Evolution and Human Behavior 37 (2016) 21–28

Contents lists available at ScienceDirect

Evolution and Human Behavior

journal homepage: www.ehbonline.org

Original Article

Experiences during specific developmental stages influence face preferences

Tamsin K. Saxton *

Evolution, Perception & Behaviour Research Group, Psychology Department, Northumbria University, Northumberland Building, Ellison Place, Newcastle, NE1 8ST

ARTICLE INFO

Article history:
Initial receipt 30 August 2014
Final revision received 18 June 2015

Keywords:
Attraction
Development
Face preferences
Imprinting
Mate choice
Sensitive period

ABSTRACT

Much research has documented how people's face preferences vary, but we do not know whether there is a specific sensitive period during development when some individual differences in face preferences become established. This study investigates which specific developmental phases may be instrumental in forming individual differences in face preferences in adulthood. The study design is based on the established finding that people tend to be attracted to facial features that resemble those of their other-sex parent, particularly if they report a close childhood relationship with that parent. Accordingly, if individual differences in adult facial preferences (specifically, preferences for faces that resemble one's parents) are formed during specific developmental stages, then only the quality of the parental relationship in those stages should predict adult preferences for facial features that resemble one's parents. Heterosexual women reported the emotional support received from their parents during three different developmental phases and at the current time, and they reported the hair and eye colour of their ideal and actual partner, and their parents and selves. The study found that a woman's retrospectively reported greater emotional support from her mother or father after menarche predicted significantly stronger preferences for partners whose eye colour was closer to that of the parent. In contrast, emotional support prior to menarche predicted greater dissimilarity between the eye colour of the parent and a woman's preferred partner. These results indicate a possible interplay of positive and negative sexual imprinting that may arise from adaptations to promote optimal outbreeding. The study also found that parental hair colour, and in particular maternal hair colour, predicted women's preferences for hair colour in a partner, although this may have been driven by ethnic group matching. The results of the study suggest that experiences during specific childhood and adolescent developmental periods may have longstanding effects on individual differences in human facial preferences.

1. Introduction

A basic attraction to faces is apparent from birth, and face preferences develop progressively across infancy, childhood and adolescence. Neonates and older infants spend more time looking at attractive than unattractive faces (Langlois, Ritter, Roggman, & Vaughn, 1991; Samuels, Butterworth, Roberts, Grauper, & Hole, 1994; Slater et al., 1998; Slater et al., 2000). Children as young as four or five years of age agree with adults explicitly about which people are attractive (Boothroyd, Meins, Vukovic, & Burt, 2014; Cavior & Lombardi, 1973; Kissler & Bäuml, 2000). Adults tend to prefer faces that are healthy in appearance, symmetric, and representative of the population average (Rhodes, 2006; Roberts & Little, 2008), and these preferences emerge during childhood. Children judge faces with more cues to health as more attractive from around age 6 to 8 (Boothroyd et al., 2014). Facial symmetry is preferred by infants aged around 12–24 months (Griffey & Little, 2014) (but not by younger infants; Rhodes, Geddes, Jeffery, Dziurawiecz, & Clark, 2002), and children select the more symmetric face as more attractive from about age 9 (Boothroyd et al., 2014; Saxton, DeBruine, Jones, Little, & Roberts, 2009a; Saxton, DeBruine, Jones, Little, & Roberts, 2011; Saxton et al., 2010). Infants look preferentially at averaged compared with unattractive faces (Rubenstein, Kalakanis, & Langlois, 1999), but do not look preferentially at averaged over less average faces (Griffey & Little, 2014; Rhodes et al., 2002), while explicit preferences for facial averageness seem to emerge from about age 9 (Boothroyd et al., 2014; Saxton et al., 2009a; Saxton et al., 2010; Saxton et al., 2011). Facial sexual dimorphism (i.e. masculinity and femininity) also influences adult face preferences (Rhodes, 2006; Roberts & Little, 2008). Differences in the sexual dimorphism of facial stimuli affect looking duration of infants aged 12–24 months (Griffey & Little, 2014) and give rise to age-linked changes in explicit attractiveness judgements across the life span (Boothroyd et al., 2014; Little et al., 2010; Saxton et al., 2009a). In sum, many standard adult facial attractiveness judgements are becoming apparent within the first decade of life.

Experiences with faces also shape individual differences in face preferences. For example, children's experiences in seeing their peers' faces, and in viewing adults' faces more frequently from a lower

* Corresponding author. Tel.: +44 191 227 4486.
E-mail address: tamsin.saxton@northumbria.ac.uk.

http://dx.doi.org/10.1016/j.evolhumbehav.2015.06.001

perspective, shape the kind of face proportions that they find most attractive (Cooper, Geldart, Mondloch, & Maurer, 2006). Similarly, experience in a single-sex school environment or with other-sex siblings has been linked to variation in preferences for faces that have typically male or female facial proportions (Saxton, Little, DeBruine, Jones, & Roberts, 2009b). The outcomes of some developmental experiences persist in adult face preferences. Adults tend to be attracted to physical features that bear resemblance to those of their parents. For example, people choose partners, and are attracted to faces, that show some facial resemblance to their other-sex parent (Bereczkei, Gyuris, Koves, & Bernath, 2002, Bereczkei, Gyuris, & Weisfeld, 2004; Marcinkowska & Rantala, 2012; Wiszewska, Pawlowski, & Boothroyd, 2007; see also Fraley & Marks, 2010; but see Nojo, Ihara, Furusawa, Akamatsu, & Ishida, 2011, Nojo, Tamura, & Ihara, 2012). This phenomenon has also been tested in adopted women, who were found to have chosen marriage partners who tended to resemble their adoptive father (Bereczkei et al., 2004), suggesting that the entire phenomenon cannot be explained as arising from heritable preferences, nor from preferences for faces that resemble the self (as biological offspring resemble their father). Men and women are more likely to couple up with someone from the same race and culture, or with the same hair and eye colour, as their parents and particularly their other-sex parent (Jedlicka, 1980; 1984; Little, Penton-Voak, Burt, & Perrett, 2003; Wilson & Barrett, 1987). People with older parents, compared with people with younger parents, have older partners and have stronger preferences for partners with an older facial appearance (Heffernan & Fraley, 2013; Perrett et al., 2002; Wilson & Barrett, 1987; Zei, Astolifi, & Jayakar, 1981). Similarly, the amount of body hair on a woman's partner and father were found to be correlated, and a woman's preference for body hair correlated with the hairiness of her father (Rantala, Polkki, & Rantala, 2010); a woman's partner and father were found to have similar levels of facial hair (Dixson, Tam, & Awasthy, 2013); and the height of an individual's other-sex parent predicted their individual preferences for the height of an ideal partner (Seki, Ihara, & Aoki, 2012). Further, these preferences for faces that resemble one's other-sex parent are stronger when people report that they had a good relationship with their parent in childhood (Bereczkei et al., 2002; 2004; Wiszewska et al., 2007; see also Kocsor, Gyuris, & Bereczkei, 2013; Vukovic, Boothroyd, Meins, & Burt, 2015; Watkins et al., 2011; but see Marcinkowska & Rantala, 2012; Nojo et al., 2012).

