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Adolescents' preferences for sexual dimorphism are influenced by relative exposure to male and female faces

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ABSTRACT

Exposure to a particular population of faces can increase ratings of the normality and attractiveness of similar-looking faces. Such exposure can also refine the perceived boundaries of that face population, such that other faces are more readily perceived as dissimilar. We predicted that relatively less exposure to opposite-sex faces, as experienced by children at single-sex compared with mixed-sex schools, would decrease ratings of the attractiveness of sexual dimorphism in opposite-sex faces (that is, boys at single-sex schools would show a decreased preference for feminised faces, and girls at single-sex schools would show a decreased preference for masculinised faces). Consistent with this prediction, girls at single-sex compared with mixed-sex schools demonstrated significantly stronger preferences for facial femininity in both male and female faces. Boys at single-sex compared with mixed-sex schools demonstrated marginally stronger preferences for facial masculinity in male faces, but did not differ in their ratings of female faces. These effects were attenuated among some single-sex school pupils by the presence of adolescent opposite-sex siblings. These data add to the evidence that long-term exposure to a particular face population can influence judgements of other faces, and contribute to our understanding of the factors leading to individual differences in face preferences.

1. Introduction

It is a long-standing tenet of psychology that increased familiarity of a stimulus enhances ratings of its attractiveness (Bornstein, 1989; Zajonc, 1968). The attractiveness of familiar faces may contribute to the findings that individuals prefer faces of genetically-similar individuals (DeBruine, 2004; Roberts et al., 2005); that marriage partners tend to resemble each other (Bereczkei, Gyuris, Koves, & Bernath, 2002; Bereczkei, Gyuris, & Weisfeld, 2004; Spuhler, 1968; Zajonc, Adelmann, Murphy, & Niedenthal, 1987); that an individual's opposite-sex parent and partner demonstrate similarities in facial appearance (Bereczkei, Hegedus, & Hajnal, 2008; Bereczkei et al., 2002, 2004) and also in hair and eye colour (Little, Penton-Voak, Burt, & Perrett, 2003); and that increased parental age corresponds positively with higher ratings of age cues in judgements of facial attractiveness (Perrett et al., 2002). In the same way, children with greater experience of same-age peers show stronger preferences for faces similar to their peers, where similarity is manipulated by adjusting the height of the internal features of the face (Cooper, Geldart, Mondloch, & Maurer, 2006). Children also rate faces whose internal features are placed lower in the face than normal as more attractive than do adults, possibly because of their increased experience with viewing foreshortened faces from their lower perspective (Cooper et al., 2006).

Over shorter time periods, judgements of visual attractiveness can also be manipulated experimentally. Visual adaptation to faces manipulated to adjust the spacing of the facial features can lead to subsequent, similar faces being judged as more normal and attractive (Cooper & Maurer, 2008; DeBruine, Jones, Unger, Little, & Feinberg, 2007; Jones, DeBruine, & Little, 2008; Little, DeBruine, & Jones, 2005; Rhodes, Jeffery, Watson, Clifford, & Nakayama, 2003; Rhodes et al., 2004). Similarly, visual adaptation to images of masculinised faces increases the rated attractiveness of new masculinised faces viewed subsequently, so long as the sex of the adapting face is congruent with the sex of the rated face (Buckingham et al., 2006; Little et al., 2005; see also Bestelmeyer et al. (2008) for further evidence of sex-contingent face aftereffects).

Visual adaptation leads to shifts in perceptions of visual category boundaries. Webster, Kaping, Mizokami, and Duhamel (2004) showed that laboratory-based visual adaptation to faces of a particular sex, ethnicity or emotional expression affects the

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viewer's perceptual boundaries, such that subsequently-viewed test faces are more likely to be judged to be of a dissimilar sex, ethnicity or emotional expression (see also Bestelmeyer, Jones, DeBruine, Little, & Welling, in press). Webster et al. (2004) also demonstrated similar adaptation effects as a result of extended visual experience in the real world. Asian visitors to the United States, who made judgements about the ethnic boundary of faces on an Asian–Caucasian continuum, were more likely to judge a face to be Asian if they had had more recent experience with Caucasian faces. The degree to which faces were more likely to be classified as Asian increased in line with the amount of time the judge had spent in the US and the quantity of the judge's interactions with Caucasian individuals. In other words, exposure to a population of faces appears to increase the visual salience of the differences of a contrasting population of faces.

