Parental preferences for the facial traits of their offspring's partners can enhance parental inclusive fitness.

Abstract

Physical appearance provides a wealth of information concerning an individual's biological fitness and reproductive quality, but we do not know whether parents make use of this information when evaluating potential partners for their offspring. This is critical to our understanding of human mate choice, because parents frequently influence their offspring's mating decisions, either directly, for instance through arranged marriages, or indirectly, through manipulating their offspring's partner choice. Here, we used facial images that varied in attractiveness, masculinity, health, and symmetry to assess both reproductively-aged daughters' and their parents' preferences in potential mates for the daughters. In line with our predictions, both daughters and their parents had clear preferences for markers of genetic quality, although the daughters showed significantly stronger preferences for these markers than their parents. Contrary to previous research, parents and daughters did not have stronger preferences for markers of genetic quality if they perceived the daughter to be more attractive. Parents' preferences for the facial markers of genetic quality in their offspring's partner may help maximise inclusive fitness.

Keywords: mate choice, parental investment, parent-offspring conflict, face preferences, inclusive fitness

Introduction

Parental involvement in their offspring's mate choice appears to be ubiquitous across human cultures (Apostolou, 2007; Goode, 1959; Menon, 1989; Minturn, Grosse, & Haider, 1969). In contemporary societies, the degree of parental involvement varies from relatively superficial, such as approval or disapproval of the offspring's choice, through to much more extensive, such as arranged marriage practices (Apostolou, 2007; 2013; Buunk, Park, & Duncan, 2010). Some level of parental involvement has probably been evident throughout our evolutionary history (Apostolou, 2010a,b; 2012; 2013; Buunk et al., 2010). As such, parental involvement in mate choice has likely been subject to evolutionary pressures, and humans may have developed specialised mechanisms for choosing suitable mates for their offspring, perhaps independent from mechanisms involved in their own mate choice.

Appearance plays an important role in mate choice, as has been convincingly demonstrated numerous times (see e.g. Penton-Voak, 2011). This is perhaps with good cause: physical traits can convey critical information concerning the suitability and genetic quality of an individual as a reproductive partner, including their genetic quality, their health status and their fertility (e.g. Thornhill, & Gangestad, 2006; Rhodes, 2006). Much research has shown that people readily and accurately discern these markers of genetic quality in others (e.g. Rhodes, 2006). Yet we do not know whether parents also exploit physical markers of genetic quality when judging potential partners for their offspring, despite the clear benefits of doing so. Indeed, research has indicated that women's judgements of the attractiveness of male faces may change at menopause, when markers of genetic quality in a partner become less relevant (Jones et al., 2011; Little et al., 2010), but we hypothesise that menopause should leave intact a woman's ability to assess markers of genetic quality of potential sons-in-law so that she can appropriately judge potential partners for her offspring so as to maximize her

inclusive fitness, i.e. the benefits to her fitness if her offspring successfully produces offspring of high genetic quality in turn.

Mate choice is often portrayed as a market, where individuals adjust their preferences according to their own desirability (Waynforth & Dunbar, 1995). This strategic adjustment contributes to assortative mating, whereby people tend to choose a partner of approximately equal mate value to themselves. Assortative mating has been established for a range of traits including physical appearance (Jones et al., 2005; Little et al., 2001), and might support long-term relationship bonds. The pursuit of a partner of equivalent mate value allows people to maximise their reproductive potential by focussing their time and efforts on a partner who is maximally high-quality while still being attainable. We hypothesise that parents may also adjust their evaluation of a potential partner's suitability according to their perceived mate value of their offspring.