However, we do not know when variation in adult preferences for parental features is acquired. Many fundamental human behaviours are shaped during sensitive periods (see e.g. Knudsen, 2004). In non-human animals, sensitive periods for the development of species-typical mate preferences have been demonstrated through cross-fostering experiments (review in e.g. Bischof, 1994). Despite this, it is not yet clear whether human adult face preferences rely on exposure during particular developmental periods. Children aged three to six with a more secure attachment to their parents had stronger preferences for fictional playmates who resembled their father (Kocsor et al., 2013), but infanthood attachment did not predict 9-year-olds' facial attractiveness judgements of parent-similar faces (Vukovic et al., 2015). Nine-year-olds with less rejecting parental relationships were more likely to judge parental-similar faces as more attractive (Vukovic et al., 2015), but we should not necessarily expect those judgements to persist unchanged into adulthood. Expression of sensitive-period behaviours during the acquisition or consolidation phase may be different from their expression in the adult phase (e.g. Marler & Peters, 1982a, 1982b).

A reasonable hypothesis is that face preference formation might be tied to processes and phases related to reproduction, because facial preferences exist in part to support adaptive partner choice and attendant reproductive consequences (Rhodes, 2006; Roberts & Little, 2008). Accordingly, the current study investigated whether the formation of individual differences in adult facial preferences takes place within particular reproductively-relevant phases of development. It made use of the finding that people's preferences for faces that resemble their parents are moderated by the quality of their relationship with that parent. Thus, if the relationship quality during only some phases of development predicts adult preferences for faces that resemble one's parents, then this would suggest that only those phases of development are instrumental in the acquisition of adult preferences for faces that resemble one's parents.

The study examined the relationship between heterosexual women's retrospectively reported emotional support received from their parents during four different lifespan phases, and the similarity between the hair and eye coloration of their parents and partners. The first developmental phase began at age six, because the link to parental relationship depends upon recollection of that relationship, and from about this age, children should have developed the ability to remember events as experienced (Perner & Ruffman, 1995), and adults recall a greater proportion of autobiographical events from about age six compared with younger ages (Rubin, 2000; Rubin & Schulkind, 1997). The first phase ended at age 10, because many adult-like face preferences (e.g. for facial symmetry, averageness, and health cues) are in place by this age (see first paragraph above). Further, this age has been proposed as a human universal in the developmental of sexuality and attraction, perhaps contingent upon rising levels of the adrenal steroid dehydroepiandrosterone (DHEA) (McClintock & Herdt, 1996), and it is the age at which retrospectively reported first hetero- and homosexual sexual attraction tends to arise (Hamer, Hu, Magnuson, Hu, & Pattatucci, 1993; McClintock & Herdt, 1996; Pattatucci & Hamer, 1995). The second phase ended at menarche because menarche represents the endpoint in a complex sequence of developmental events related to reproduction, and because of the links between menarche and reproductive ecology (see e.g. Ellis, 2004). The third phase represented the post-menarchal phase, and ended at age 16. Participants were also asked to report on the current time as a comparison phase. In this way, the study aimed to uncover the impact of different developmental phases on the formation of individual differences in adult face preferences.

2. Methods

2.1. Participants

All of the students enrolled on the second year of three psychology-based undergraduate degree programmes were invited to participate in the study in the context of a data analysis teaching exercise, and 171 students accessed the study. In addition, a separate version of the study was advertised via social networks, and 58 people accessed the study. Data from 7 participants were deleted because they opted out of making their data available for research, and data from 16 participants were deleted because they answered fewer than eight questions. Male participants were removed because of small numbers ($n = 44$). Eleven female participants were removed because they stated their ideal partner was female rather than male. The data reported below come from the remaining 145 participants aged 18–48 (mean = 21 years, st.dev. = 4 years).

2.2. Material and methods

Data collection took place in the form of an online survey. Participants were asked their age and ethnicity; the gender of their ideal partner; and the hair and eye colour of their ideal partner, actual partner (if in a relationship), mother, father, and self. Ethnic group categories were taken from the current recommendations of the UK Office for National Statistics for surveys in England. Participants were asked for details of both their actual and ideal partner because both can provide important information: the ideal partner represents a choice in an unconstrained environment; the actual partner represents the distillation of a set of preferences that may fluctuate (e.g. Jones et al., 2008), and has ecological validity. Parental hair colour was requested with reference to the predominant colour while the participant was growing up. Hair and

eye coloration options and data coding were based on Little et al. (2003). The hair colours used in the analysis, ordered from dark to light, consisted of black, very dark brown, dark brown, mid-brown, light brown, and blonde, and these were coded from 1 to 6 for the analysis. Other options were given (e.g. dark red, grey, 'Multiple colours (changed hair through colouring or dyeing)'), but these were excluded from the analyses. Eye colour options ordered from dark to light consisted of black, dark brown, light brown, hazel (i.e. greenish-brown), green, blue green, blue, and these were coded from 1 to 7 for the analysis. 'Grey' eye colour was also included in the social network participant dataset, and was recoded as the next lightest colour, blue, in the analysis ($n = 6$). At the end of the survey, the psychology student participants (but not the social network participants) were also asked to contact their parents and ask them to state how they would describe their hair and eye colour, from the list of colours used in the survey.

Participants were asked to rate how much emotional support they received from each of their parents using a 1–7 scale, where 1 represented no support, and 7 represented a lot of support. This question followed Watkins et al. (2011), who found that participants' reports of their father's emotional support using this question predicted the extent to which participants preferred self-resemblance in other-sex faces. This single-item measure appears to measure the same underlying construct as longer questionnaires of parental investment (Watkins et al., 2011), including the EMBU which has been used by other researchers who examined a link between childhood closeness to parents and preferences for parental features (Bereczkei et al., 2002; 2004; Nojo et al., 2012). Although retrospective reports suffer some limitations, measures of parental bonding have good test–retest reliability (Gerlsma, Das, & Emmelkamp, 1993, Gerlsma, Kramer, Scholing, & Emmelkamp, 1994; Wilhelm & Parker, 1990), and scores on a measure of maternal attachment were fairly well-matched between children aged 7–11 reflecting on their current relationship with their mother and those same children seven years later reflecting back to that period (Cournoyer & Rohner, 1996). Participants were instructed to select 'N/A' if they were not able to provide a rating (e.g. they could not remember the emotional support received, or were without a parent for the time period specified).

In rating parental emotional support, participants were asked to refer to four different stages of their life: age 6 to 10 ½ ("middle childhood"), age 10 ½ to half a year after their stated age of menarche in years (i.e. if they stated that menarche occurred at age 12, then the phase would be from age 10 ½ to 12 ½; the "pre-menarchal phase"); half a year after their stated age of menarche to age 16 (the "post-menarchal phase"); and at the current time in their life now ("current time"). Ages were constructed with the inclusion of the half year to best represent the actual age: if a woman reported that she experienced menarche aged 12, then age 12 ½ is the most accurate approximation on average. Similarly, the age of 10½ is the most accurate approximation on average of an event that occurs during the year in which one is 10. The female participants were asked to report their age of menarche early in the online survey, and their answers were fed forwards into the later questions, so that participants only saw references to specific ages, and not to 'age of menarche'. Participants who stated an age of menarche outside the age range 11–15, or who stated that they could not remember or preferred not to report their age of menarche, were not included in the analyses related to parental relationship at different developmental phases. Sample sizes for each analysis are given within the Results section.