We set out to investigate whether similar effects could arise in relation to judgements of the attractiveness of facial sexual dimorphism, contingent upon real-world differences in exposure to male and female faces. In our study, over 240 adolescents at single-sex and mixed-sex schools underwent forced-choice preference tests to determine preferences for sexual dimorphism in male and female faces. Adolescents also provided details of other children living within the home, to investigate home-based visual experience with opposite-sex faces. Following Webster et al. (2004), we predicted that exposure to feminine faces should increase the salience of facial masculinity, and vice versa. Thus, compared with children at mixed-sex schools, girls at single-sex schools, who are exposed to proportionally larger numbers of female faces, might perceive faces as more masculine, whereas boys at single-sex schools might perceive faces as more feminine, compared with children at mixed-sex schools. If all else is equal, this would lead to a greater apparent preference for feminised faces by girls at single-sex schools, and a greater apparent preference for masculinised faces by boys at single-sex schools.

It was unclear whether we should expect differences in face judgements in relation to both male and female faces, or only in relation to the faces commonly experienced. On the one hand, in laboratory testing sessions, visual adaptation effects can be instilled independently in male and female faces (Bestelmeyer et al., 2008; Little et al., 2005). Further, studies of contemporary partners have found similarity between an individual's partner and opposite-sex parent, and not, or to a greater extent than, that individual's same-sex parent (Bereczkei et al., 2008; Little et al., 2003), suggesting that changes in attractiveness judgements that are contingent upon differences in experience can be greater within sex. On the other hand, under some circumstances, adaptation effects generalise across face categories such as male and female faces (Webster et al., 2004) or adult and child faces (Cooper et al., 2006).

2. Methods

2.1. Stimuli

Digital photographs of 60 Caucasian children were separated evenly among the categories male and female, and younger (11–13 years) or older (13–15 years). The facial features (eyes, nose, etc.) of the digital images were marked out with 179 points using dedicated software (Tiddeman, Burt, & Perrett, 2001). The positions of these points were used to calculate the shape difference between the average face shape of the 15 older girls and the average face shape of the 15 older boys. Twelve photographs of the younger children (six boys) and 12 of the older children (six boys) were manipulated to create two new images. For each photograph, one of these new images was created by moving the face shape 50% along the sexual dimorphism continuum towards the average face shape of the older girls (the feminised image), and the other was created by moving the face shape 50% along the continuum towards the average face shape of the older boys (the masculinised image) (Fig. 1). The face shape of the older children was used because pilot testing in adults revealed very little perceptual difference between images masculinised and feminised using templates created from the younger stimuli (i.e. 11–13 years old), probably because of lower levels of sexual dimorphism in faces of pre-pubertal individuals (Farkas, 1987). This methodology follows standard protocol for creating masculinised and feminised images (see e.g. Buckingham et al., 2006; Little, Burt, Penton-Voak, & Perrett, 2001; Penton-Voak et al., 1999). DeBruine et al. (2006) demonstrated that manipulating the masculinity–femininity of face images using this method produces preferences that match those for face stimuli manipulated in masculinity–femininity using other methods. Many previous studies have also demonstrated

Fig. 1. Examples of image manipulation, applied to an adult base face (children's faces not shown for reasons of consent). Face has been masculinised (left) and feminised (right). Image originally published in Saxton et al. (in press).

that face images manipulated in masculinity–femininity using these methods differ reliably in perceived masculinity (e.g. DeBruine et al., 2006; Perrett et al., 1998).

2.2. Judges

Pupils were recruited from the first and third year of secondary education (i.e. classes admitting children aged around 11, and around 13) from private schools charging similar levels of school fees. Because age-matched faces are easier to process and recognise (e.g. Anastasi & Rhodes, 2005; Fulton & Bartlett, 1991; Wright & Stroud, 2002), younger children viewed younger children's faces and older children viewed older children's faces. Attractiveness judgement tests were carried out in two rounds of data collection between 9 and 13 months apart. Each child viewed the same faces in the two testing sessions s/he attended. Preliminary analysis showed no significant and consistent differences between the two rounds. Accordingly, data were collapsed across the two rating sessions. Children provided details of the sex and age of other children living within their home. To maintain privacy, children were not asked for specific details of the relationship (e.g. brother, stepsister, cousin), but the majority are expected to be siblings and are referred to below as such.

