

Facial and bodily correlates of family background

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It has been suggested that absence of the father during early childhood has long-reaching effects on reproductive strategy and development of offspring. This paper reports two studies designed to investigate the physical characteristics of daughters associated with father absence. Study 1 used a facial averaging method to produce composite images of faces of women whose parents separated during their childhood (who were ‘father absent’), women whose parents remained together, but had poor quality relationships and women whose parents were together and had good quality relationships. Images were then rated by male and female judges. Father absence and poor parental relationships were associated with apparent facial masculinity and reduced attractiveness in daughters. Poor parental relationships were also associated with reduced apparent health. Study 2 compared family background with body measurements and found that father absence or a poor quality relationship between parents were associated with body masculinity (high waist-to-hip ratio) and increased weight-for-height and adiposity. These results highlight the possibility of physical masculinization being associated with purported father absence ‘effects’.

Keywords: masculinity; father absence; facial attraction; health; waist-hip ratio

1. INTRODUCTION

It has been argued that parental relationships have profound implications for offsprings’ life histories (Draper & Harpending 1982). Father absence, that is absence of the father from the family home during childhood due to parental separation, has been shown to be associated with earlier menarche (e.g. Surbey 1990; Moffitt *et al.* 1992), earlier coitus and more teenage pregnancies (e.g. Ellis *et al.* 2003). Despite an extensive literature on the reproductive outcomes linked to family background, little attention has been paid to other physiological correlates. It may be, however, that the nature of the relationship between parents is also associated with other physical differences in offspring such as physical attractiveness.

Family background may relate to offspring attractiveness because of associations with health. Early family stress and father absence were associated with higher cortisol levels and greater levels of illness in offspring in a rural Dominican sample (Flinn & England 1997). In Western samples, parental divorce may also be associated with poor health outcomes in offspring (e.g. Maier & Lachman 2000). Given these associations between early family relationships and later offspring health, it may be predicted that women from father absent backgrounds or whose parents had a difficult relationship should appear less healthy, which should in turn reduce their attractiveness and lower their ‘mate value’.

Epel *et al.* (2000) showed that high cortisol reactivity is associated with high (i.e. masculinized) waist-to-hip ratio

(WHR). Given that Flinn & England (1997) also found childhood stress to be sometimes associated with high cortisol reactivity (cortisol levels rising rapidly in times of stress), father absence may also be associated with differences in body shape.

Father absence and early stress may also be associated with greater masculinization in offspring (which would be unattractive in females). Daughters of absent fathers may have a higher incidence of a gene coding for increased androgen sensitivity, which is associated with early menarche in women and absenteeism in fathers (Comings *et al.* 2002; although cf. Jorm *et al.* 2004).

Although there is at present very little research assessing the relationships between early family experience and later appearance, Waynforth (2002) found that, among the Mayan people of Belize, father absence was associated with increased craniofacial masculinity (cheekbone prominence and chin/jaw length, both relative to face height) in sons. Father absence may, therefore, also be associated with changed facial appearance in females.

The purpose of the present study was to investigate associations between daughters’ physical appearance and parental relationships (no attempt was made here to study the basis of associations in terms of genetic or environmental factors; it is only once relationships are established that causal mechanisms can be investigated). Study 1 assessed facial appearance, while Study 2 assessed bodily appearance. Both studies compared women with separated parents with women whose parents did not separate. The studies also compared measures of offspring characteristics with the quality of the relationship between married parents.

2. STUDY 1

Study 1 investigated the links between family background and rated masculinity, health and attractiveness in faces. Testosterone is related to facial masculinity, both in terms of craniofacial measurements (Verdonck *et al.* 1999) and

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Table 1. Summary of images used in stimuli.

parental status	batch	<i>n</i>	mean age
separated	1	15	22.50
	2	15	20.50
good relationship	1	15	21.65
	2	15	19.33
poor relationship	1	15	21.82
	2	15	20.70

rated masculinity (Penton-Voak & Chen 2004). Thus, rated facial masculinity can be considered to be a valid measure of masculinity. Similarly, rated facial health has been shown to relate to genotypes which purportedly contribute to immunity (Roberts *et al.* 2005) and to symmetry, which is an indicator of health (Jones *et al.* 2001).