A number of measures were taken to attempt to obtain accurate and truthful answers that were not biased by the research hypotheses. The information provided at the beginning of the survey did not state that the specific hypotheses surrounded links between partner and parent trait coloration, but rather explained that the project investigated the relationships between people's experiences, family background, and perceptions, particularly in terms of the features they might find attractive in others. The first three questions of the survey asked the participants to imagine their ideal partner, and describe that person's gender, hair colour, and eye colour. Questions about parental and own hair and eye colour were only asked much later in the survey, following several questions that were collected as part of a separate investigation. At the end of the survey, the psychology students were asked to contact their parents and ask how those parents would report their own hair and eye colours from the list of colours provided, without telling the parents what colour the students had selected for them. If they were not able to access that information from their parents straight away, they were able to close and re-access the survey at a later date to enter the information. This method was used to check for participant misperceptions that might link a specific colour to a person's gender (e.g. wrongly assuming that women tend to have blue eyes while men have brown eyes), which could bias the results. The psychology student participants were asked to answer the survey in a private setting where their answers could not be observed, and not to discuss the contents of the survey with their peers until the first teaching class so that people could complete the survey without preconceptions. They were also told that it was not essential to answer the questions, but if they chose to do so, they should make the answers accurate. They were able to opt out of making their data available for the class analysis, and/or for the research project. The study was granted ethical approval by the Department of Psychology Ethics Committee of Northumbria University.

2.3. Data and analysis

Analysis was carried out in SPSS v 21. Backwards linear regression was used and reported below because the value of its versatility was thought to outweigh the drawbacks of using a parametric analysis on ordinal variables (e.g. Kim, 1975, 1978; Labovitz, 1967; but see Supplementary Materials 1, available on the journal's website at www.ehbonline.org). *N* values differ across the analyses below, depending on how many women supplied appropriate data for the relevant question(s).

3. Results

3.1. Accuracy of reported hair and eye colour

To check the validity of the data, the participants' reports of their parents' hair and eye colours were compared to their parents' self-reported coloration. Participants' reports closely matched their parents' reports in all four comparisons (see Tables 1 and 2), and so the participants' reports of their parents' coloration are used in the remaining analyses below.

3.2. Own, parent and partner coloration

There were significant correlations between the hair colour that a participant would choose for her ideal partner, and the hair colour of that participant, her mother, and her father (Table 3). However, these seem to be driven by matching for ethnicity; the participants who did not report their ethnic group as 'White' very frequently stated black or dark hair colours, and when they were excluded (between $n = 11$ and 13, depending on the analysis), there was no longer any evidence

Table 1
Pearson's correlations between participants' reports of their parents' hair and eye colour, and their parents' self-reported hair and eye colour.

	Correlation (r)	p	n
Father's hair colour	.779	<.001	77
Father's eye colour	.940	<.001	93
Mother's hair colour	.917	<.001	78
Mother's eye colour	.974	<.001	100

Patterns of statistical significance are identical with non-parametric correlations (Kendall's tau-b).

Table 2
Comparison of participant and parent reports of parental hair and eye colour (values = frequencies).

		Number of scale items difference between the participant's and parent's choice				
Parent	Trait	0*	1	2	3	4
Father	Hair	43	24	7	3**	
	Eye	74	14	3	1**	1**
Mother	Hair	54	21	3		
	Eye	87	10	3		

* Identical item chosen.
** Reported colours (participant/parent) were: dark brown/blonde hair; light brown/very dark brown hair; black/mid-brown hair; light brown/blue green eyes; blue/light brown eyes.

for the correlations (ideal partner and self r = .034, p = .718, n = 116; mother r = .049, p = .613, n = 110; father r = .102, p = .296, n = 107). Similarly, with the exclusion of non-White participants (n = between 4 and 6, depending on the analysis), the apparent tendency towards a relationship between the hair colour of a woman's actual partner, and that of her parents, disappears (actual partner and mother r = .127, p = .320, n = 63; father r = .117, p = .364, n = 62). However, the differences between the r-values prior to and following restriction to White participants were not significant in any instance (Fisher's r-to-z transformations, all *ps* > 0.10). Own and parental eye colour did not correspond to actual or ideal partner eye colour (Table 4).

Backwards regression with a removal criterion of .10 was used to uncover whether ideal or actual partner trait coloration (the outcome variable) was predicted by the participant's report of her mother, father, and own coloration (the three predictor variables). Ideal partner hair colour was predicted by mother and father hair colour (Table 5). However, when the analysis was restricted to participants who reported their ethnicity as White (n = 79), none of the predictor variables was significant at any stage (all *ps* > .29). Similarly, actual partner hair colour was predicted by maternal hair colour (Table 5), but when the analysis was restricted to participants who reported their ethnicity as White (n = 47), none of the predictor variables was significant at any stage (all *ps* > .15). Ideal and actual partner eye colour were not predicted by the participant's report of her own, father's or mother's eye colour, at any stage of the backwards regression models (all *ps* > .11).

3.3. Parental relationship at different developmental phases, and preferences for parental features

Regression was used to uncover whether similarity between parent and partner trait coloration (the outcome variable) was predicted by emotional support received from that parent at the four developmental stages (the four predictor variables). The similarity between parent and partner trait coloration was calculated as the difference between the coded colour values for father and partner, or mother and partner, for the trait in question. Given the ambiguity of including the non-White sample, the analysis was restricted to participants who reported their ethnicity as White, although results were identical in their patterns of statistical significance when the data were analysed with the inclusion of those participants who did not report their ethnicity as White. Emotional support ratings from a parent at the four stages were imperfectly correlated; in the significant analyses below, correlations ranged from r = .87 to r = .52, and VIF and tolerance statistics did not indicate problems with multicollinearity (Field, 2005). The eye colour of a woman's ideal or actual partner and father was more likely to be more similar if the woman received less emotional support from her father during middle childhood, and more emotional support from her father during the post-menarchal phase (Table 6). The eye colour of a woman's ideal partner and mother was more likely to be similar if the woman received less emotional support from her mother during the pre-menarchal phase, and more emotional support from her mother during the post-menarchal phase (Table 6).

The similarity between paternal hair colour and actual or ideal partner hair colour were not predicted by the participant's report of emotional support received from her father the four developmental phases, at any stage of the backwards regression models (all *ps* > .05). The similarity between maternal eye colour and actual partner eye colour, and between maternal hair colour and ideal or actual partner hair colour, was not predicted by the participant's report of emotional support received from her mother at the four developmental phases, at any stage of the backwards regression models (all *ps* > .18).