Men can provide both direct benefits (investment) and indirect benefits (heritable fitness) as reproductive partners, and may trade off one against each other. For example, males with high facial masculinity, a marker of genetic quality (Perrett et al., 1998), show fewer investing traits (Boothroyd et al., 2008) and are perceived as less investing compared to males with lower levels of facial masculinity (Perrett et al., 1998). Similarly, men with higher attractiveness, or higher facial symmetry, also markers of genetic quality (Little et al., 2001), are less co-operative and offer fewer resources in experimental settings (Sanchez-Pages & Turiegano, 2010; Takahashi et al., 2006; Zaatari & Trivers, 2007). Accordingly, women may need to trade off investment and genetic quality when choosing a mate (Perrett et al., 1998; Roney et al., 2006).

Parents and their daughters benefit in different ways from the genetic quality and investment of the daughter's partner, and thus the ideal trade-off point might be different for parents compared to daughters (Andersson, 1994; Buunk, Park, & Dubbs, 2008). The genetic quality of a daughter's partner provides relatively greater benefits to that daughter than to her parents, because any children born to the daughter are related 0.5 to her, but only 0.25 to the daughter's parents. A daughter therefore might be happy to sacrifice a partner with good investment potential for one who has high genetic quality. In contrast, the daughter's parents will be less willing to relinquish traits that make a partner valuable but which do not constitute genetic quality. Further, parents might have additional specific preferences for a partner with good investment potential, to reduce the risk that they might have to shoulder some of the costs arising from low paternal investment by the daughter's partner to the detriment of their investment in other (grand-)offspring (Buunk et al., 2008; Apostolou 2011, 2015). This position is supported by questionnaire studies. Parents put more emphasis on traits indicating investment (e.g. 'kind', 'housekeeper') while their offspring judged markers of genetic quality (e.g. 'attractive') as more important (Perilloux, Fleischman, & Buss; 2011). Similarly, people indicated that they would have greater preferences for good looks in a partner than in a son- or daughter-in-law, alongside greater preferences for a good family background in a son- or daughter-in-law than a partner (Apostolou, 2011). Finally, children (aged 16+) rated good looks more important in a prospective spouse than their parents did in a prospective son- or daughter-in-law (Apostolou 2015).

In the present study, we recruited parents with daughters of reproductive age, and tested the preferences of the parents and their daughters for markers of genetic quality in potential partners for the daughters. We predicted that: 1) parents would show directional preferences for facial markers of genetic quality (attractiveness, masculinity, health, and symmetry) in an

offspring's potential partner, and these preferences would not be affected by the menopause; 2) facial markers of genetic quality would be more attractive to daughters judging the attractiveness of a potential partner than to parents judging a potential partner for their daughter; and 3) parents and daughters would adjust their preferences in accordance with their perception of the daughter's mate quality (attractiveness).

Methods

Participants

Participants consisted of 210 parents (111 female; mean age = 52 yrs, age range = 37-73yrs) and 125 of their daughters (mean age = 20.57 yrs, age range = 18-29). Eighty seven daughters had both parents participate, there were no sisters in the sample. All participants self-identified as white and lived in the UK. The daughters were recruited predominantly from a large Psychology undergraduate teaching class. Participants were only included if daughters were between 18 and 30 years old, so that daughters were in the peak reproductive phase, and were of roughly equivalent age to the male face stimuli used. Additionally, daughters had to have lived with both their biological parents until at least age 16. This restriction was applied to ensure that all parents had invested substantially and extensively in their daughters. All participants gave informed consent. The study was approved by the XXXXXXX.

Stimuli

Daughter-aged male face stimuli were created from 15 male base identities. Each identity was a composite of three photographs drawn from a white student image set generated at the University of St Andrews. These images were combined to create a composite to avoid individuals being identified. Each identity was then transformed for attractiveness, health, masculinity, and symmetry. Attractiveness transforms were conducted by applying ±25% of

the shape and colour difference of an attractive and unattractive prototype, taken from Todorov and colleagues (Todorov et al., 2013; Todorov & Oosterhof, 2011). For health transforms, a ±17% carotenoid colouration transform was applied (Lefevre et al., 2013). For masculinity, base images were transformed by ±50% of the shape and colour difference between an average male and average female (Perrett et al., 1998). Finally, to create stimuli differing in symmetry, base faces were symmetrised while the untransformed base faces were used as the low-symmetry versions of each face (Little et al., 2001). Example stimuli are shown in Figure 1. These stimuli were presented in pairs in a forced choice paradigm in an online study. Each face pair contained two versions of the same identity, with high and low levels (each level randomly presented on the left/right) of one of the four manipulations, presented in random order.

