

Original Article

Sexual Imprinting on Facial Traits of Opposite-Sex Parents in Humans

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Abstract: Positive sexual imprinting is a process by which individuals use the phenotype of their opposite-sex parent as a template for acquiring mates. Recent studies in humans have concluded that an imprinting-like mechanism influences human mate choice in facial traits. However, some of the previous studies have had methodological problems or flaws which might have invalidated or led to an overgeneralization of the original interpretation of their results. In this study, 70 heterosexual adults were used to test if their partners resembled facially their opposite-sex parent as the sexual imprinting hypothesis predicts. Judges assessed the subjective facial similarity between each participant's partner and their parent. We found that there was no perceived facial similarity between women's partners and their fathers. However, men tended to pair more often with women that were perceived as resembling the men's own mothers. In contrast to previous studies, the quality of the relationship between participants and their parents did not predict the level of facial resemblance between the participant's spouse and their parent.

Keywords: assortative mating, facial resemblance, sexual imprinting, homogamy

Introduction

Positive sexual imprinting has been defined as a sexual preference for individuals possessing the characteristics of one's parents (Pfaus, Kippin, and Centeno, 2001). It is said to be a result of acquiring sexual preferences via exposure to the parental phenotype during a sensitive period in early childhood. Since the first works of Konrad Lorenz, sexual imprinting has been examined experimentally in fish (e.g., Schielzeth, Burger, Bolund, and Forstmeier, 2008), birds (e.g., ten Cate, Verzijden, and Etman, 2006), and mammals (e.g., Kendrick, Hinton, and Atkins, 1999; Penn and Potts, 1998). It has been found that, during pair formation, adults tend to prefer sexual partners of the species that gave them parental care when young rather than other adults of their own species (Immelmann, Prove, Lassek, and Bischof, 1991; ten Cate et al., 2006).

Sexual imprinting

Likewise, studies using novel or artificially exaggerated ornaments in birds have found positive sexual imprinting on these ornaments (ten Cate and Bateson, 1989). Early research seemed to show that imprinted preferences are life-long, however more recent studies suggest that sexual preferences in cross-fostered individuals might depend upon the first courtship with a mate from the same or cross-fostered species, and that the process of imprinting might have two stages that influence the magnitude of long-lasting effects: (1) acquisition and (2) consolidation (Bischof and Clayton, 1991; Oetting, Prove, and Bischof., 1995). Thus, sexual imprinting might not be fixed during adolescence, as previously thought, and may change as a result of social experiences (as found by Oetting and Bischof, 1996).

Although positive sexual imprinting affects species recognition and preference between color morphs or novel ornaments, these have been tested as categorical variables; to our knowledge there is only one cross-fostering experiment on non-human animals that tested the role of sexual imprinting on continuously variable traits. Schielzeth et al. (2008) cross-fostered female zebra finches, *Taeniopygia guttata*, and subsequently gave them a choice between unfamiliar mates, one of which was a genetic son of their foster parents. They found that cross-fostered females demonstrated neither significant avoidance nor preference towards the genetic sons of their foster parents. Additionally, it has been shown in birds that a conspecific sexual preference can occur in individuals that have not socialized with any other individual. This result would suggest that animals have an innate conspecific sexual preference and sexual imprinting merely refines this bias in natural conditions (e.g., Gallagher, 1977).

Although previous research suggests that positive sexual imprinting plays an important role in species recognition (Hansen, Johannessen, and Slagvold, 2007) and in preferences for novel ornaments in zebra finches (Witte and Caspers, 2006), it remains possible that it does not affect mating preferences for traits that display the whole span of possible variations in natural circumstances (Schielzeth et al., 2008). Thus, more studies testing the role of sexual imprinting on continuously variable traits within the same species are needed before any generalization can be made.