4. Discussion

The study set out to investigate whether there is a phase within development that is particularly instrumental in the formation of individual differences in face preferences. The study focussed on the development of preferences for faces that resembled participants' parents, specifically looking at heterosexual women's preferences for partner hair and eye coloration. Previous work has shown that people have stronger preferences for parental features if they are close to their parents, and so by asking women about the quality of the emotional relationship that they had with their parents during different developmental phases, and examining whether this reported relationship predicted preferences for faces that resembled their parents, the study could establish links between developmental periods and individual differences in adult face preferences.

First, the study found that a woman's mother's hair colour predicted the hair colour that a woman selected for her ideal partner, and the hair colour she described her actual partner as having. There was also evidence that a woman's father's hair colour predicted the hair colour she wanted her ideal partner to have, but this was a weaker effect than that of her mother's hair colour. These results are broadly consistent with the previous research and effect sizes of a larger sample that found that the hair colour of men's mothers and fathers is linked to the hair colour of their partners, and that there is some evidence that the hair colour of a woman's father is linked to the hair colour of her partner (Little et al., 2003). While some studies have found that women select partners who resemble their other-sex and not their same-sex parent (Bereczkei et al., 2004; Seki et al., 2012), others have found that the features of both parents may be apparent in an individual's preferences (Jedlicka, 1984; Little et al., 2003; Wilson & Barrett, 1987). A positive selection pressure for lighter hair, eye and skin colour has been noted in Europeans over the last 5000 years, and may be driven in part by sexual selection (Frost, 2006; Wilde et al.,

Table 3
Pearson's correlations between the hair coloration of different individuals in the survey.

	Participants' reports of maternal hair colour	Participants' reports of paternal hair colour	Participants' reports of actual partner hair colour	Participants' reports of ideal partner hair colour
Participant's own hair colour	**r = .300, p = .001, n = 111**	**r = .391, p < .001, n = 107**	r = .058, p = .619, n = 76	**r = .238, p = .007, n = 129**
Participants' reports of maternal hair colour		r = .138, p = .168, n = 101	r = .231, p = .060, n = 67	**r = .210, p = .021, n = 121**
Participants' reports of paternal hair colour			r = .232, p = .057, n = 68	**r = .208, p = .023, n = 119**
Participants' reports of actual partner hair colour				**r = .810, p < .001, n = 80**

Patterns of statistical significance are identical with non-parametric correlations (Kendall's tau-b), with the exception that the correlation between paternal and actual partner hair colour becomes statistically significant (τ = .203, p = .037, n = 68). Statistically significant results (p < .05) are indicated in bold.

Table 4
Pearson's correlations between the eye coloration of different individuals in the survey.

	Participants' reports of maternal eye colour	Participants' reports of paternal eye colour	Participants' reports of actual partner eye colour	Participants' reports of ideal partner eye colour
Participants' own eye colour	**r = .561, p < .001, n = 145**	**r = .545, p < .001, n = 140**	r = .087, p = .431, n = 84	r = .096, p = .255, n = 143
Participants' report of maternal eye colour		r = .139, p = .102, n = 140	r = .175, p = .111, n = 84	r = .092, p = .273, n = 143
Participants' report of paternal eye colour			r = .091, p = .420, n = 80	r = .090, p = .295, n = 138
Participants' report of actual partner eye colour				**r = .701, p < .001, n = 83**

Patterns of statistical significance are identical with non-parametric correlations (Kendall's tau-b). Statistically significant results ($p < .05$) are indicated in bold.

2014). In contrast to other research with larger samples (Little et al., 2003; Wilson & Barrett, 1987), the study did not find that partner eye colours were predicted by the women's reports of their own or parental eye colour. However, the correlations between parent and partner hair colour may have been driven to a disproportionate extent by the small number of participants who identified their ethnicity as something other than White. With the exclusion of those participants, the majority of whom identified their parent and ideal/actual partner hair colours as being black or at the dark end of the spectrum, there was no longer a significant relationship between parental and partner hair colour. Once non-White participants had been excluded, there was also no evidence for simple assortative mating (i.e. choosing a partner who resembles the self) at the level of hair or eye colour (although the findings of a relationship between emotional support at different age phases and preferences for parental trait coloration held with or without the exclusion of non-White participants). It might be that participants prefer the trait coloration of their parents in a partner because they prefer partners who match the ethnic group (and attendant coloration) of their parents (cf. Jedlicka, 1980, 1984). It is unclear how much cultural group matching should be controlled in future studies of this type, because culture and coloration overlap. Part of ethnic group matching may be based on coloration preferences, and hair coloration frequencies differ by region even within the White ethnic group (see e.g. Frost, 2006), so any preference for partners from a particular geographical or cultural background may shade into a preference for the coloration linked to partners from those backgrounds, and it may be very difficult to disentangle preferences for physical traits from preferences for non-physical attributes.

Across ideal and actual partner, a woman was more likely to select an eye colour that was closer to her father's if she received more emotional support from him in the post-menarchal phase; in contrast, increases in the woman's ratings of her father's emotional support during middle childhood predicted a greater difference between her father's and ideal/actual partner's eye colour. Similarly, increased emotional support from a woman's mother during the post-menarchal phase positively predicted similarity between the eye colour of a woman's mother and her stated ideal partner eye coloration, whereas women who rated their mother as providing more emotional support during the pre-menarchal phase were less likely to demonstrate similarity in the eye colour of their mother and ideal partner. This pattern of results is consistent with the evidence that people are not attracted to those with whom they socialise during early childhood (reviews in e.g. Lieberman & Smith, 2012; Rantala & Marcinkowska, 2011), and indicates that parental models may be used to provide both positive and negative sexual imprinting in humans. That is, the distinction between positive and negative sexual imprinting may be dependent upon specific age of exposure, instead of relationship (parent, sibling, etc) to the individual encountered. We note, following Little et al. (2003), that in the context of human studies, the term 'imprinting' may in some instances usefully be equated with social learning. Imprinting, particularly in the non-human animal literature, usually refers to a sensitive period that takes place early in development, lasts for only a short period of time, and has long-lasting effects (Hess, 1973; Lorenz, 1937). Nevertheless, for consistency with existing literature, the term 'imprinting' is used here. Negative sexual imprinting may function to reduce the risk of forming a reproductive relationship with someone to whom one is too closely related, with the attendant risk of recessive genetic disorders (see e.g. Bittles & Neel, 1994; Blouin & Blouin, 1988). Positive sexual imprinting may have a number of benefits, including supporting optimal outbreeding (Bateson, 1978; 1980; 1982; Helgason, Pálsson, Guðbjartsson, Kristjánsson, & Stefánsson, 2008; Mascie-Taylor & Boldsen, 1988), enhancing one's own genetic representation in future generations through the selection of a partner with some genetic matches (Thiessen, 1999), and encouraging the selection of a partner from the same population who is more likely to have appropriate adaptations to the local environment, and thereby enabling the maintenance of co-adapted genetic complexes (Read & Harvey, 1991). Long-term relationships may benefit from a degree of affiliative behaviour associated with distant relatedness, including enhanced trust (DeBruine, 2005).