Parent-aged male face stimuli were created from 15 male faces (mean age=45.9yrs) from the FACES database (Ebner, Riediger, & Lindenberger, 2010). Faces were transformed for attractiveness, health, masculinity, and symmetry using the methods described above, and presented in the online survey as described above.

Daughter-aged female face stimuli (n = 20) were taken from a set of photographs taken at the University of St Andrews. They were all white and of undergraduate student age. We attempted to choose a range of attractiveness levels for these stimuli.

---- insert Figure 1 about here -----

Procedure: The daughter participants were first shown the pairs of daughter-aged male face stimuli. For each pair, they were asked to select the face that they found more attractive. This

allowed us to calculate a 'high preference score' representing the proportion of trials on which the high trait face was chosen. Next, the daughter participants were asked to compare themselves to each of the daughter-aged female face stimuli, and to state whether they considered themselves more or less attractive than each (Clark, 2004). Subsequent to participation in the study, they were contacted to ask if they would like to invite their parents to take part in a related study. Those who agreed forwarded details of the study to their parents.

Parental participants were first shown the same set of daughter-aged male face stimuli that their daughters saw. They were asked to refer to the daughter who participated in the study, and to select the face that would be more suitable as a partner for the daughter[1]. This allowed us to calculate a 'high preference score' representing the proportion of trials on which the high trait face was chosen. Next, the parental participants saw the same daughter-aged female face stimuli that their daughters saw, and were asked to rate whether the daughter was more or less attractive than each. Thirty-two participants (14 female) chose to skip this step. In addition, female parental participants completed an additional facial preference test. In this test, the parent-age male face pairs were presented in random order as above, and women were asked to choose the more attractive face in each pair. They also reported whether they had stopped menstruating due to menopause (43 stopped cycling; 2 unsure).

Results

[1] We have no evidence that the question wording might have affected responses: in a separate study with a similar cohort of white, heterosexual females (N=114, mean age=20.06) we presented participants with the same face pairs as described in this paper but randomly assigned them to answer either the question 'Who is more attractive' or the question 'Who would be a more suitable partner for you'. A repeated measures ANOVA with question as a between subjects factor indicated no main effect of question (p=.69) and no interaction between face transform and question (p=.89). This cohort was recruited from the same large undergraduate psychology class, but one year later than the cohort described in the main study.

176 *Directional preferences*

177 One-sample t-tests against chance (0.5) indicated directional preferences of parents and

178 daughters for facial markers of genetic quality (all $p<.001$; see Table 1).

179

180 Table 1: Mean preference scores, representing the proportion of times participants selected

181 the high-trait face. All scores are significantly above chance (all $p<.001$).

	Mean (SD) preference of…		
	Daughter	Mother	Father
Attractiveness	.79 (.15)	.76 (.18)	.70 (.20)
Health	.76 (.15)	.68 (.19)	.67 (.18)
Masculinity	.75 (.21)	.70 (.23)	.68 (.23)
Symmetry	.64 (.19)	.66 (.19)	.66 (.16)

182

183 Additionally, attractiveness, health, and masculinity preferences were weakly to moderately

184 correlated, while symmetry preferences were independent (Table 2). Fathers and mothers

185 showed a significant correlation in attractiveness preferences ($r_{rho}=.25$, $p=.02$). There were no

186 other significant correlations between parents (all $p>.12$) or parents and daughters (all $p>.10$).

187

Table 2: Zero-order correlations of parental trait preferences.