In humans, there is some evidence for positive assortative mating according to parental hair and eye color (Laeng, Mathisen, and Johnsen, 2007; Little, Penton-Voak, Burt, and Perret, 2003; Wilson and Barrett, 1987), which simply means that the hair and eye colors of sexual partners correlate positively with the hair and eye colors of parents. Moreover, it has been reported that the effect of the opposite-sex parent is significantly stronger than the same-sex parent in predicting both the hair and eye colors of actual partners (Little et al., 2003). Little and colleagues suggested that their study supported an “imprinting-like” (analogous to “social learning”) effect on mate choice. Two groups of researchers have found slight correlations between the ages of women’s actual partners and their parents (Wilson and Barrett, 1987; Zei, Astofli, and Jayaker, 1981) and this effect is supported by a study using computer-graphic digitally modified faces (Perrett et al., 2002). Although the methods used for these studies were robust, the association between parental hair and eye color and human mate choice may have alternative explanations, such as heritable preferences, that would affect results of the positive sexual imprinting (see Rantala and Marcinkowska, 2011).

Berezkei, Gyuris, Koves, and Bernath (2002) tested the positive sexual imprinting hypothesis on facial traits in humans by measuring the resemblance of married women to their mothers-in-law. Participants were reported to have correctly matched the wives to their mothers-in-law at a significantly higher rate than expected by chance. Berezkei continued his research in the same field by studying the sexual preferences of married women who were adopted as children. He asked judges to rank the similarity between pictures of a woman's adoptive father, her husband and three randomly chosen controls. The facial photos of husbands and adoptive fathers resembled each other significantly more than expected by chance (Berezkei, Gyuris, and Weisfeld, 2004). Another study correlated facial measurements taken from people from the same family, and then compared that data with measurements taken from randomly selected individuals from the same population (Berezkei, Hegedus, and Hajnal, 2009). It was concluded that the study supported the positive sexual imprinting hypothesis. However, after the external expert appointed by the journal identified errors in the data analysis (which could have altered the results of the research), the authors decided to retract the article (see Berezkei et al., 2009; retraction and publishers note); hence its results should not be taken into further discussion.

To test the role of sexual imprinting on actual mate preferences, Wiszewska, Pawlowski, and Boothroyd (2007) compared the facial traits of men to the preferences for male facial traits of their daughters. They found that women who had a good relationship with their fathers as children showed a stronger preference in other men for some of the characteristics of their father's face, compared with women who had negative or neutral relationships with their fathers. However, again, the results of this experiment may be difficult to interpret because the authors excluded the majority of average stimuli faces (Wiszewska et al., 2007, p. 249). The effects of sexual imprinting on facial preferences that were found in this study were thus only present in a subset of the original data, which was not randomly selected; as average faces were excluded, only more extreme characteristics of faces were presented. A broader data set may have altered the results and conclusions of the paper, especially if women preferred faces close to the population mean. Based on this paper, then, it seems that there is evidence for positive sexual imprinting for human facial traits in faces that deviate from the average, but it is unclear to what extent this is generalizable. What is more, Zietsch and colleagues, in a recent study on twins, found no effects of sexual imprinting in any of their examined traits and near zero genetic influence on mate choice (Zietsch, Verweij, Heath, and Martin, 2011). It was suggested that partner similarity was based rather on assortative mating.

The aim of this study was to test the sexual imprinting hypothesis by measuring the facial resemblance between participants' spouse's faces and that of their opposite-sex parents. We based our methods of the retracted study of Berezkei et al. (2009), on a data set of long-term white Caucasian couples currently living in southern Poland. We also used this data set to investigate the impact of the quality of child-parent interactions on positive sexual imprinting. Following other authors (e.g., Schmitt et al., 2012), we see value in replication and re-evaluation of hypotheses with different methods and in different populations.

Materials and Methods

Participants

The participants were from 70 families. From each family, we used three people: a participant, the participant's partner, and the participant's opposite-sex parent. In total, we used 210 volunteers, aged between 18 and 66 years ($M = 24.78$, $SD = 3.73$). The participants had to have been in a relationship with their current partner for at least six months ($M = 3.78$ years, $SD = 3$ years). The mean age of male participants was 25 years ($SD = 4.05$); for female participants it was 24.6 years ($SD = 3.35$). There were 37 females and 33 males. Individuals were unsystematically chosen, all white, Caucasian, heterosexual couples. We recruited them using several methods: Internet forums, leaving invitations to take part in the research on the information desks in the universities, asking people opportunistically encountered on the university campus in Cracow, and, finally, by asking participants to forward the information about the research to their acquaintances.