How well do these findings of age-bounded effects marry up with existing research that found that parent–partner similarity was positively predicted by an individual's relationship with their parent during childhood? Wiszewska et al. (2007) asked their participants to report their relationship with their parents from birth to 7 years of age. The other studies (Bereczkei et al., 2002; 2004; Nojo et al., 2012) used the EMBU questionnaire to assess parent/child relationships. This questionnaire does not specify an exact age, but refers to "your childhood" and to being "very young" in the preamble, and to "your adolescence" in one of the questions (see Arrindell et al., 1999). Bereczkei et al. (2002; 2004) asked their participants to focus on family experiences before adolescence, that is, up to 12–14 years (Tamás Bereczkei, personal communication). Similarly, Watkins et al. (2011) referred participants to "your childhood". If the current results are consistent with existing research, we would have to assume that participants' relationships with their parents between the ages of about 12 and 16 particularly coloured their reports. This is perhaps not unreasonable given that more recent events are more accessible and might overshadow more distant memories in evaluation contexts (e.g. Feldman & Lynch, 1988; Murdock, 1962), and recent positive events can outshine more distant negative events

Table 5
Regression models to predict ideal and actual partner hair colour from maternal, paternal and own hair colour.

Outcome variable	Model	Maternal hair colour	Paternal hair colour	Own hair colour
Ideal partner hair colour	Initial model (enter): **R^2 = .114, p = .016**, n = 89	**β = .228, p = .038**	β = .179, p = .113	β = .228, p = .572
	Step 2: **R^2 = .110, p = .007**	**β = .248, p = .017**	**β = .204, p = .049**	(Removed)
Actual partner hair colour	Initial model (enter): R^2 = .104, p = .157, n = 51	**β = .313, p = .040**	β = .212, p = .165	β = −.137, p = .388
	Step 3: R^2 = .064, p = .074	β = .252, p = .074	(Removed)	(Removed)

Significant results (p < .05) are in bold. Ideal and actual partner eye colour were not predicted by the participant's report of her own, father's or mother's eye colour, at any stage of the backwards regression models (all *ps* > .11).

Table 6
Regression models to predict similarity between parent and partner eye colour from ratings of emotional closeness to parents at different phases.

Outcome variable	Model	Middle childhood	Pre-menarchal phase	Post-menarchal phase	Current time
Difference between father and ideal partner eye colour	Initial model (enter): $R^2 = .103$, p = .064, n = 86	**β = .376, p = .037**	β = −.091, p = .700	β = −.302, p = .105	β = −.024, p = .872
	Step 3: $R^2 = .101$, p = .012	**β = .327, p = .015**	(Removed)	**β = −.380, p = .005**	(Removed)
Difference between father and actual partner eye colour	Initial model (enter): $R^2 = .151$, p = .074, n = 56	β = 306, p = .170	β = 046, p = .886	**β = −.634, p = .024**	β = .243, p = .192
	Step 3: $R^2 = 121$, p = .033	**β = .383, p = .038**	(Removed)	**β = −.481, p = .010**	(Removed)
Difference between mother and ideal partner eye colour	Initial model (enter): $R^2 = .070$, p = .126, n = 103	β = −.009, p = .957	β = .328, p = .093	β = −.304, p = .070	β = −.134, p = .329
	Step 3: $R^2 = .061$, p = .044	(Removed)	**β = .296, p = .049**	**β = −.377, p = .013**	(Removed)

Negative β-values denote greater similarity. Significant results (p < .05) are in bold. The similarity between paternal and actual/ideal partner hair colour was not predicted by the participant's report of emotional support received from her father during the four developmental phases, at any stage of the backwards regression models (all *ps* > .05). The similarity between maternal and actual partner eye colour, and between maternal hair colour and actual/ideal partner hair colour, was not predicted by the participant's report of emotional support received from her mother at the four developmental phases, at any stage of the backwards regression models (all *ps* > .18).

(Ross & Simonson, 1991). This recollection bias might be reduced if participants are asked to focus and report separately on different shorter life phases to improve access to the time period being recalled, as they were in the current study (see e.g. Pearson, Ross, & Dawes, 1992), although this merits further exploration. The validity of retrospective evaluations is always a potential limitation of this type of research (e.g. Henry, Moffitt, Caspi, Langley, & Silva, 1994; Pearson et al., 1992). Earlier periods than those used in this study (i.e. before the age of six) also merit exploration for their role in shaping individual differences in adult face preferences, and it is worth noting that children aged 4–5 demonstrate explicit preferences for attractive over unattractive faces (but not for symmetric, average, healthy looking, or feminised faces; Boothroyd et al., 2014), and that some sexual arousal responses may have their roots in experiences from before the age of five (Enquist, Aronsson, Ghirlanda, Jansson, & Jannini, 2011). Nevertheless, it seems reasonable to assume that the finding within the literature, that parental childhood relationship predicts preferences for parental features, relies greatly on reflections on relationships after about the age of about six, because prior to that age individuals have not developed the ability to remember events as experienced (Perner & Ruffman, 1995) and demonstrate a degree of childhood amnesia over autobiographical events (Rubin, 2000; Rubin & Schulkind, 1997).

The study results also need to be integrated with findings on the preferences of children for faces that resemble their parents. Children aged three to six who had a more secure attachment to their parents, and in particular to their mother, were found to express a stronger preference for playing with fictional children whose faces had been created to resemble their fathers (Kocsor et al., 2013). However, this preference may not persist, or may be distinct from judgements of attractiveness: a separate study found that attachment to mother in infancy did not predict 9-year-old children's attractiveness judgements of faces that resembled their mothers (Vukovic et al., 2015). Those 9-year-olds did however judge faces that resembled either their mother or their father to be more attractive if they had a more accepting, less rejecting relationship with that parent currently (Vukovic et al., 2015). If these results are consistent with the current study's findings, it is possible that that these judgements do not persist into adulthood; attractiveness judgements in 9-year-olds are similar in some ways to those of adults, but are not identical, and continue to adjust during adolescence (e.g. Boothroyd et al., 2014; Saxton, Caryl, & Roberts, 2006, Saxton et al., 2009b; 2010; 2011).

Future research might examine the lifetime stability of preferences for faces that resemble one's parents. Do individuals retain a preference for their parents' traits as they proceed through adulthood, even in the absence of regular exposure to their parents, and in the context of other close relationships? Nevertheless, the results indicate that specific childhood and adolescent developmental periods may have longstanding effects on individual differences in human facial preferences, and open up further avenues of research in relation to the interplay between positive and negative sexual imprinting.

Supplementary materials

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.evolhumbehav.2015.06.001.

Acknowledgements

Many thanks to Lynda Boothroyd, the editor Lisa DeBruine, and two anonymous reviewers, for their useful comments on a previous version of the manuscript, and to Joe Jones for assistance with data collection. The dataset is available as Supplementary Material 2, available on the journal's website at www.ehbonline.org.

