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A LONGITUDINAL STUDY OF ADOLESCENTS' JUDGMENTS OF THE ATTRACTIVENESS OF FACIAL SYMMETRY, AVERAGENESS AND SEXUAL DIMORPHISM

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Abstract. Adolescents have been found to differ by age in their attraction to facial symmetry, averageness, and sexual dimorphism. However, it has not been demonstrated that attraction to these facial characters changes over time as a consequence of age-linked development. We aimed to extend previous cross-sectional findings by examining whether facial attractiveness judgments change over time during adolescence as a consequence of increasing age, in a within-subjects study of two cohorts of adolescents aged 11–16. Consistent with previous findings, we find that adolescents (often particularly females) judged faces with increased averageness, symmetry and femininity to be more attractive than original, asymmetric and masculine faces respectively. However, we do not find longitudinal changes in face preference judgments across the course of a year, leading us to question the extent to which some of the previously reported differences in facial attractiveness judgments between younger and older adolescents were due to age-linked changes.

Keywords: adolescence, face attractiveness judgments, facial averageness, facial sexual dimorphism, facial symmetry

Judgments of physical attractiveness are shaped in part by the requirements of choosing a partner. As these requirements change, judgments of what is attractive can shift dynamically to reflect them: an individual's specific requirements for a partner influence his or her judgments of what is attractive (see e.g. RHODES 2006; ROBERTS and LITTLE 2008). For example, attractiveness judgments change depending on whether the judge is assessing potential partners for a short-term or long-term relationship (e.g. LITTLE et al. 2002), and women differ in what they prefer depending on whether they are likely to conceive or not at the time when they make the assessment (see JONES et al. 2008; LITTLE et al. 2010). In the same way, partner choice is not relevant to pre-adolescents, and so we might predict that human judg-

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ments of attractiveness might change somewhat during adolescence, perhaps in tandem with pubertal development and separate from general task performance development, as requirements shift from judging potential affiliates to judging potential affiliates and partners. However, our current understanding of the effects of ontogeny on attractiveness judgments is limited, despite the value of understanding ontogeny alongside function in forming a description of a biological feature (TINBERGEN 1963). Infants can distinguish sexual dimorphism in faces (DRIVER LEINBACH and FAGOT 1993), and are sensitive to differences in facial symmetry and distinctiveness, but these do not appear to affect their judgments in the same way as they do adults' (SAMUELS et al. 1994; RHODES et al. 2002). A recent review on facial attraction concluded that we know "little about whether preferences change during development (e.g., at puberty)" (RHODES 2006, p.218).

One study on preference changes during adolescence (SAXTON et al. 2009; summarised in *Table 2*) found initial evidence for some differences between participants aged around 11–12 compared with participants aged around 13–14 in their judgments of facial sexual dimorphism, symmetry, and distinctiveness in a cross-sectional study. Facial sexual dimorphism, symmetry, and distinctiveness (or averageness) all affect adults' attractiveness judgments and are thought to provide information, in part, on an individual's quality as a reproductive partner (see e.g. RHODES 2006; ROBERTS and LITTLE 2008). The initial study found differences using a between-subjects design comparing younger and older adolescents who rated symmetry, averageness and sexual dimorphism in age-matched faces (i.e. older children rated older faces, and younger children rated younger faces). However, a subsequent study (SAXTON et al. 2010) that asked Czech adolescents aged 12–14 to rate all of these same facial stimuli found both that some of the older adolescents' judgments differed from some of the younger adolescents' judgments, but also that some of the manipulations were judged more attractive more often in some of the older stimuli compared with some of the younger stimuli, implying that both differences in the age of the judge and differences in the nature of the task may have been contributing to at least some of the noted preference differences.