Two digital photographs were taken of the face of each participant, spouse and parent: one from the front and one of the profile. Photos were taken with different cameras, but with the same settings (i.e., same size of the picture, time of exposure, and brightness control). It was not necessary to take all profile pictures from the same side, because reference points were marked to the profile line. Each participant was asked to stand still and to look straight ahead or directly into the camera, which was placed at eye level. In total, 420 pictures were taken by five different photographers who were instructed how to take the pictures and followed similar procedures. All pictures were standardized in size and resolution. Pictures of partners and family members were usually taken on different occasions and in different places, hence there was no consistency between them in terms of their physical context (e.g., lighting, color, and shading).

Facial Similarity Ratings

For each participant, we presented a tableau of five color, frontal, facial photographs in a similar manner as used in previous papers (e.g., Berezkei et al., 2002, 2004). They displayed on the left-hand side the picture of the participant's opposite-sex parent identified by a number. On the right-hand side there were four photographs of three individuals of the partner's age taken from the control group and a photograph of the actual partner of the participant. The control group was created by gathering individuals from southern Poland, unsystematically asking students on the campus. They did not know the individuals approached. The age of control group individuals, 18 to 30 years old, was in the same range as the age of the participants. Each of the four pictures of potential partners was marked with a single letter from A to D. We chose to present four pictures from the participant's control age group. This is because a parent is a fixed stimulus presented throughout the individual's sensitive phases as an individual grows, whilst a partner is hypothesized to have been chosen based upon that stimulus. Opportunistically chosen judges from southern Poland (i.e., other students from the campus and people encountered in the street; $n = 120$), were asked to rate the faces coded A to D on their similarity to the numbered, opposite-sex parent's face on a scale from 1 (not at all similar) to 10 (extremely similar) (see Berezkei et al., 2009). The tableaux of five pictures were shown to each

judge in a randomized order. Judges neither knew, nor recognized, the presented individuals.

Questionnaires

Each participant completed two questionnaires in the Polish language. The first questionnaire was a shortened form of the EMBU questionnaire – Swedish acronym for “My memories of upbringing.” It measures relations between the parent and child during the first ten years of his/her life (Arrindell et al., 1999), which is a standardized method for the assessment of an adult’s perception of their parents’ rearing behavior. This questionnaire was translated independently by two Polish native speakers with CAE Cambridge certification, and their versions were consistent. The second questionnaire consisted of general questions about demographics and personal information about the participant and his/her parents and partner.

Data Analyses

Since Kolmogorov–Smirnov analysis revealed that the data on ratings of facial resemblance were not normally distributed we transformed the data by taking the log (base 10), after which the data were normally distributed. Thus, we used parametric tests to compare facial resemblance between opposite sex parent with mate and controls. Since EMBU scores were not normally distributed and we were not able to transform it, we used non-parametric correlations between EMBU scores and facial resemblances. All statistical tests were performed with PASW Statistics 18 software and all tests were two-tailed.

Results

Mothers were subjectively rated to be more similar to their daughters-in-law than controls on average, $t(30) = 2.84$, $p = 0.008$, whereas fathers were not more similar to their sons-in-law than controls on average, $t(37) = 0.94$, $p = 0.356$ (see Figure 1). Thus, it seems that men tend to pair with women who resemble their mother more likely than we would expect by chance, but women do not tend to pair with men who resemble their father. We also found that mothers were rated as more similar to their daughters-in-law than fathers were to their sons-in-law, $t(67) = 2.044$, $p = 0.045$, which may be suggesting that people are significantly better at seeing resemblance in mothers/daughters-in-law than in fathers/sons-in-law.