References

Arrindell, W. A., Sanavio, E., Aguilar, G., Sica, C., Hatzichristou, C., Eisemann, M., et al. (1999). The development of a short form of the EMBU: Its appraisal with students in Greece, Guatemala, Hungary and Italy. *Personality and Individual Differences*, *27*(4), 613–628. http://dx.doi.org/10.1016/S0191-8869(98)00192-5.

Bateson, P. (1978). Sexual imprinting and optimal outbreeding. *Nature*, *273*, 659–660. http://dx.doi.org/10.1038/273659a0.

Bateson, P. (1980). Optimal outbreeding and the development of sexual preferences in Japanese quail. *Zeitschrift für Tierpsychologie*, *53*, 231–244. http://dx.doi.org/10.1111/j.1439-0310.1980.tb01052.x.

Bateson, P. (1982). Preferences for cousins in Japanese quail. *Nature*, *295*, 236–237. http://dx.doi.org/10.1038/295236a0.

Bereczkei, T., Gyuris, P., Koves, P., & Bernath, L. (2002). Homogamy, genetic similarity, and imprinting; parental influence on mate choice preferences. *Personality and Individual Differences*, *33*(5), 677–690. http://dx.doi.org/10.1016/S0191-8869(01)00182-9.

Bereczkei, T., Gyuris, P., & Weisfeld, G. E. (2004). Sexual imprinting in human mate choice. *Proceedings of the Royal Society of London, Series B: Biological Sciences*, *271*(1544), 1129–1134. http://dx.doi.org/10.1098/rspb.2003.2672.

Bischof, H. -J. (1994). Sexual imprinting as a two-stage process. In J. A. Hogan, & J. J. Bolhuis (Eds.), *Causal Mechanisms of Behavioural Development*. Cambridge: Cambridge University Press.

Bittles, A. H., & Neel, J. V. (1994). The costs of human inbreeding and their implications for variations at the DNA level. *Nature Genetics*, *8*, 117–121. http://dx.doi.org/10.1038/ng1094-117.

Blouin, S. F., & Blouin, M. (1988). Inbreeding avoidance behaviors. *Trends in Ecology & Evolution*, *3*(9), 230–233. http://dx.doi.org/10.1016/0169-5347(88)90164-4.

Boothroyd, L. G., Meins, E., Vukovic, J., & Burt, D. M. (2014). Developmental changes in children's facial preferences. *Evolution and Human Behavior*, *35*(5), 376–383. http://dx.doi.org/10.1016/j.evolhumbehav.2014.05.002.

Cavior, N., & Lombardi, D. A. (1973). Developmental aspects of judgment of physical attractiveness in children. *Developmental Psychology*, *8*(1), 67–71. http://dx.doi.org/10.1037/h0033824.

Cooper, P. A., Geldart, S. S., Mondloch, C. J., & Maurer, D. (2006). Developmental changes in perceptions of attractiveness: A role of experience? *Developmental Science*, *9*(5), 530–543. http://dx.doi.org/10.1111/j.1467-7687.2006.00520.x.

Cournoyer, D. E., & Rohner, R. P. (1996). Reliability of retrospective reports of perceived maternal acceptance-rejection in childhood. *Psychological Reports*, *78*(1), 147–150. http://dx.doi.org/10.2466/pr0.1996.78.1.147.

DeBruine, L. M. (2005). Trustworthy but not lust-worthy: Context-specific effects of facial resemblance. *Proceedings of the Royal Society of London, Series B: Biological Sciences*, *272*(1566), 919–922. http://dx.doi.org/10.1098/rspb.2004.3003.

Dixson, B. J., Tam, J. C., & Awasthy, M. (2013). Do women's preferences for men's facial hair change with reproductive status? *Behavioural Ecology*, *24*(3), 708–716. http://dx.doi.org/10.1093/beheco/ars211.

Ellis, B. J. (2004). Timing of pubertal maturation in girls: An integrated life history approach. *Psychological Bulletin*, *130*(6), 920–958. http://dx.doi.org/10.1037/0033-2909.130.6.920.

Enquist, M., Aronsson, H., Ghirlanda, S., Jansson, L., & Jannini, E. A. (2011). Exposure to mother's pregnancy and lactation in infancy is associated with sexual attraction to pregnancy and lactation in adulthood. *The Journal of Sexual Medicine*, *8*(1), 140–147. http://dx.doi.org/10.1111/j.1743-6109.2010.02065.x.

Feldman, J. M., & Lynch, J. G. (1988). Self-generated validity and other effects of measurement on belief, attitude, intention, and behavior. *Journal of Applied Psychology*, *73*(3), 421–435. http://dx.doi.org/10.1037/0021-9010.73.3.421.

Field, A. (2005). *Discovering statistics using SPSS*. London: SAGE Publications Ltd.

Fraley, R. C., & Marks, M. J. (2010). Westermarck, Freud, and the incest taboo: Does familial resemblance activate sexual attraction? *Personality and Social Psychology Bulletin*, *36*(9), 1202–1212. http://dx.doi.org/10.1177/0146167210377180.

Frost, P. (2006). European hair and eye color: A case of frequency-dependent sexual selection? *Evolution and Human Behavior*, *27*(2), 85–103. http://dx.doi.org/10.1016/j.evolhumbehav.2005.07.002.

Gerlsma, C., Das, J., & Emmelkamp, P. M. G. (1993). Depressed patients' parental representations: stability across changes in depressed mood and specificity across diagnoses. *Journal of Affective Disorders*, *27*(3), 173–181. http://dx.doi.org/10.1016/0165-0327(93)90005-5.

Gerlsma, C., Kramer, J. J. A. M., Scholing, A., & Emmelkamp, P. M. G. (1994). The influence of mood on memories of parental rearing practices. *British Journal of Clinical Psychology*, *33*(2), 159–172. http://dx.doi.org/10.1111/j.2044-8260.1994.tb01107.x.

Griffey, J. A. F., & Little, A. C. (2014). Infant's visual preferences for facial traits associated with adult attractiveness judgements: Data from eye-tracking. *Infant Behavior and Development*, *37*(3), 268–275. http://dx.doi.org/10.1016/j.infbeh.2014.03.001.

Hamer, D., Hu, S., Magnuson, V., Hu, N., & Pattatucci, A. (1993). A linkage between DNA markers on the X chromosome and male sexual orientation. *Science*, *261*(5119), 321–327. http://dx.doi.org/10.1126/science.8332896.

Heffernan, M. E., & Fraley, R. C. (2013). Do early caregiving experiences shape what people find attractive in adulthood? Evidence from a study on parental age. *Journal of Research in Personality*, *47*(4), 364–368. http://dx.doi.org/10.1016/j.jrp.2013.03.003.

Helgason, A., Pálsson, S., Guðbjartsson, D. F., Kristjánsson, þ., & Stefánsson, K. (2008). An association between the kinship and fertility of human couples. *Science*, *319*(5864), 813–816. http://dx.doi.org/10.1126/science.1150232.