Preference for…	Attractiveness	Health	Masculinity
Health	.53**		
Masculinity	.21**	.41**	
Symmetry	.10	.10	-.02

Note. **p<.01.

Parent-offspring conflict

Next, for those families were daughter, mother, and father participated (N=87), we next ran a 3x4 repeated measures ANOVA with rater (daughter, mother, father) and rating (attractiveness, health, masculinity, and symmetry) as repeated measures. The test revealed a main effect of rater ($F(2,85)=5.60$, $p=.005$), a main effect of rating ($F(3,84)=17.68$, $p<.001$), and a rater by rating interaction ($F(6,81)=3.01$, $p=.01$). The main effect of rater was driven by daughters showing stronger preferences than both their mothers ($p=.04$) and their fathers ($p=.002$). There was no significant difference in preference between mothers and fathers ($p=.33$). The main effect of rating was driven by the high attractive face having been chosen significantly more frequently than the 'high' face of any of the other traits (all $p<.01$) and the high health and high masculinity faces having been chosen significantly more often than the high symmetry face (ps<.01). The interaction between rater and rating was resolved using sub-sequent independent repeated measures ANOVAs for each rating. For attractiveness, mothers and daughters did not differ in their ratings ($p=.46$), but fathers and daughters did ($p<.01$). For health, daughters chose the 'high' face significantly more often than both their mothers ($p=.003$) and fathers ($p<.001$). For masculinity, daughters showed a marginally stronger preference for 'high' faces than their mothers ($p=.08$) and a significantly stronger

preference than their fathers (p=.02). Finally, for symmetry there was no difference between daughters and their parents (all p>.34; Figure 2). Mothers and fathers did not differ in their ratings for any traits, although for attractiveness, mothers showed a marginally stronger preference (p=.05). Finally, in order to assess whether menopause influenced mothers' ratings we ran an additional repeated measures ANOVA including only mothers with rating as a repeated measure and controlling for menopause and age. This test revealed no effect of either age (p=.67) or menopause (p=.47).

--- Insert Figure 2 here ---

To determine whether the parents' lesser preferences for markers of genetic quality were driven by judging faces much younger than themselves, we used paired-samples t-tests to compare the mothers' ratings of the suitability of daughter-aged male faces for their daughters with their ratings of the attractiveness of parent-aged male faces for themselves. With the exception of health ($t(104)=0.79$, $p=.43$, $d=.15$), mothers showed significantly stronger preferences for markers of genetic quality when making judgements for their daughters than when judging potential partners for themselves (attractiveness: $t(104)=5.01$, $p<.001$, $d=0.98$; masculinity: $t(104)=4.73$, $p<.001$, $d=0.93$; symmetry: $t(104)=3.94$, $p<.001$, $d=0.77$).

Effect of daughter's attractiveness

Next, we assessed whether participants adjusted their preferences for potential partners according to the daughter's attractiveness. Spearman's correlations revealed that the associations between preferences for markers of genetic quality and assessments of

daughters' attractiveness were generally negative and non-significant (Table 3). Results were similar for fathers and mothers.

Table 3: Zero-order correlations between preferences for facial markers of genetic quality in the daughter's potential partner and rated attractiveness of the daughter

Preference for…	Parent preference and parent-perceived daughter attractiveness		Daughter preference and self-perceived daughter attractiveness	
	r	*p*	*r*	*p*
Attractiveness	-.15	.05	-.15‡	.09
Health	-.15	.04	-.13	.16
Masculinity	-.03	.73	-.14	.13
Symmetry	-.02	.77	.11	.21

Discussion

Our results are the first demonstration that parents show clear preferences for facial markers of genetic quality when assessing potential partners for their daughters. Parents thus have mechanisms that assess facial markers of genetic quality when assessing their daughters' partners, and could use this information to inform their dealings with potential sons-in-law.