To test if the quality of the relationship between a participant and his/her parent had any effect on the facial resemblance between the spouse of participant and their parent, we tested whether facial similarity rating correlated with EMBU scores. The EMBU questionnaire provided us with three main factors influencing parent-child relations: rejection, emotional warmth, and over-protection. However, none of the factors in either sex correlated with facial similarity ratings (see Table 1).

Figure 1. Log10 transformed facial resemblance (\pm SE) assessed by randomly chosen raters (of both sexes) between the partner, control and participant's opposite-sex parent

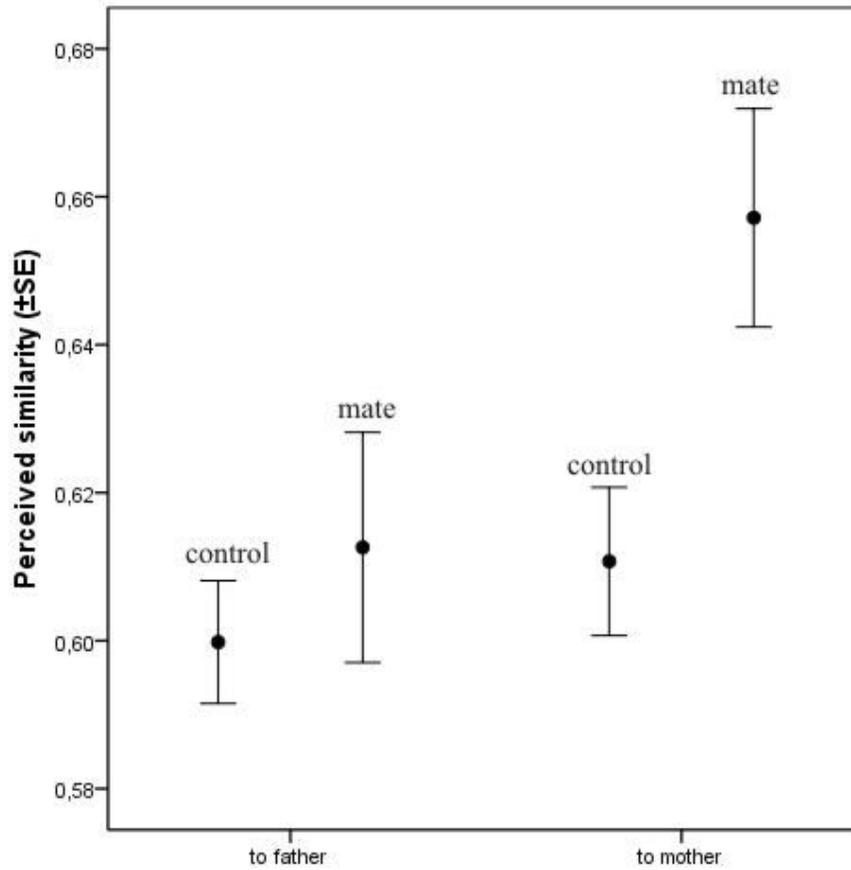


Table 1. Correlations between facial similarity ratings and EMBU scores

	Partner-father ($n = 37$)		Partner-mother ($n = 33$)	
	r_s	p	r_s	p
Rejection	-0.148	0.376	0.016	0.933
Emotional warmth	-0.029	0.864	0.157	0.399
Over protection	-0.095	0.569	-0.073	0.697

Discussion

Our study was designed to test for facial resemblances between spouses and opposite-sex parents as predicted by the sexual imprinting hypothesis. We found that men tend to pair more often with women that facially resemble their mothers than expected by chance. In contrast, judges were not able to see facial similarity between fathers and their

sons-in-law. Interestingly, the quality of the relationship between a participant and their parent was not associated with facial resemblance between the spouse of the participant and their parent. Thus, our results support only partly those of Bereczkei et al. (2002, 2004) who found that good parental relationships were associated with higher similarity ratings between opposite-sex parents and spouses (for possible explanations of lack of correlation, see Rantala and Marcinkowska, 2011).