(a) Initial data and image collection

Two independent cohorts of female Psychology students from a Scottish university (Batch 1, 2001–2002: $n=134$, mean age=21.62 years; Batch 2, 2002–2003: $n=95$, mean age=20.83 years) had standardized head-and-neck photographs (one smiling, one neutral) taken and, at the same time, completed questionnaires detailing background information. Subjects reported whether or not their parents had separated, when this separation took place and at what age they started menses. They were then given a 1–9 Likert scale and asked ‘Whether they lived together or not, how good was the quality of your biological parents’ relationship during your childhood (up until you reached puberty)?’ Although not a previously used scale, this measure relates inversely to insecure-avoidant scores on the adult attachment questionnaire (Boothroyd 2004). As a measure of socio-economic status, participants were asked to give postcode of first house, family income when they were born and to categorize family income during their childhood as being in the 1st, 2nd, 3rd or 4th population quartile. Only the latter of these, however, was consistently recalled by all participants; the former two measures were not answered sufficiently often to allow analysis.

(b) Stimuli

Separate composite facial stimuli were created from the two cohorts of female students. Composites were made of 15 Caucasian individuals reporting parental separation before they reached puberty (the latest separation occurring at 11 years of age), the 15 individuals with the highest parental relationship scores (i.e. those whose parents had a very high-quality relationship) and the 15 individuals with the lowest scores (those whose parents had stayed together but had a poor quality relationship). Summaries of the images used in composites are given in table 1.

Smiling and neutral versions of each stimulus were made. There were no significant differences between the parental status groups’ ages ($F_{2,86}=0.88$, $p=0.45$) or parental income brackets ($\chi^2(2)=3.75$, $p=0.19$).

Composites (averaging colour and shape of component face images) were made using the computer package Psychomorph, based on 179-point delineation. Average texture was computed using intensity wavelet analysis

(Tiddeman *et al.* 2001). All images were standardized to a size of 400×515 pixels. Composite facial images of Batch 1 females are illustrated in figure 1 (for colour version of figure 1 see the electronic supplementary material).

(c) Procedure

Judges, recruited through the laboratory website, followed a URL to the test site. Stimuli were presented singly using a java applet embedded into the html page. A Likert scale was presented beneath the images, running from 1 (very feminine) to 7 (very masculine), 1 (very unattractive) to 7 (very attractive) or 1 (very unhealthy) to 7 (very healthy). Judges were asked to click on the point of their choice, which triggered the presentation of the next face. Images were randomized on presentation order. Each dimension was tested in a separate trial block. Twenty-eight females (mean age=26.0) and 18 males (mean age=25.9) rated all the stimuli for masculinity/femininity and then rated them all for health. Twenty-three females (mean age=24.65) and 15 males (mean age=24.87) rated the stimuli for attractiveness.

(d) Results

Ratings were averaged together for all images within each parental separation category, producing one score per rate, per variable for females with separated parents, females whose parents had a good relationship and females whose parents remained together but had a poor quality relationship. All ratings were normally distributed (all Kolmogorov Smirnov $z<1.1$). Judge gender had no effect on the magnitude of the ratings given and did not interact with parental separation (all $F<1$), so male and female ratings were considered together.

(i) Attractiveness

Parental separation category related significantly to judges’ ratings of composite attractiveness ($F_{2,72}=11.71$, $p<0.001$). Planned comparisons showed that subjects rated the images of females whose parents had a good relationship as significantly more attractive than the images of those whose parents were separated ($t_{37}=2.03$, $p=0.05$), which were in turn rated as significantly more attractive than those whose parents remained together, but had a poor quality relationship ($t_{37}=3.30$, $p<0.01$).

(ii) Health

Parental separation also related to ratings of the health of the composites ($F_{2,84}=14.82$, $p<0.001$). Composites of women whose parents were separated and of women whose parents had a good relationship did not differ from each other ($t_{42}=1.52$, $p=0.14$), but both were rated as significantly healthier than composites of women whose parents remained together, but had a bad relationship ($t_{42}=3.93$, $p<0.001$; $t_{42}=5.87$, $p<0.001$; respectively).

