and chosen faces
161 for factor 1 than women in the lower positivity group ($z=2.537$, $p=0.016$). There were no
162 other significant differences in correlations (see Table 1).

163

164 *Differences between high and low Positivity women in chosen faces and fathers' faces.*
165 The facial factors of Chosen Face and father's face were entered as dependant variables
166 into a multiple ANCOVA where Positivity group of daughters was a between subjects
167 factor, and daughter's age was a covariate. There were no significant differences between
168 the two groups on any of the factors either for their father's facial dimensions, or those of
169 the faces they found most attractive (all $F_{1,44} < 1$).

170

171 TABLE 1 HERE

172

173 **4.0 Discussion**

174

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

183

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

190

191 The fact that the features which showed concordance between fathers and Chosen Faces
192 were related to the central section of the face may suggest that either the women in the
193 study paid most attention to this area of the face (it would be interesting to repeat this using
194 an eye-tracker), or perhaps this was the most distinctive aspect of the fathers' and/or the
195 stimuli faces. Alternatively, it may be that these areas of the face are least prone to change
196 over time (e.g. due to weight changes), and so only these areas of the fathers' faces (as
197 measured now) accurately reflect their facial proportions during their daughters'
198 childhoods.

199

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

211

212 Furthermore, measurements of the fathers' faces in the current study represent their present
213 facial features, rather than their features at the time of their daughters' childhood. It is
214 therefore not possible to determine whether the apparent imprinting effects seen here
215 occurred during early years, or whether fathers' faces continue to influence partner choice

216 into adulthood. Another development of this research therefore would be to conduct
217 longitudinal research in which parental faces are measured at the time of their children's
218 birth and those same children are later followed up in adulthood. This design would also
219 allow for prospective family relationship data to be gathered, which would further enhance
220 the quality of the research.

221

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261 evidence for Oedipal imprinting. *J Biosoc Sci*, 19, 157-161.

262

263

264 **Appendix A**

265

266 Questions asked regarding daughter-father relationship

267

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

274

275

276 **Tables and Figures**

277

278 Table 1. Factor structure of the facial proportion factors, and the correlations between
279 women's father and their chosen male faces on those factors.

280

281 Figure 1. Measurements taken of fathers' and stimulus faces.