Given this confusion, to help resolve the influences of age during adolescence, we returned to the group of adolescents studied in (SAXTON et al. 2009) to carry out a longitudinal study where the same adolescents judged the same set of faces one year later. If the differences in facial judgments between the younger and older group of adolescents who differed in age by two years were due to developmental effects, then we would expect to see similar differences (although of smaller magnitude) in judgments at an interval of one year. On the other hand, if the previously noted differences between the older and younger adolescents were due to stimulus set and/or cohort effects, then we might not see any changes between the first and second round of data collection. In addition, we wanted to determine whether we would replicate findings of general adolescent preferences, and of differences stratified by sex and pubertal development, to help distinguish robust effects from random fluctuations.

METHODS

Participants

Pupils were recruited from private schools charging similar levels of school fees. In the first round of data collection, children were recruited from the first and third year of secondary education (i.e. admitting children aged around 11, and around 13). The attractiveness judgment tests were repeated with as many of the same pupils as were available plus a number of their classmates in a second data collection round between nine and 13 months subsequent to the first test, subject to school time availability.

In the first round of data collection, younger children (n = 150, 77 male) were aged (mean ± SD) 11 years 9 months ± 5 months and older children (n = 158, 84 male) were aged (mean ± SD) 13 years 10 months ± 5 months. (Numbers and ages differ slightly from those reported in the previous study because these figures describe the subset of participants who carried out the face rating task). In the second round of data collection, younger children (n = 174, 95 male) were aged (mean ± SD) 12 years 9 months ± 4 months (18 children did not provide date of birth); older children (n = 151, 58 male) were aged (mean ± SD) 14 years 11 months 6 months (one child did not provide date of birth). Ethnicities of the raters predominantly matched those of the stimuli (i.e. 81% stated Caucasian in the first round and 88% in the second round). We had data from both rounds for 77 younger boys, 40 older boys, 66 younger girls and 62 older girls.

Materials

Stimuli are the same as those used in the original study (SAXTON et al. 2009). Sixty Caucasian individuals (divided into four age and sex groups: 15 boys aged 11–13, 15 girls aged 11–13, 15 boys aged 13–15 and 15 girls aged 13–15) were photographed, and 179 points delineating the facial features (eyes, ears, nose, mouth, eyebrows, cheekbones, face perimeter) were marked out using the specialist software Psychomorph (TIDDEMAN, BURT and PERRETT 2001).

Following PERRETT et al. (PENTON-VOAK et al. 1999) (1999, Study 2), asymmetric and symmetric versions of real face shapes were manufactured that differed by 100% of the vector differences in shape between original and perfectly symmetric shapes. Here, asymmetric and symmetric versions were manufactured by adding or substracting 50% of the shape differences between orginal and perfectly symmetric versions of an individual to the original face images

To create pairs of images that differed in symmetry, following PERRETT et al. (1999, Study 2), asymmetric and symmetric versions of real face shapes were manufactured that differed by 100% of the vector differences in shape between original and perfectly symmetric shapes. Here, asymmetric and symmetric versions

Figure 1. Examples of image manipulation, applied to an adult base face (children's faces are not shown for reasons of consent). Top row: face has been masculinised (left) and feminised (right); middle row: face is original (left) and made more average (right); bottom row: face has been made more asymmetric (left) and more symmetric (right). Image originally published in SAXTON et al. (2009)

of six images from each of the four age and sex categories were manufactured by adding or substracting 50% of the shape differences between orginal and perfectly symmetric versions of an individual to the original face images. To create pairs of faces that differed in sexual dimorphism of 2D face shape we added or subtracted 50% of the linear 2D shape differences between the average face shape of the 15 older boys and that of the 15 older girls (i.e. 13–15 years old) to and from six photographs from each age and sex group (see e.g. DEBRUINE et al. 2006). To make six individual images from each age and sex group more 'average', we calculated the linear differences in 2D shape between six individual images and the average shape for the 15 images of that age and sex category, and then added those differences to six individual images to make the individual images more average; the six averaged images could then be tested alongside the six original images (see e.g. JONES, DEBRUINE and LITTLE 2007). Faces were not symmetrized prior to manipulating averageness, so facial symmetry was also altered, although symmetry contributes only slightly to preferences for average faces (RHODES et al. 2001a; JONES, DEBRUINE and LITTLE 2007). All manipulations affected only the shape and not the colour of the images.