We also saw diverging patterns of preferences between parents and their daughters. Daughters showed stronger preferences for attractiveness, health, and masculinity than their fathers, and stronger preferences for health and marginally for masculinity than their mothers. Fathers and mothers did not differ in their levels of preference. Parent-offspring conflict predicts that daughters should have greater preferences than their parents for markers of genetic quality in order to maximise their own fitness through mating with a high quality

partner, whereas parents should have stronger preferences for partners who are likely to invest resources into offspring (Buunk et al., 2008). While our data are consistent with this prediction, we did not explicitly test parental preferences for investment but rather inferred these following previous research that indicates that markers of genetic quality are traded off with investment traits (Perrett et al., 1998). It is unlikely that parents should disregard markers of genetic quality completely, and this is also evident in our findings. We did not find the same pattern of results for symmetry judgements, perhaps due to stimuli being harder to distinguish, although both parents and daughters showed above chance preferences for symmetrical faces. Our results are further corroborated by a previous study (Kruger, 2006) where university students were asked to imagine their preferences if they had a grown-up daughter, and demonstrated a stronger preference for feminised male faces (i.e. more rather than less investing) as potential sons-in-law compared to other contexts, including dating, marriage, and sexual relations. The differences in judgements between parents and daughters in our study is unlikely to be attributable to the possibility that the parents struggled to properly judge genetic quality in faces younger than themselves; indeed mothers showed stronger preferences for genetic quality in daughter-aged male faces than in parent-aged male faces.

Menopause did not change the mothers' assessments of the faces, irrespective of whether they were judging daughter-aged faces in terms of their suitability as a partner for their daughter, or age-matched faces in terms of their attractiveness to themselves. This latter point stands in contrast to previous work showing that menopause reduces women's preferences for facial markers of genetic quality when assessing potential partners for themselves in age-matched and younger faces (Jones et al., 2011; Little et al., 2010). Given the potential benefit to inclusive fitness, maintained ability to assess mate quality for their daughters might be

independent from the hormonal effects of the menopause that could affect own mate choice. In line with this, mothers demonstrated stronger preferences for markers of genetic quality in their daughters' partners than in partners for themselves. This seems to run counter to the parent-offspring conflict hypothesis, as genetic quality should be more important in a reproductive partner than in an in-law. On the other hand, we cannot directly compare ratings of daughter-aged and parent-aged stimuli because the stimuli themselves were different and so properties of the stimuli could have interacted with properties of the manipulations. In addition, even though the majority of the mothers were pre-menopausal, genetic quality could still be of lesser strategic importance than investment in a potential partner for women who have more years of potential grandparenting than potential reproduction in the near future.

Finally, we did not find that parents and daughters had stronger preferences for markers of genetic quality if they perceived the daughter to be more attractive. Indeed, we found weak evidence for the contrary: parents had stronger preferences for healthy male faces if they perceived their daughters to be less attractive, and there were non-significant negative relationships between perceptions of daughter attractiveness and preferences for other facial markers of genetic quality (Table 3). While this is surprising given the existing literature on assortative mating (Jones et al., 2005; Little et al., 2001), parents and daughters appeared to be behaving similarly, indicating an analogous mechanism at play. It is possible that physical appearance is somewhat less critical in partner choice if a daughter is very attractive and accordingly carries many markers of genetic quality. In this instance, a trade-off towards caring personality traits might be made by both parents and women choosing partners. Our results run contrary to a recent study (Apostolou & Papageorgi, 2014) however, showing that parents preferred sons-in-law who were similar in attractiveness to their daughter, although

this study assessed attractiveness equivalence using a single Likert-scale item, rather than rating both partners' and own daughter's attractiveness on a large number of trials.