(iii) Masculinity

Finally, parental separation category related to ratings of the femininity of the composites ($F_{2,84}=35.40$, $p<0.001$). Composites of women whose parents had a good relationship were rated as significantly more feminine than composites of both women whose parents had a poor quality relationship ($t_{42}=7.36$, $p<0.001$) and women

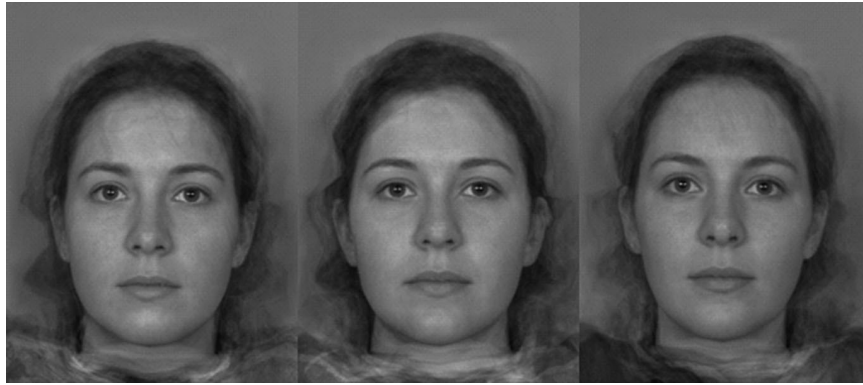


Figure 1. Batch 1 female composites (neutral expression). From left to right: separated parents, poor parental relationship and good parental relationship. For colour version see the electronic supplementary material.

whose parents had separated ($t_{42}=7.13$, $p<0.001$). Women whose parents separated and those whose parents had poor quality relationships did not differ from each other ($t_{42}=1.26$, $p=0.22$).

(e) Discussion

These data showed that separation of a woman's parents during her childhood are associated with decreased apparent facial femininity and reduced facial attractiveness (see table 2 for a summary). Perception of poor marital relations between parents during childhood, even for parents who remained together, is also associated with an increase in apparent masculinity and with a reduction in apparent health and attractiveness in daughter's faces. These results are concordant with Waynforth's (2002) data regarding the link between father absence and craniofacial masculinity in Mayan men.

Although it could be suggested that a masculine appearance might be due to accelerated maturation (since facial masculinity and maturity are closely related: Boothroyd *et al.* 2005), there were no differences between the groups on age of menarche ($F_{2,87}=0.08$, $p=0.93$). In this sample, therefore, neither parental separation nor early family stress appears to relate the speed of maturation. This is perhaps unsurprising as most studies reporting significant effects use large sample sizes—ranging from the hundreds to thousands of participants.

3. STUDY 2

Where Study 1 had assessed masculinity and healthiness through rated facial appearance, Study 2 was concerned with body shape and composition in relation to childhood background. Waist size is sexually dimorphic and is related negatively to oestrogen levels (Jasienska *et al.* 2004) and positively to testosterone levels (Ibanez *et al.* 2003). Relative measures of waist size (WHR and waist-chest ratio (WCR)) can therefore be regarded as measures of bodily masculinity/femininity.

Body composition is related to healthiness and attractiveness—in that slimmer women with low body-mass index (BMI: kg m^{-2}) have more attractive bodies than other women (Tovee *et al.* 1999), and having a BMI outside of the range 20–25 can have negative health implications. Similarly, high levels of body fat are unhealthy (depending on topography); the National

Table 2. Summary of comparisons between composites.

attractiveness	good relationship > separated > poor relationship
health	good relationship = separated > poor relationship
masculinity	good relationship < separated = poor relationship

Institutes of Health defines 30% body fat in women as obese.

(a) Method

Eighty-seven females (mean age=19.88 years; range=17–23) from Batch 2 of Study 1 had further physical measurements made at the time of the photograph being taken. Each subject's height, waist, hip and chest (around the ribs *not* the breasts) were measured using a measuring tape. Weight and 'impedance' (a measure of percentage body fat, estimated from resistance to mild current flow through the body) were assessed using electronic scales. The dependent variables calculated were WHR, WCR and BMI. Impedance was also used as a dependent variable. Subjects also rated their own attractiveness on a 1–7 Likert scale.