Following these manipulations, facial stimuli comprised 72 pairs of faces from 24 Caucasian individuals aged 11–15. Twenty-four pairs consisted of one face that had been manipulated to increase symmetry paired with one face manipulated to decrease symmetry. Twenty-four pairs consisted of one face manipulated to increase averageness paired with one original (i.e. less average) face. Twenty-four pairs consisted of one face manipulated to increase femininity paired with one face manipulated to increase masculinity. Within each of these groups of 24 pairs, half were female; half were aged 11–13 and half were aged 13–15. Examples of the stimuli manipulations are given in *Figure 1*. The raters saw six individuals manipulated in a variety of ways multiple times: so each stimulus face was used in the averageness, symmetry and sexual dimorphism manipulations.

Procedure

Stimuli were presented in pairs; the faces within a pair were identical except for the manipulation (averageness, symmetry, or sexual dimorphism). Children indicated which image in each pair was more attractive. We calculated six scores per child, which represented the number of average, symmetric and feminine male or female faces chosen as more attractive. Children rated the stimuli either all fully randomised at an individual computer (n = 206 and 203 in the first and second round of data collection, respectively) or provided pen-and-paper ratings of stimuli presented through an overhead projector that ran the same fully randomising software (n = 102 and 122 in the first and second round of data collection, respectively). The differences in presentation depended on what facilities were available at the school, and were consistent between the two rating sessions. Presentation type differences such as these do not appear to have systematic effects on judgments, and did not appear to affect the data here (further discussion in SAXTON et al. 2009). Children rated the same set of age-matched faces presented in the same format in both rounds of data collection: the younger group of children rated faces of individuals aged 11–13 in both rounds, while the older children rated faces of individuals aged 13–15 in both rounds. Three children demonstrated extreme side bias in their preferences (choosing consistently the image presented on one side 35 times out of 36), and two participants entered an unrealistic year of birth; their data were excluded. Omissions also arose if a participant's response was not recorded for a face pair (which could arise if a participant elected not to rate a face pair, or because of a technical problem). Eleven potential data points (where a data point might be, for example, a participant's score representing their judgments of male facial averageness in the second round of data collection) were missing and are thus omitted from the analysis reported. In addition, scores were only calculated if data from at least five out of six possible judgments per category were obtained (n = 3 potential data points removed). Degrees of freedom vary accordingly.

Children who only took part in one of the two years are included in the analyses when the two years are analysed separately below because the hypotheses concern the effects of age and puberty in general and should be independent of the specific participants. Statistical analysis was carried out in SPSS 18.0.

RESULTS

Data consisted of the proportion of times that the participant picked the average over the original face, the feminine over the masculine face, or the symmetric over the asymmetric face, calculated separately for male and female faces. We replicated findings that adolescents prefer facial symmetry, averageness and femininity (*Table 1*).

Table 1. Adolescents chose the average, symmetric and feminine faces as more attractive compared with the unchanged, asymmetric and masculine faces at levels significantly greater than chance (single-sample t-test against chance)

Sex of rated face	Preferred dimension	Younger group of adolescents	Older group of adolescents
Male	Averageness	$t(172) = 4.54, p < .001$	$t(150) = 13.48, p < .001$
	Symmetry	$t(173) = 3.07, p = .002$	$t(150) = 6.92, p < .001$
	Femininity	$t(172) = 3.51, p = .001$	$t(150) = 11.41, p < .001$
Female	Averageness	$t(173) = 5.38, p < .001$	$t(150) = 10.08, p < .001$
	Symmetry	$t(172) = 3.89, p < .001$	$t(150) = 5.71, p < .001$
	Femininity	$t(173) = 5.78, p < .001$	$t(150) = 9.12, p < .001$

Age and sex differences in preferences

Six within-subjects ANOVAs examined the effects of the independent variables of rater age group, sex and round on one of the six dependent variables (the proportion of average, symmetric or feminine male or female faces selected). *Tables 2* and *3* report all significant findings (all interactions $p > .05$). Round was not significant in any of the analyses (all $p > .09$; see *Figure 2*).