We did not collect data on hormonal contraceptive usage. Women who use hormonal contraceptives show weaker preferences for male facial masculinity than women who do not (e.g. Little et al. 2013). Use of oral contraceptives by women in the UK declines sharply throughout adulthood (Lader, 2009; Lifestyle Statistics, Health and Social Care Information Centre, 2014). Accordingly, hormonal contraceptive usage should create stronger preferences for male facial femininity in the daughters, and stronger preferences for male facial masculinity in the mothers. This was opposite to what we found, and indicates that the effects we noted might have been even stronger if we had taken account of hormonal contraceptive usage. Overall, here, we found that the masculinised rather than feminised male facial stimuli tended to be preferred; research studies have previously reported findings of enhanced attractiveness both in masculinised and also in feminised male facial stimuli (Rhodes 2006). These differences likely result from a complex combination of the features of the stimuli and individual variables relating to the raters (Rhodes 2006). For our research study, the key question was not whether male facial masculinity or feminity overall was preferred, but how parents' preferences compared with those of their daughters.

We chose to focus on female rather than male participants and their parents. Females can incur higher potential costs than males in mate choice (Trivers 1972). We would anticipate that, in respect of sons, the parents would have similar preferences for markers of genetic quality in daughters-in-law, and would also have weaker preferences than their sons for markers of genetic quality (Apostolou, 2011, 2015; Perilloux, Fleischman, & Buss; 2011).

The current study did not assess whether the parents in the study were influential in their daughter's actual mate choice, although a wealth of evidence shows the existence of this phenomenon (Apostolou, 2007; Goode, 1959; Menon, 1989; Minturn, Grosse, & Haider, 1969). Likewise, like almost every study on attractiveness preferences, we did not test how the preferences that we assessed would translate into real-world encounters. While several studies have shown a relationship between ideal and actual partner choice, the former does not necessarily predict the latter (Campbell & Stanton 2014; Eastwick et al. 2014). For consistency with the wealth of existing literature on human mate choice, we asked the daughters to indicate the more attractive male face in the pair. This exact question could not be used directly to ask parents about their preferences for their daughter, and so, instead, we asked them to select which face was more suitable as a partner for their daughter. To check whether the wording difference could have contributed to the difference in preferences, we ran a further study recruited from the same teaching class but amongst the students in the following year's cohort. Participants were randomly allocated to answer one question or the other. The question wording did not influence stated preferences. However, the difference in question wording for the parents compared to the daughters is a potential limitation of the study.

Taken together, we present evidence for parental preferences for sons-in-law being directional and supportive of inclusive fitness. Our data are consistent with parent-offspring conflict, which may be the driving force behind parental involvement in their offspring's mate choice. Contemporary western research seeks to understand universal patterns of human mate choice by extrapolating from measurements of individual preferences, but human mate choice across cultures is often modified by parental wishes (Apostolou, 2007; Goode, 1959; Menon, 1989; Minturn, Grosse, & Haider, 1969). In showing commonalities and differences

between an individual's preferences for their own partner, and parents' preferences for an in-law, we show how research on physical attraction within WEIRDs (western, educated, industrialised, rich, democratic people; Henrich, Heine, & Norenzayan, 2010) can be integrated with cross-cultural, historical and anthropological data that highlight the role of the family in marriage and partnership choices.

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Figure Caption:

Figure 1: Example stimuli pairs.

*Figure 2: Differences between parent and offspring preferences for each marker of genetic quality, where 0.5 would indicate preferences at chance levels (mean +/- SE). *p<.05; **p<.01; ***p<.001 (Bonferroni corrected).*

References

Andersson, M. B. (1994). *Sexual Selection.* Princeton University Press.

Apostolou, M. (2007). Sexual selection under parental choice: the role of parents in the evolution of human mating. *Evol. Hum. Behav*., 28(6):403-409.

Apostolou, M. (2008). Parent-offspring conflict over mating: The case of beauty. *Evolutionary Psychology*, *6*(2), 303-315.

Apostolou, M. (2010a). Sexual selection under parental choice in agropastoral societies. *Evol. Hum. Behav.*, 31, 39-47.

Apostolou, M. (2010b). Parental choice: What parents want in a son-in-law and a daughter-in-law across 67 pre-industrial societies. *Brit J Psychol*, 101, 695-704.