Children viewed pairs of faces that were identical except for the manipulation applied and indicated which was more attractive. The presented stimuli also included faces manipulated for symmetry and averageness, but these results are not relevant to the present predictions and are not presented here (for details see Saxton, DeBruine, Jones, Little, & Roberts, in press). Stimuli presentation order and side were randomised. Children rated the stimuli either at an individual computer ($n = 151$; self-paced) or provided pen-and-paper indication of choices between stimuli presented through an overhead projector ($n = 91$; the researcher (TS) moved to the next pair once children had responded).

Children were excluded if they chose the image presented only on one side 35 times out of 36 ($n = 3$) or entered an unrealistic year of birth ($n = 2$). Two children's male face scores were excluded because they did not supply data for at least five out of six possible judgements in both data collection rounds; degrees of freedom are adjusted accordingly.

Single-sex school participants numbered 54 boys (22 previously at a single-sex school) and 71 girls (26 previously at a single-sex school). Mixed-sex school participants numbered 62 boys and 55 girls (four of each sex previously at a single-sex school). One single-sex male student did not state previous school type. In the first round of data collection, younger children were aged 11:10 ± 0:5 years:months, and older children were aged 14:00 ± 0:6 years:months. Ethnicities were 195 Caucasian, 18 West Asian, 11 East Asian, one African (17 non-respondents). Analysis was carried out in SPSS 15.0. Only results pertaining to the hypotheses (i.e. main effects of, or interactions with, school type or siblings) are reported here.

3. Results

3.1. Effects of school type

Mixed model analysis (within-subjects factor: sex of target face [same- or opposite-sex to rater]; between-subjects factors: school type, sex and age group of judge; covariate: age in months) was carried out on the proportion of times each child chose the face whose manipulation matched their own gender (i.e. the proportion of times that the girls chose the feminine face as more attractive, and the proportion of times that the boys chose the masculine face as more attractive; in single-sex schools, this would represent the face type corresponding to the type of faces seen most often).

Girls selected significantly greater proportions of the faces manipulated to resemble their own gender than did boys ($F_{1,233} = 261.19$, $p < .001$, $r = .73$), and children at single-sex schools were significantly more likely than children at mixed-sex schools to prefer the face manipulated to resemble their own gender (i.e. girls at single-sex schools preferred femininity, and boys at single-sex schools preferred masculinity, compared with children at mixed-sex schools; $F_{1,233} = 5.58$, $p = .019$, $r = .15$). However, the main effect of school type was modified by borderline interactions between school type and the sex of the viewed face ($F_{1,233} = 2.94$, $p = .088$), and between school type, sex of the viewed face and sex of the judge ($F_{1,233} = 3.46$, $p = .064$).

With results separated by sex of viewed face, increased preference for own sexual dimorphism by children at single-sex schools was apparent in relation to male ($F_{1,233} = 8.68$, $p = .004$, $r = .19$) but not female ($F_{1,235} = .68$, $p = .410$) faces. With results further split by sex of judge, girls showed greater preference for femininity if they attended single-sex schools, both when rating male faces ($F_{1,121} = 6.12$, $p = .015$, $r = .22$) and female faces ($F_{1,123} = 8.40$, $p = .004$, $r = .25$) (Fig. 2). Boys showed marginally greater preference for masculinity if they attended single-sex schools, but only when rating male faces ($F_{1,111} = 3.67$, $p = .058$, $r = .18$), and not when rating female faces ($F_{1,112} = 1.54$, $p = .217$) (Fig. 3).