Table 2. A comparison of the older and younger adolescents' judgments

Sex of rated face	Preferred dimension	Were the older stimuli selected as attractive by the older group significantly more often than the younger stimuli were selected as more attractive by the younger group?	
		First round of data collection (from SAXTON et al. 2009)	First and second rounds of data collection combined (the round of data collection did not interact significantly with the age group, all $p > .05$)
Male	Averageness	Yes	Yes ($F_{1,241} = 31.15$, $p < .001$)
	Symmetry	Yes	Yes ($F_{1,239} = 8.12$, $p = .005$)
	Femininity	Older girls had significantly stronger preferences than younger girls	Yes ($F_{1,238} = 45.65$, $p < .001$); this was modified by a significant interaction with the sex of the rater ($F_{1,238} = 8.27$, $p = .004$), but subsequent separate analysis showed that the older group selected more than the younger group among both the boys ($F_{1,114} = 6.88$, $p = .010$) and the girls ($F_{1,124} = 51.23$, $p < .001$)
Femal+e	Averageness	Yes	Yes ($F_{1,239} = 25.18$, $p < .001$)
	Symmetry	No	No ($F_{1,240} = .37$, $p = .543$)
	Femininity	No	No ($F_{1,240} = 2.14$, $p = .145$)

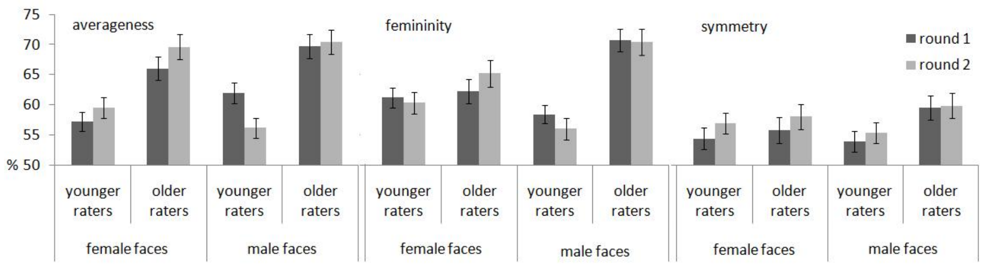

Figure 2. Percentage of times average faces selected as more attractive than original faces, feminine than masculine, and symmetric than asymmetric, contrasting first and second round of data collection, and the younger and older groups of raters. Bars = mean ± SE.

Table 3. A comparison of male and female raters' preferences

Sex of rated face	Preferred dimension	Did girls select the average, feminine or symmetric faces significantly more often than boys?	
		First round of data collection (from SAXTON et al. 2009)	First and second rounds of data collection combined (the round of data collection did not interact significantly with rater sex, all $p > .05$)
Male	Averageness	Yes	Yes ($F_{1,241} = 6.50$, $p = .011$)
	Symmetry	No	No ($F_{1,239} = .69$, $p = .406$)
	Femininity	Older girls had stronger preferences than older boys	Yes ($F_{1,238} = 12.49$, $p < .001$), but this was modified by a significant interaction with the age group of the rater ($F_{1,238} = 8.27$, $p = .004$); girls only selected more than boys in the older ($F_{1,99} = 13.85$, $p < .001$) and not the younger group ($F_{1,139} = .32$, $p = .570$)
Female	Averageness	No	Yes ($F_{1,239} = 4.24$, $p = .041$)
	Symmetry	No	No ($F_{1,240} = .04$, $p = .833$)
	Femininity	Yes	Yes ($F_{1,240} = 15.31$, $p < .001$)