Apostolou, M. (2011). Parent-offspring conflict over mating: Testing the tradeoffs hypothesis. *Evolutionary Psychology*, *9*(4), 147470491100900401.

Apostolou, M. (2012). Sexual selection under parental choice: Evidence from sixteen historical societies. *Evolutionary Psychology*, 10, 504-518.

Apostolou, M. (2013). Do as we wish: Parental tactics of mate choice manipulation. *Evolutionary Psychology*, 11, 795-813.

Apostolou, M. (2015). Parent–Offspring Conflict Over Mating: Domains of Agreement and Disagreement. *Evolutionary Psychology*, *13*(3).

Apostolou, M. & Papageorgi, I. (2014). In-law choice and the search for similarity. *Personality and Individual Differences*, 66, 106-111

Boothroyd, L. G., Jones, B. C., Burt, D. M., DeBruine, L. M., & Perrett, D. I. (2008). Facial correlates of sociosexuality. *Evolution and Human Behavior*, *29*(3), 211-218.

Buunk, A.P., Park, J.H., & Dubbs, S.L. (2008). Parent-offspring conflict in mate preferences. *Rev Gen Psychol*, *12*(1), 47.

Buunk, A.P., Park, J.H., & Duncan, L.A. (2010). Cultural variation in parental influence on mate choice. *Cross-Cult. Res.*, 44(1):23-40.

Campbell, L., & Stanton, S. C. (2014). The predictive validity of ideal partner preferences in relationship formation: What we know, what we don't know, and why it matters. Social and Personality Psychology Compass, 8(9), 485-494.

Clark, A. P. (2004). Self-perceived attractiveness and masculinization predict women's sociosexuality. *Evolution and Human Behavior*, *25*(2), 113-124.

DeBruine, L. M., Jones, B. C., Little, A. C., Boothroyd, L. G., Perrett, D. I., Penton-Voak, I. S., ... & Tiddeman, B. P. (2006). Correlated preferences for facial masculinity and ideal or actual partner's masculinity. Proceedings of the Royal Society of London B: Biological Sciences, 273(1592), 1355-1360.

Eastwick, P. W., Luchies, L. B., Finkel, E. J., & Hunt, L. L. (2014). The predictive validity of ideal partner preferences: A review and meta-analysis. Psychological Bulletin, 140(3), 623.

Ebner, N.C., Riediger, M., & Lindenberger, U. (2010). FACES—A database of facial expressions in young, middle-aged, and older women and men: Development and validation. *Behav Res Methods*, 42, 351-362.

Goode, W. J. (1959). The theoretical importance of love. *American Sociological Review*, 24(1), 38-47.

Hamilton, W.D. (1964). The genetical evolution of social behaviour I and II. *J Theor Biol*, 7, 1–52.

Henrich, J., Heine, S.J., & Norenzayan, A. (2010). The weirdest people in the world. *Behav Brain Sci*, 33(2-3), 61-83.

Jones, B. C., Little, A. C., Boothroyd, L., Feinberg, D. R., Cornwell, R. E., DeBruine, L. M., et al. (2005). Women's physical and psychological condition independently predict their

preference for apparent health in faces. *Evolution and Human Behavior, 26*(6), 451-457.

Jones, B.C., Vukovic, J., Little, A.C., Roberts, S.C., & DeBruine, L.M. (2011). Circum-menopausal changes in women's preferences for sexually dimorphic shape cues in peer-aged faces. *Biol Psychol, 87*(3), 453-455.

Kruger, D.J. (2006). Male facial masculinity influences attributions of personality and reproductive strategy. *Pers Relationship, 13*(4), 451-463.

Lader, D. (2009). Contraception and Sexual Heath, 2008/09. London: Office for National Statistics.

Lefevre, C.E., Ewbank, M.P., Calder, A.J., Von Dem Hagen, E., & Perrett, D.I. (2013). It is all in the face: carotenoid skin coloration loses attractiveness outside the face. *Biology letters*, *9*(6), 20130633.