3.2. Effects of siblings

Among children at single-sex schools, girls with brothers showed weaker preferences for facial femininity, and boys with sisters showed weaker preferences for facial masculinity

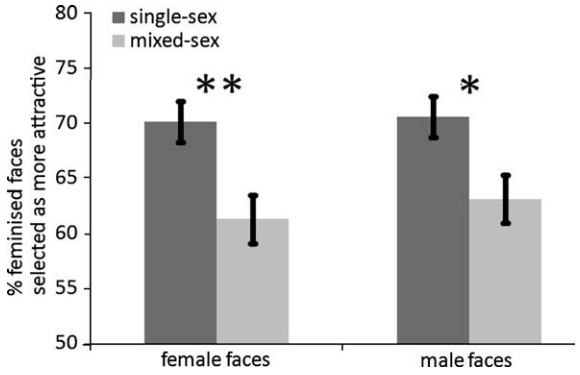

Fig. 2. Percentage of times girls at single-sex and mixed-sex schools chose feminised faces as more attractive. Bars = mean ± SE. $^{**}p < .01$; $^{*}p < .05$.

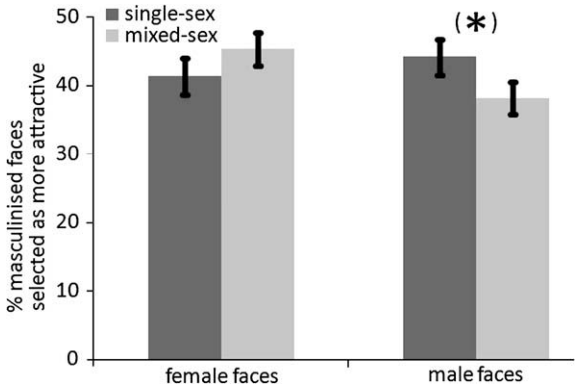

Fig. 3. Percentage of times boys at single-sex and mixed-sex schools chose masculinised faces as more attractive. Bars = mean ± SE. $^{(*)}p < .1$.

(mixed-model ANOVA; within-subjects factor: sex of target face [same or opposite-sex to rater]; between-subjects factors: presence or absence of opposite-sex siblings aged 10–18, sex, and age group of judge; $F_{1,117} = 4.52$, $p = .036$, $r = .19$). However, there was also a significant interaction between the presence or absence of opposite-sex siblings aged 10–18, the sex of the target face, and the age group of the judge ($F_{1,117} = 4.05$, $p = .047$). Subsequent analysis separately on the male and female faces and the older and younger raters showed that the only significant effect of siblings was among children in the younger age group when rating female faces ($F_{1,78} = 13.46$, $p < .001$, $r = .38$; all others $p > .4$). That is, in this younger age group, girls liked female facial masculinity more if they had brothers than if they did not, and boys liked female facial femininity more if they had sisters than if they did not.

The initial analysis of sibling effects also indicated a possible interaction between the presence or absence of opposite-sex siblings aged 10–18, the sex of the target face, and the sex of the judge ($F_{1,117} = 3.71$, $p = .056$). Subsequent analysis separately on the male and female faces and the male and female raters showed that the only significant effect of siblings was among girls' judgements of female faces ($F_{1,68} = 9.79$, $p = .003$, $r = .35$; all others $p > .2$). Girls preferred masculinity in female faces more if they had brothers than if they did not.

4. Discussion

Pupils aged 11–16 from single-sex and mixed-sex schools made forced-choice preference judgements between feminised and masculinised versions of age-matched faces. All children tended to prefer feminised faces, but children at single-sex schools were significantly more likely to select the face manipulated to resemble their own gender than were children at mixed-sex schools. That is, overall, preference for facial femininity by girls, and preference for facial masculinity by boys, was significantly greater in children at single-sex compared with mixed-sex schools.

Girls' judgements differed by school type in relation to both male and female faces. This seems superficially at odds with previous findings that visual adaptation should be specific to sex category, such that experience of female faces can affect female but not male faces and vice versa (Bestelmeyer et al., 2008; Little et al., 2005). However, Webster et al. (2004) showed that visual adaptation can also shift the relative positioning of facial category boundaries in a more global way: so for example exposure to female faces made participants more likely to see the subsequent face as male, as though expectations of the appearance of all faces had been shifted towards femininity. Consistent with this finding, it seems that frequent exposure to female faces by girls at single-sex schools may shift expected categorical boundaries of all faces, and create the expectation that both male and female faces should appear more feminine, and are less attractive when they do not.