(b) Results

The four physical measures were all significantly positively related to each other (all $r>0.34$, $p<0.001$; except impedance and WHR: $r_s=0.23$, $p<0.05$). Neither self-rated attractiveness nor participant's age related to any of the body shape/composition measures and parents' relationship did not relate to age of menarche, self-rated attractiveness or parents' income bracket (see table 3 for values).

Across all participants (with and without separated parents), the rated quality of parents' relationship was significantly negatively related to WHR ($r_s=-0.24$, $p<0.05$), WCR ($r_s=-0.28$, $p<0.01$), BMI ($r_s=-0.28$, $p<0.05$) and impedance ($r_s=-0.29$, $p<0.05$).

In order to allow for tests of the relationship between parental separation and age of menarche, subjects were split into those whose parents separated before they reached 12 years old ($n=12$), those whose parents were reported to have had a very good relationship (rated 9, $n=26$) and those whose parents were reported to have had a less good relationship (rated 1–6, $n=21$). Those whose parents had separated had higher BMI and higher WCR

Table 3. Inter-correlations of body shape and composition measures and self-rated attractiveness. (All $n=87$, unless correlation with impedance where $n=86$.)

	impedance	WHR	WCR	self-rated attractiveness	quality of parents' relationship
BMI	0.66 ^c	0.35 ^b	0.50 ^c	-0.13	-0.26 ^a
impedance		0.19 ^d	0.38 ^c	0.05	-0.27 ^a
WHR			0.40 ^c	0.09	-0.27 ^a
WCR				0.07	-0.28 ^b
self-rated attractiveness					-0.11

^a $p < 0.05$. ^b $p < 0.01$. ^c $p < 0.001$. ^d $p = 0.087$.

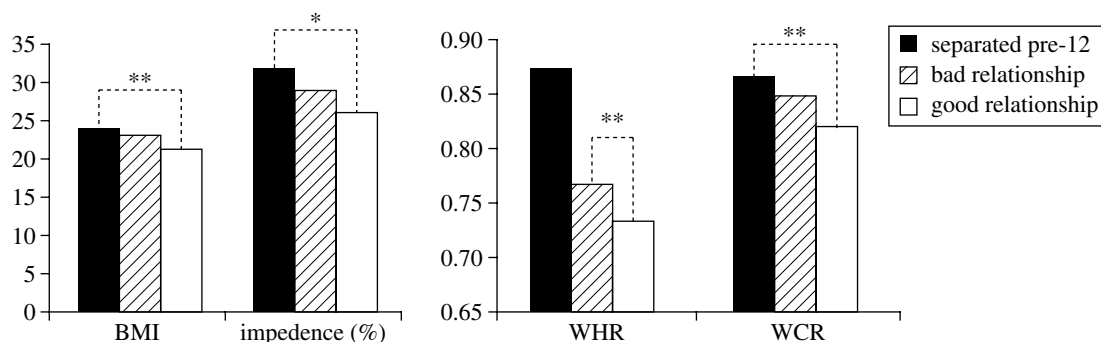


Figure 2. Relationships between type of parental relationship and body mass index (BMI), impedance (% body fat), waist–chest ratio (WCR) and waist–hip ratio (WHR) respectively. Broken lines show Tukey's HSD: ** $p \leq 0.05$, * $p \leq 0.06$.

(i.e. a larger waist compared to the chest) and a marginally higher impedance score (i.e. had a greater proportion of body fat) than those whose parents had a good relationship, (BMI: $F_{2,54} = 4.16$, $p < 0.05$; WCR: $F_{2,54} = 3.37$, $p < 0.05$; impedance: $F_{2,54} = 2.83$, $p = 0.07$). Figure 2 shows the means for all groups and the results of *post-hoc* Tukey's HSD tests. Those whose parents were reported to have had a poorer relationship had higher WHRs than those whose parents had a good relationship; daughters of separated parents did not differ from either group ($F_{2,54} = 4.88$, $p < 0.05$). The three groups did not differ on current age ($F_{2,54} = 1.05$, $p = 0.36$) or age of menarche ($F_{2,54} = 0.46$, $p = 0.63$). There was a marginal difference in self-rated attractiveness ($F_{2,54} = 2.50$, $p = 0.09$), with those with separated parents having marginally higher ratings than those whose parents had a good relationship (Tukey's HSD $p = 0.09$).