Pubertal development and preference

Following the rating task, the participants completed a questionnaire (from SAXTON et al. 2009) where they provided demographic data including details of pubertal development. In boys, self-report of pubertal development was scored on a 0–2 scale, with one point for self-report of body hair and one point for self-report of voice change; while in girls, one point was awarded for self-report of greater physical development than their peers and one point for the attainment of menarche. Twelve boys were excluded from the analyses on pubertal development because they said that they had body hair or had undergone voice change in the first but not the second round of data collection (suggesting a lack of understanding or reliability), data from 14 adolescents could not be used in this analysis because they did not supply exact age data, and 38 participants were not used in the analysis because they did not respond to all of the questions. Scores were very unequal in the older groups (older boys: $n = 2$, 8 and 39 and older girls: $n = 4$, 29 and 44 scoring 0, 1 and 2 points respectively), and so analysis was restricted to the younger group (younger boys: $n = 22$, 35 and 25 and younger girls: $n = 17$, 16 and 20 scoring 0, 1 and 2 points respectively). We carried out 12 ANCOVAs on the data from the second round, analysing the effects of rater pubertal development and the covariate of age in years and months, on one of the six dependent variables (the proportion of average, symmetric or feminine male or female faces selected) for male and female raters separately. Pubertal development was not significant in any analysis (all $p > .09$).

DISCUSSION

We found that adolescents preferred male and female adolescent faces manipulated to increase symmetry, averageness and femininity over asymmetry, non-averageness and masculinity, respectively (Table 1). Preferences for these characteristics are thought to assist individuals in selecting a suitable reproductive partner (reviews in e.g. RHODES 2006; ROBERTS and LITTLE 2008). Facial symmetry may index a genotype that is better able to resist local pathogens, facial averageness may indicate developmental stability, heterozygosity and functional optimality, while male facial masculinity and female facial femininity may denote health and immunocompetence (see RHODES 2006). Facial sexual dimorphism, symmetry, and distinctiveness might also be used to make judgments about social affiliates. For instance, men with more feminine face shapes are perceived to have personalities that are higher in warmth, emotionality, honesty and co-operativeness (PERRETT et al. 1998; JOHNSTON et al. 2001). More masculine male and more feminine female adolescent faces are perceived as more healthy (RHODES et al. 2003). Facial symmetry is associated with greater perceived honesty (ZEBROWITZ, VOINESCU and COLLINS 1996), and both facial symmetry and facial averageness are positively related to perceived intelligence (ZEBROWITZ et al. 2002) and perceived health (RHODES et al. 2001b). When the participants made judgments of 'attractiveness', we did not define to them what this should mean, and accordingly they could have relied on these or any other consideration in their judgments.

We replicated cross-sectional differences in judgments between the older and younger groups of adolescents, using the same participants (*Table 2*). However, we found no significant differences in judgments that were measured longitudinally across the course of a year (*Figure 2*). This suggests that previously-noted age differences in face judgments during adolescence may have been due in part to the stimuli used. The adolescents rated age-matched faces to increase ecological validity and appropriateness, and because age-matched faces are processed more effectively (ANASTASI and RHODES 2005). Thus, the younger adolescents judged a different set of faces from the older adolescents. Facial appearance changes a great deal during adolescence (ENLOW 1990) and it may be that older faces seen by the older adolescents cue more consistent sexual attractiveness judgments than younger faces, or interacted in other ways with the manipulations.

Set alongside results from a set of Czech adolescents aged 12–14 who carried out the same set of forced-choice preference judgments but on the complete set of younger and older faces (SAXTON et al. 2010), the implications of these findings differ somewhat for each face manipulation type. The Czech adolescents selected average male faces significantly more often when judging older compared with younger male faces, but the older Czech adolescents did not select more of the average male faces as more attractive than the younger Czech adolescents did. Coupled with the lack of longitudinal change among British adolescents, we have no robust evidence that preferences for male facial averageness change longitudinally during adolescence. Similarly, the Czech adolescents selected feminine male faces significantly more often when judging older compared with younger male faces, and did not judge these faces differently according to the age of the rater. Together with the lack of longitudinal change among British adolescents, it seems that the noted greater preference for male facial femininity in the older age group (evident among the girls but not the boys in the first year of data collection) is likely due to stimuli differences. Indeed, this explanation fits with the findings of LITTLE et al. (2010), who found in a cross-sectional design that female preference for male facial masculinity increased significantly as females reached approximate reproductive age (i.e. from 15–25). We previously found that boys further through puberty had stronger preferences for male facial masculinity. This was not replicated here, although here we used a smaller sample of adolescents, and it might be that links between pubertal development and preferences arise only at certain limited points during adolescence. It is unlikely that the previous results were an artifice of the greater number of more developed boys who judged the older faces, because male facial femininity rather than masculinity was preferred in the older faces.