Furthermore, our study is not consistent with the mathematical model of Tramm and Servedio (2008), who found that imprinting may depend on the level of engagement of the parent in rearing offspring (i.e., if the mother is the one providing care, maternal imprinting should be stronger, and vice versa for the father). It is possible that the pattern we found is the result of positive sexual imprinting on facial traits of the opposite-sex parent, but since the relationship with the mother did not predict the facial resemblance between mother and spouse, our study suggests that facial resemblance might also be the result of heritable components for facial preferences. Unfortunately, in our study we were not able to rule out genetic effects or preferences for self-similarity because we did not include adoptive families. However, if the facial similarity between fathers and their sons-in-law were so weak that raters were not able to see it, it is unlikely that in adopted families the similarity would be any higher. In addition, our study does not support the finding of Wiszewska et al. (2007) who claimed that women who had a good relationship with their father as a child showed a stronger preference in other men for some characteristics of their father's face. It does not support either the results of Watkins et al. (2011), who found a positive correlation between women's preferences for self-resemblance in opposite-sex (but not same-sex) individuals and reported emotional closeness to their fathers. Watkins et al. (2011) examined reported emotional closeness based on only 1 item; however, this should be sufficient to depict parental support (e.g., Hall, 2009) and hence should not be the cause of our discrepant results. The cause of divergence might lay in the fact that Watkins et al. (2011) correlated parental support with self-similarity, not with the actual partner – opposite sex parent similarity (which as variables are not unequivocal).

Another factor that might explain the differences in sexual imprinting between males and females is the Westermarck effect. It is known that individuals do feel sexual aversion and tend not to bond with other individuals that were raised in the same peer or family group (e.g., Bixler, 1981; Blouin and Blouin, 1988). It has been also shown that this aversion is stronger for women than men (Walter and Buyske, 2003). In females, weaker sexual attraction towards co-socialized individuals would support Trivers' (1972) parental investment theory, which states that females should show greater inbreeding avoidance than males because of the greater costs they suffer as a consequence of inbreeding depression. As inbreeding-avoidance would be a factor that suppresses possible sexual imprinting for parental traits, then the weaker inbreeding avoidance is, the stronger the sexual imprinting. In other words, in females showing strong inbreeding avoidance, sexual imprinting should be less visible, as it is suppressed more. Our data support this hypothesis.

It is noteworthy that among all animals, including humans, the actual state of pairing does not always reflect the exact preferences of an individual. Competition to form partnerships and many other socio-cultural constraints may prevent individuals from pairing with people that bear their preferred traits (Burley, 1983). In previous research, the

traits of partners were interpreted as identical with individual preferences, although it might be that partners are the most preferred individuals from those that are available. Thus, it might be misleading to base a template of preferences on the actual mate of the individual, whilst ignoring the constraints of human mate choice. Additionally, as individuals within a culture often have, on average, a common perception of what is physically attractive in the opposite-sex, attractiveness may signal good genes (see Roberts et al., 2005; Rantala et al., 2012), and a perception of certain facial qualities as attractive may have evolved as an adaptation to the problem of choosing a high-quality mate (Buss and Schmitt, 1993). Consequently, as attaining a high quality mate should enhance our fitness, it may be adaptive to mate with high quality mates for all females, despite their own self-perception, actual social position, etc. Hence the preferences of the majority of females would be similar, with little apparent variance, regardless of parental features. This also might explain why we did not find facial similarity between fathers and their sons-in-law.

In this study we retested Bereczkei et al.'s (2009) hypothesis with a more robust methodology. Although their study was criticized, our results suggest that there may indeed be facial similarities between spouses and their opposite-sex parents in men, as Bereczkei et al. (2009) suggested. However, the effects we observed were substantially weaker than the ones reported in previous studies. Furthermore, we did not find any support for previous findings that good parental relationships were associated with higher similarity ratings between opposite-sex parents and spouses. Since we did not use adoptive families in our experiment, we were not able to say whether the pattern was a result of heritable preferences or sexual imprinting.

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