Henry, B., Moffitt, T. E., Caspi, A., Langley, J., & Silva, P. A. (1994). On the "remembrance of things past": A longitudinal evaluation of the retrospective method. *Psychological Assessment*, *6*(2), 92–101. http://dx.doi.org/10.1037/1040-3590.6.2.92.

Hess, E. H. (1973). *Imprinting: Early experience and the developmental psychobiology of attachment*. New York: Van Nostrand Rheinhold.

Jedlicka, D. (1980). A test of the psychoanalytic theory of mate selection. *Journal of Social Psychology*, *112*(2), 295–299. http://dx.doi.org/10.1080/00224545.1980.9924331.

Jedlicka, D. (1984). Indirect parental influence on mate choice: A test of the psychoanalytic theory. *Journal of Marriage and Family*, *46*(1), 65–70. http://dx.doi.org/10.2307/351864.

Jones, B. C., DeBruine, L. M., Perrett, D. I., Little, A. C., Feinberg, D. R., & Law Smith, M. J. (2008). Effects of menstrual cycle phase on face preferences. *Archives of Sexual Behavior*, *37*(1), 78–84. http://dx.doi.org/10.1007/s10508-007-9268-y.

Kim, J. -O. (1975). Multivariate analysis of ordinal variables. *American Journal of Sociology*, *81*(2), 261–298. http://dx.doi.org/10.2307/2777378.

Kim, J. -O. (1978). Multivariate analysis of ordinal variables revisited. *American Journal of Sociology*, *84*(2), 448–456. http://dx.doi.org/10.2307/2777859.

Kissler, J., & Bäuml, K. -H. (2000). Effects of the beholder's age on the perception of facial attractiveness. *Acta Psychologica*, *104*(2), 145–166. http://dx.doi.org/10.1016/S0001-6918(00)00018-4.

Knudsen, E. (2004). Sensitive periods in the development of the brain and behavior. *Journal of Cognitive Neuroscience*, *16*(8), 1412–1425. http://dx.doi.org/10.1162/0898929042304796.

Kocsor, F., Gyuris, P., & Bereczkei, T. (2013). The impact of attachment on preschool children's preference for parent-resembling faces — A possible link to sexual imprinting. *Journal of Evolutionary Psychology*, *11*(4), 171–183. http://dx.doi.org/10.1556/jep.11.2013.4.2.

Labovitz, S. (1967). Some observations on measurement and statistics. *Social Forces*, *46*(2), 151–160. http://dx.doi.org/10.2307/2574595.

Langlois, J. H., Ritter, J. M., Roggman, L. A., & Vaughn, L. S. (1991). Facial diversity and infant preferences for attractive faces. *Developmental Psychology*, *27*(1), 79–84. http://dx.doi.org/10.1037/0012-1649.27.1.79.

Lieberman, D., & Smith, A. (2012). It's all relative: Sexual aversions and moral judgments regarding sex among siblings. *Current Directions in Psychological Science*, *21*(4), 243–247. http://dx.doi.org/10.1177/0963721412447620.

Little, A. C., Penton-Voak, I. S., Burt, D. M., & Perrett, D. I. (2003). Investigating an imprinting-like phenomenon in humans: Partners and opposite-sex parents have similar hair and eye colour. *Evolution and Human Behavior*, *24*(1), 43–51. http://dx.doi.org/10.1016/S1090-5138(02)00119-8.

Little, A. C., Saxton, T. K., Roberts, S. C., Jones, B. C., DeBruine, L. M., Vukovic, J., et al. (2010). Women's preferences for masculinity in male faces are highest during reproductive age-range and lower around puberty and post-menopause. *Psychoneuroendocrinology*, *35*(6), 912–920. http://dx.doi.org/10.1016/j.psyneuen.2009.12.006.

Lorenz, K. Z. (1937). The companion in the bird's world. *Auk*, *54*, 245–273.

Marcinkowska, U. M., & Rantala, M. J. (2012). Sexual imprinting on facial traits of opposite-sex parents in humans. *Evolutionary Psychology*, *10*(3), 621–630.

Marler, P., & Peters, S. (1982a). Developmental overproduction and selective attrition: New processes in the epigenesis of birdsong. *Developmental Psychobiology*, *15*(4), 369–378. http://dx.doi.org/10.1002/dev.420150409.

Marler, P., & Peters, S. (1982b). Long-term storage of learned birdsongs prior to production. *Animal Behaviour*, *30*(2), 479–482. http://dx.doi.org/10.1016/S0003-3472(82)80059-6.

Mascie-Taylor, C. G. N., & Boldsen, J. L. (1988). Assortative mating, differential fertility and abnormal pregnancy outcome. *Annals of Human Biology*, *15*(3), 223–228. http://dx.doi.org/10.1080/03014468800009661.

McClintock, M. K., & Herdt, G. (1996). Rethinking puberty: The development of sexual attraction. *Current Directions in Psychological Science*, *5*(6), 178–183.

Murdock, B. B., Jr. (1962). The serial position effect of free recall. *Journal of Experimental Psychology*, *64*(5), 482–488. http://dx.doi.org/10.1037/h0045106.

Nojo, S., Ihara, Y., Furusawa, H., Akamatsu, S., & Ishida, T. (2011). Facial resemblance and attractiveness: An experimental study in rural Indonesia. *Letters on Evolutionary Behavioral Science*, *2*(1), 9–12.

Nojo, S., Tamura, S., & Ihara, Y. (2012). Human homogamy in facial characteristics. *Human Nature*, *23*(3), 323–340. http://dx.doi.org/10.1007/s12110-012-9146-8.

Pattatucci, A. L., & Hamer, D. (1995). Development and familiality of sexual orientation in females. *Behavior Genetics*, *25*(5), 407–419. http://dx.doi.org/10.1007/bf02253370.

Pearson, R. W., Ross, M., & Dawes, R. M. (1992). Chapter 4: Personal recall and the limits of retrospective questions in surveys. In J. M. Tanur (Ed.), *Questions about Questions: Inquiries into the Cognitive Bases of Surveys*. New York: Russell Sage Foundation.

Perner, J., & Ruffman, T. (1995). Episodic memory and autonoetic conciousness: Developmental evidence and a theory of childhood amnesia. *Journal of Experimental Child Psychology*, *59*(3), 516–548. http://dx.doi.org/10.1006/jecp.1995.1024.

Perrett, D. I., Penton-Voak, I. S., Little, A. C., Tiddeman, B. P., Burt, D. M., Schmidt, N., et al. (2002). Facial attractiveness judgements reflect learning of parental age characteristics. *Proceedings of the Biological Sciences*, *269*(1494), 873–880. http://dx.doi.org/10.1098/rspb.2002.1971.

Rantala, M., & Marcinkowska, U. (2011). The role of sexual imprinting and the Westermarck effect in mate choice in humans. *Behavioral Ecology and Sociobiology*, *65*(5), 859–873. http://dx.doi.org/10.1007/s00265-011-1145-y.

Rantala, M. J., Polkki, M., & Rantala, L. M. (2010). Preference for human male body hair changes across the menstrual cycle and menopause. *Behavioural Ecology*, *21*(2), 419–423. http://dx.doi.org/10.1093/beheco/arp206.