Better evidence, perhaps, for a genuine age effect comes from consideration of ratings of facial symmetry. The older Czech adolescents selected more of the male and female symmetric faces as more attractive than the younger Czech adolescents (although the male symmetric faces were also more likely to be selected if they came from the older stimulus set). However, among the British adolescents studied here, the older group selected more of the symmetric male but not female faces than the younger group, and there was no evidence for longitudinal changes in judgments of facial symmetry. Likewise, female facial averageness was not selected more often by the Czech adolescents in judging older compared with younger stimuli, suggesting that the cross-sectional differences in judgments between the older and younger British adolescents might be attributable to age, although there were equally no longitudinal differences in the judgments of British adolescents across the course of one year. Finally, despite evidence from the Czech adolescents that female facial femininity should be selected more often in the older stimuli, there were no age group or longitudinal differences in the British adolescents' judgments.

The overall picture is a confusing one, and one caveat of the Czech judgments is that they may not be completely comparable to the British judgments. For example, they did not demonstrate the sex differences that were replicated here from the first round of data collection. Among the British adolescents, girls often selected significantly more of the preferred faces compared with boys. Girls' advantage in judging faces might be attributable to greater attention to the task, enhanced selectivity or attention to physical appearance, or greater awareness of social cues (MCCLURE 2000).

We are not able to rule out cohort effects as an explanation for the null findings for longitudinal effects of age in the British teenagers, although these are unlikely given that the groups were relatively large, were taken from the same schools, and differed in age by only two years. A further possible interpretation is that the development of face attractiveness judgments does not follow a linear trajectory, something that is true of face processing abilities in adolescence. Face encoding abilities enter a period of decline or stagnation from around the age of 10 or 12, recovering from around the age of 13 or 16 (CAREY, DIAMOND and WOODS 1980; FLIN 1980; DIAMOND, CAREY and BACK 1983). It is unlikely that carrying out the test twice *per se* affected judgments, because there are no significant differences in second round judgments comparing the adolescents who did the test in the first round with those who did not (analysis not shown). A further limitation of the null findings are that age-linked changes could be subtle, and only detectable when measured in larger temporal increments or using more sensitive measures. The difference of just one year, using a test that consisted of just six images per type, might not have been precise enough to detect facial judgment changes.

To conclude, adolescents seem to be sensitive to the same parameters (averageness, sexual dimorphism and symmetry) as adults in judging facial attractiveness, and their facial attractiveness judgments present patterns that differ systematically according to sex. There seem to be some differences according to age and possibly also pubertal development, although the magnitude and exact nature of these has yet to be clarified. Research has shown that preference differences in adults can be traced back retrospectively to differences in adolescent pubertal development (CORNWELL et al. 2006; JONES et al. 2010): individuals who first experienced coitus at a younger age are those who have stronger preferences for opposite-sex facial sexual dimorphism, and age at menarche has been found to be negatively associated with women's preferences for masculinised voices in adulthood. As such, the variability in preferences apparent in the adolescents here might represent some of the roots of the known adult individual differences in preferences. Future work might seek to examine further the developmental trajectory of judgments of attractiveness, in order to determine proximate causes of individual differences in adult preferences. The participants here were all drawn from a particular demographic (fee-paying schools from two geographical locations in the UK). Research has demonstrated that differences in human ecology can influence judgments of facial attractiveness, perhaps particularly in respect of judgments of facial sexual dimorphism (see e.g. PENTON-VOAK, JACOBSON and TRIVERS 2004), and as such future work might also consider these influences on adolescents' attractiveness judgments.

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