In contrast, boys' judgements differed by school type in relation to male but not female faces. There are a number of possible explanations. Firstly, this difference may arise from the difference in the impact of femininity on the attractiveness of male compared with female faces. Feminised and masculinised male faces can both be attractive, whereas female faces are more unambiguously attractive when feminised (Rhodes, 2006). Accordingly, it is possible that attraction to female facial femininity is more robust to visual adaptation effects. Secondly, girls may have taken more care with the task, or may be more socially aware (Eagly, 1987; Eagly & Wood, 1985). Previous work has shown that women demonstrate marginally greater adaptation effects than men, at least in relation to adult and infant faces, although this latter is possibly due to greater attention to infant faces by women (Little, DeBruine, Jones, & Waitt, 2008; see also Jones et al. (2008) for further evidence that attentional factors can modulate face aftereffects). Finally, at single-sex schools, boys may have had more exposure than girls to opposite-sex faces, due to a greater prevalence of female staff in the school environment, the tendency for greater contact with the female than the male parent at home, and on a short-term basis, the presence of the female researcher running the study. As male faces change more at puberty there is greater similarity between women's and girls' faces than between men's and boys' faces (Virgilio, Chiarella, Carlo, & Johannes, 1998) and so exposure to adult female faces may shift boys' perceptions of girls' faces more than exposure to adult male faces can shift girls' perceptions of boys' faces.

Age-matched faces are easier to process and recognise (e.g. Anastasi & Rhodes, 2005; Fulton & Bartlett, 1991; Wright & Stroud, 2002), and so the younger children judged younger faces, while the older children judged older faces. Although there are significant differences in girls' and boys' faces even in the age group of the younger children (Farkas, 1987; Virgilio et al., 1998), the sexual dimorphism of younger faces differs less than that of older faces (Farkas, 1987). Indeed, the masculinised and feminised younger faces were created with reference to the differences between the male and female older faces because perceptual differences were very small when the digital manipulations were initially carried out with reference to the differences between the younger faces. In addition, the older children at single-sex schools would have had more years of experience with same-sex faces than the younger children. Despite these factors, we found no significant interactions between a child's age category and school type. Children carried out the rating task twice at an interval of around a year, but similarly, there were no consistent significant differences between these two data sets, and accordingly in the analysis these two data sets were collapsed together for simplicity. It is possible that increasing adaptation effects would be found over time with more sensitive measures (cf. de Heering & Rossion, 2008). The first year of the study took place at least 7 weeks after the beginning of term, such that all children had at least 7 weeks' experience in their school environment. We do not know how long it takes for the type of perceptual experience investigated here to influence judgements, though experimental adaptation studies require only seconds for short-term effects.

As the study was based on observation rather than experimental manipulation, some of the differences could be due to cultural or environmental differences between children at single-sex compared with mixed-sex schools, both prior to and arising from school attendance. For instance, stronger preferences for facial sexual dimorphism are associated with judges who are themselves more attractive, whether measured perceptually or more objectively (e.g. Little et al., 2001; Penton-Voak et al., 2003; Smith et al., 2009). Schools were matched for fees to try and reduce some of these possible differences. In further support of the visual experience hypothesis, the presence of opposite-sex siblings was associated with similar shifts in attractiveness judgments among some of the children at single-sex schools (i.e. sisters associated with preference for femininity, and brothers associated with preferences for masculinity), corroborating evidence for visual adaptation.

Our study was not designed to test how the visual adaptation occurs. Face visual adaptation effects are independent of the size, retinal position and orientation of images (Leopold, O'Toole, Vetter, & Blanz, 2001; Rhodes et al., 2003; Watson & Clifford, 2003), leading researchers to infer that the adaptation takes place within specialised face processing areas rather than at early levels of visual processing (Webster et al., 2004). Such adaptation may facilitate face perception by normalising responses to centre around the visual stimuli most often viewed (Leopold, O'Toole, Vetter, & Blanz, 2001; Webster et al., 2004). Our findings raise the question of whether school differences persist over the longer term. If these

effects are long lasting then they could contribute to the variability in sexual dimorphism preferences amongst adults.

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