Read, A. F., & Harvey, P. H. (1991). Genetic relatedness and the evolution of animal mating patterns. In C. G. Mascie-Taylor, & A. J. Boyce (Eds.), *Human Mating Patterns*. Oxford: Oxford University Press.

Rhodes, G. (2006). The evolutionary psychology of facial beauty. *Annual Review of Psychology*, *57*, 199–226. http://dx.doi.org/10.1146/annurev.psych.57.102904.190208.

Rhodes, G., Geddes, K., Jeffery, L., Dziurawiecz, S., & Clark, A. (2002). Are average and symmetric faces attractive to infants? Discrimination and looking preferences. *Perception*, *31*(3), 315–321.

Roberts, S. C., & Little, A. C. (2008). Good genes, complementary genes and human mate choice. *Genetica*, *132*(1), 309–321. http://dx.doi.org/10.1007/s10709-007-9174-1.

Ross, W. T., & Simonson, I. (1991). Evaluations of pairs of experiences: A preference for happy endings. *Journal of Behavioral Decision Making*, *4*(4), 273–282. http://dx.doi.org/10.1002/bdm.3960040405.

Rubenstein, A. J., Kalakanis, L., & Langlois, J. H. (1999). Infant preferences for attractive faces: A cognitive explanation. *Developmental Psychology*, *35*(3), 848–855. http://dx.doi.org/10.1037/0012-1649.35.3.848.

Rubin, D. C. (2000). The distribution of early childhood memories. *Memory*, *8*(4), 265–269. http://dx.doi.org/10.1080/096582100406810.

Rubin, D. C., & Schulkind, M. D. (1997). Distribution of important and word-cued autobiographical memories in 20-, 35-, and 70-year-old adults. *Psychology and Aging*, *12*(3), 524–535. http://dx.doi.org/10.1037/0882-7974.12.3.524.

Samuels, C. A., Butterworth, G., Roberts, T., Grauper, L., & Hole, G. (1994). Facial aesthetics: Babies prefer attractiveness to symmetry. *Perception*, *23*, 823–831. http://dx.doi.org/10.1068/p230823.

Saxton, T. K., Caryl, P. G., & Roberts, S. C. (2006). Vocal and facial attractiveness judgments of children, adolescents and adults: The ontogeny of mate choice. *Ethology*, *112*(12), 1179–1185. http://dx.doi.org/10.1111/j.1439-0310.2006.01278.x.

Saxton, T. K., DeBruine, L. M., Jones, B. C., Little, A. C., & Roberts, S. C. (2009a). Face and voice attractiveness judgments change during adolescence. *Evolution and Human Behavior*, *30*(6), 398–408. http://dx.doi.org/10.1016/j.evolhumbehav.2009.06.004.

Saxton, T. K., DeBruine, L. M., Jones, B. C., Little, A. C., & Roberts, S. C. (2011). A longitudinal study of adolescents' judgments of the attractiveness of facial symmetry, averageness and sexual dimorphism. *Journal of Evolutionary Psychology*, *9*(1), 43–55. http://dx.doi.org/10.1556/JEP.9.2011.22.1.

Saxton, T. K., Kohoutova, D., Roberts, S. C., Jones, B. C., DeBruine, L. M., & Havlicek, J. (2010). Age, puberty and attractiveness judgments in adolescents. *Personality and Individual Differences*, *49*, 857–862. http://dx.doi.org/10.1016/j.paid.2010.07.016.

Saxton, T. K., Little, A. C., DeBruine, L. M., Jones, B. C., & Roberts, S. C. (2009b). Adolescents' preferences for sexual dimorphism are influenced by relative exposure to male and female faces. *Personality and Individual Differences*, *47*, 864–868. http://dx.doi.org/10.1016/j.paid.2009.07.005.

Seki, M., Ihara, Y., & Aoki, K. (2012). Homogamy and imprinting-like effect on mate choice preference for body height in the current Japanese population. *Annals of Human Biology*, *39*(1), 28–35. http://dx.doi.org/10.3109/03014460.2011.635695.

Slater, A., Bremner, G., Johnson, S. P., Sherwood, P., Hayes, R., & Brown, E. (2000). Newborn infants' preference for attractive faces: The role of internal and external facial features. *Infancy*, *1*(2), 265–274. http://dx.doi.org/10.1207/s15327078in0102_8.

Slater, A., Von der Schulenburg, C., Brown, E., Badenoch, M., Butterworth, G., Parsons, S., et al. (1998). Newborn infants prefer attractive faces. *Infant Behavior and Development*, *21*(2), 345–354. http://dx.doi.org/10.1016/S0163-6383(98)90011-X.

Thiessen, D. (1999). Social influences on assortative mating. In M. C. Corballis, & S. G. Lea (Eds.), *The Descent of Mind: Psychological perspectives on hominid evolution*. Oxford: Oxford University Press.

Vukovic, J., Boothroyd, L. G., Meins, E., & Burt, D. M. (2015). Concurrent parent–child relationship quality is associated with an imprinting-like effect in children's facial

preferences. *Evolution and Human Behavior*, *36*(4), 331–336. http://dx.doi.org/10.1016/j.evolhumbehav.2015.03.004.

Watkins, C. D., DeBruine, L. M., Smith, F. G., Jones, B. C., Vukovic, J., & Fraccaro, P. J. (2011). Like father, like self: Emotional closeness to father predicts women's preferences for self-resemblance in opposite-sex faces. *Evolution and Human Behavior*, *32*(1), 70–75. http://dx.doi.org/10.1016/j.evolhumbehav.2010.09.001.

Wilde, S., Timpson, A., Kirsanow, K., Kaiser, E., Kayser, M., Unterländer, M., et al. (2014). Direct evidence for positive selection of skin, hair, and eye pigmentation in Europeans during the last 5,000 y. *Proceedings of the National Academy of Sciences*, *111*(13), 4832–4837. http://dx.doi.org/10.1073/pnas.1316513111.

Wilhelm, K., & Parker, G. (1990). Reliability of the parental bonding instrument and intimate bond measure scales. *The Australian and New Zealand Journal of Psychiatry*, *24*(2), 199–202. http://dx.doi.org/10.3109/00048679009077683.

Wilson, G. D., & Barrett, P. T. (1987). Parental characteristics and partner choice: Some evidence for Oedipal imprinting. *Journal of Biosocial Science*, *19*(02), 157–161. http://dx.doi.org/10.1017/S0021932000016758.

Wiszewska, A., Pawlowski, B., & Boothroyd, L. G. (2007). Father–daughter relationship as a moderator of sexual imprinting: A facial metric study. *Evolution and Human Behavior*, *28*(4), 248–252. http://dx.doi.org/10.1016/j.evolhumbehav.2007.02.006.

Zei, G. P., Astolifi, P., & Jayakar, S. D. (1981). Correlation between father's age and husband's age: A case of imprinting? *Journal of Biosocial Science*, *13*, 409–418. http://dx.doi.org/10.1017/S0021932000013663.