(c) Discussion

These results show that differences in physique are associated with childhood background. Parental separation was associated with increased adiposity and weight. Participants' recall of the quality of parents' relationship (whether married or not) was associated with physique, in that the higher the reported quality of the parents' relationship, the smaller the waist in relation to both hips and torso, the lower the weight relative to height and the lower the level of adiposity. These results are unlikely to be the result of differing rates of maturation and biological ageing, as reported parental relationship did not relate to age of menarche. Furthermore, reported quality of parents' relationship did not relate to daughter's self-rated attractiveness and thus differences in body shape do not appear to have produced or reflected differences in body esteem (although as self-rated

attractiveness did not relate to body shape measures, this could be a methodological weakness of the general self-rated attractiveness question).

The relationships between parents' reported relationship and WHR and WCR are concordant with the data in Study 1 and show that lower quality of parents' marriage and parental separation is associated with body masculinity as well as apparent facial masculinity.

4. GENERAL DISCUSSION

Overall, these studies strongly suggest that the status and quality of parental relationship is associated with later physical development of daughters. Parental separation and/or recall of poor parental relationships are associated with increased apparent facial masculinity and body masculinity and decreased apparent facial health. These results are concordant with previously published data, which found links between family background and actual health (Maier & Lachman 2000) and between father absence and son's facial masculinity (Waynforth 2002), and with research suggesting father absence is possibly related to androgen receptivity in daughters (Comings *et al.* 2002).

The increased apparent masculinity and decreased facial attractiveness among females from father absent or reportedly disharmonious marital backgrounds have important implications for the understanding of father absence and reproductive outcomes. Less attractive women and women with larger waists show reduced preferences for male symmetry and masculinity in facial attraction tests (Little *et al.* 2001; Penton-Voak *et al.* 2003). This choice may be due to an inability for lower quality women to acquire higher quality long-term partners, as there was no such difference when asked to choose a short-term partner. Less attractive women may

find that they must compromise on partner quality or engage in short-term relationships where no compromise is necessary. Ergo, the short-term strategy which is believed to be associated with father absence may in fact be due to such women being more likely to adopt a short-term strategy in compensation for reduced competitiveness. (We might also expect to see a change in long-term mate preferences associated with disharmonious parental backgrounds). The fact that women whose parents were separated or who recalled their parents' relationship less positively did not view themselves as less attractive than women from harmonious backgrounds suggests that parental influences on sexual strategy do not have to be mediated by self esteem or operate consciously.

It is important to note that this study cannot distinguish between the possible environmental and hereditary influences underlying the relationships between family background and physical development. There are several ways in which health of offspring might be linked to parental relationship. Family stress may negatively impact on offspring health via the immunosuppressant effects of cortisol or high-stress families may have less healthy lifestyles. Alternatively, heritable parental health may influence both offspring health and parental marital relations. Finally, less healthy children may be a catalyst for difficult relationships between parents.

High childhood stress may cause masculinization in offspring, but it is perhaps more likely that the quality and nature of the parents' relationship are determined by parental hormone levels or hormone sensitivity, which are in turn passed on to offspring. For instance, Comings *et al.* (2002) found that the GGC repeat polymorphism of the androgen receptor gene (associated with father absence in women) was associated with higher aggression and more sexual partners in men. An inherited increased sensitivity to androgens might also explain the tendency of father absence to be associated with higher levels of aggression and delinquency in offspring (although the relationship between father absence and other behavioural and personality measures of masculinity is complex: see Stevenson & Black (1988) for a meta-analysis). Although androgenization is likely detrimental to the mate value of women, it is likely to enhance the mate value of men. A link between father absence and androgenization may provide a selective advantage due to sons becoming more masculine and perhaps more successful in intra-sexual competition or having greater reproductive success in unstable environments. Further research incorporating wider family membership should investigate this possibility.

Previous research into father absence (albeit extensive) has concentrated on reproductive behaviour and social and cognitive development and for the most part has investigated only one physical correlate (age of puberty). This research has highlighted the importance of considering the possible associates of father absence and parental relationships in other aspects of physical development. Further research is essential in order to determine the underlying causal mechanisms at work and the potential adaptive significance of this phenomenon.

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