Lifestyle Statistics, Health and Social Care Information Centre (2014). NHS Contraceptive Services: England, Community Contraceptive Clinics Statistics for 2013-14. London: National Statistics.

Little, A. C., Burriss, R. P., Petrie, M., Jones, B. C., & Roberts, S. C. (2013). Oral contraceptive use in women changes preferences for male facial masculinity and is associated with partner facial masculinity.Psychoneuroendocrinology, 38(9), 1777-1785.

Little, A.C., Burt, D.M., Penton-Voak, I.S., & Perrett, D.I. (2001). Self-perceived attractiveness influences human female preferences for sexual dimorphism and symmetry in male faces. *P R SOC B, 268*(1462), 39-44.

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. *Psychoneuroendocrino, 35*(6), 912-920.

Menon, R. (1989). Arranged marriages among South Asian immigrants. *Sociology and Social Research, 73*(4), 180-181.

Minturn, L., Grosse, M., & Haider, S. (1969). Cultural patterning of sexual beliefs and behavior. *Ethnology*, 301-318.

Penton-Voak, I. (2011). In retreat from nature? Successes and concerns in Darwinian approaches to facial attractiveness. *Journal of Evolutionary Psychology*, 9(2), 173-193.

Perrett, D.I., Lee, K.J., Penton-Voak, I., Rowland, D., Yoshikawa, S., Burt, D.M., et al. (1998). Effects of sexual dimorphism on facial attractiveness. *Nature, 394*(6696), 884-887.

Perilloux, Fleischman, & Buss (2011). Meet the parents: Parent-offspring convergence and divergence in mate preferences. *Pers. Indiv. Differ.*, 50(2):253-258.

Rhodes, G. (2006). The evolutionary psychology of facial beauty. *Annu. Rev. Psychol., 57*, 199-226.

Roney, J.R., Hanson, K.N., Durante, K.M., & Maestripieri, D. (2006). Reading men's faces: women's mate attractiveness judgments track men's testosterone and interest in infants. *P R SOC B, 273*(1598), 2169-2175.

Sanchez-Pages, S., & Turiegano, E. (2010). Testosterone, facial symmetry and cooperation in the prisoners' dilemma. *Physiology & Behavior*, 99(3), 355-361.

Saxton, T.K. 2016. Experiences during specific developmental stages influence face preferences. Evolution and Human Behavior, 37(1), 21-28.

Takahashi, C., Yamagishi, T., Tanida, S., Kiyonari, T., & Kanazawa, S. (2006). Attractiveness and cooperation in social exchange. *Evolutionary Psychology*, 4, 315-329.

466 Thornhill, R., & Gangestad, S.W. (2006). Facial sexual dimorphism, developmental stability,
467 and susceptibility to disease in men and women. *Evol. Hum. Behav.*, *27*(2), 131-144.
468 Todorov, A., Dotsch, R., Porter, J., Oosterhof, N., & Falvello, V. (2013). Validation of data-
469 driven computational models of social perception of faces. *Emotion*, 13, 724-738.
470 Todorov, A., & Oosterhoof, N.N. (2011). Modeling social perception of faces. Signal
471 Processing Magazine, *IEEE,* 28, 117-122.
472 Trivers, R.L. (1972). Parental investment and sexual selection. In: *Sexual Selection & the*
473 *Descent of Man.* Aldine de Gruyter: New York, 136-179.
474 Trivers, R.L. (1974). Parent-offspring conflict. *Am Zool*, *14*(1), 249-264.
475 Waynforth, D., & Dunbar, R. I. (1995). Conditional mate choice strategies in humans:
476 evidence from 'Lonely Hearts' advertisements. *Behaviour*, 132(9), 755-779.
477 Zaatari, D., & Trivers, R. (2007). Fluctuating asymmetry and behavior in the ultimatum game
478 in Jamaica. *Evolution and Human Behavior*, 28(4), 223-227.