Visual adaptation to masculine and feminine faces influences generalized preferences and perceptions of trustworthiness[☆]

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Abstract

Although previous studies of individual differences in preferences for masculinity in male faces have typically emphasized the importance of factors such as changes in levels of sex hormones during the menstrual cycle, other research has demonstrated that recent visual experience with faces also influences preferences for sexual dimorphism in faces. Adaptation to either masculine or feminine faces increases preferences for novel faces that are similar to those that were recently seen. Here, we replicate this effect and demonstrate that adaptation to masculine or feminine faces also influences the extent to which masculine faces are perceived as trustworthy. These adaptation effects may reflect a proximate mechanism that contributes to the development of face preferences within individuals, underpins phenomena such as imprinting-like effects and condition-dependent face preferences, and shapes personality attributions to faces that play an important role in romantic partner and associate

choices. Furthermore, our findings also support the proposal that visual exposure alone cannot explain the context specificity of attitudes to self-resembling faces.

1. Introduction

Face preferences and perceptions influence important social interactions including partner and associate choices, hiring decisions, and voting behavior (e.g., Langlois et al., 2000; Todorov, Mandisodza, Goren, & Hall, 2005). Furthermore, many researchers have highlighted the importance of identifying the factors that influence the development of these attitudes (DeBruine, 2005; Little, DeBruine, & Jones, 2005; Perrett et al., 2002; Rhodes, Jeffery, Watson, Clifford, & Nakayama, 2003). Although factors such as changes in levels of sex hormones influence attitudes to faces (e.g., DeBruine, Jones, & Perrett, 2005; Jones, Little, Boothroyd, DeBruine, et al., 2005; Jones, Perrett, Little, et al., 2005; Penton-Voak et al., 1999), visual experience also plays an important role in shaping how we perceive others (Little et al., 2005; Perrett et al., 2002; Rhodes et al., 2003; Webster, Kaping, Mizokami, & Duhamel, 2004).

Adaptation to faces following visual experience (i.e., weakened responses of neurons that code a given type of stimulus following habituation to that type of stimulus; Loffler, Yourganov, Wilkinson, & Wilson, 2005; Winston, Henson, Fine-Goulden, & Dolan, 2004) influences perceptions of faces (Leopold, O'Toole, Vetter, & Blanz, 2001; Leopold, Rhodes, Müller, & Jeffery, 2005; Little et al., 2005; Rhodes et al., 2003, 2004; Webster et al., 2004). Adaptation to faces varying in race, sex, sexual dimorphism of shape, identity, eye spacing, and expanded or compressed features has been shown to influence subsequent perceptions of the normality (Leopold et al., 2001, 2005; Little et al., 2005; Rhodes et al., 2003, 2004; Webster et al., 2004) and attractiveness (Little et al., 2005; Rhodes et al., 2003) of faces such that faces similar to those seen previously are judged more normal and attractive than would otherwise be the case. Many researchers have emphasized the possible direct and indirect benefits of imprinting-like effects on mate preferences in both humans and nonhumans (as opposed to relatively inflexible innate preferences; for reviews, see Little, Burt, Penton-Voak, & Perrett, 2001 and Perrett et al., 2002), and visual adaptation has been identified as a plausible proximate mechanism for imprinting-like effects on face preferences (Little et al., 2005; Perrett et al., 2002). "Face aftereffects" (Leopold et al., 2001, 2005; Little et al., 2005; Rhodes et al., 2003, 2004; Webster et al., 2004) reflect changes in the responses of neurons that code faces (Loffler et al., 2005; Winston et al., 2004) and cannot be explained by retinal adaptation because they are robust to changes in the size and retinal location of the stimuli between adaptation and test phases (Leopold et al., 2001, 2005). Furthermore, bigger face aftereffects occur when the orientation or sex of the faces shown in the adaptation and test phases are congruent than when they are incongruent, suggesting that different neural populations code different subcategories of faces (Little et al., 2005; Rhodes et al., 2004).

Although previous experiments have established that adaptation to faces increases subsequent attraction to novel similar faces (Little et al., 2005; Rhodes et al., 2003), it is unclear if face aftereffects also influence attributions of other prosocial traits that are important for social interactions (e.g., trustworthiness; see DeBruine, 2005 and Perrett et al., 1998). Although the "beauty is good" stereotype is a prevalent way to explain how humans attribute personality characteristics such as trustworthiness to faces (e.g., Langlois et al., 2000), judgments of faces in the contexts of mate choice and general social interaction may have different functional explanations and may be affected in different ways by different aspects of facial appearance (e.g., age and cues of kinship). For example, facial self-resemblance increases perceptions of the trustworthiness of opposite-sex faces but decreases perceptions of these same faces' sexual attractiveness and does not influence attractiveness judgments made in the context of long-term relationships (which arguably reflect a mixture of sexual attraction and prosocial regard, DeBruine, 2005; see Little et al., 2001 and Little, Jones, Penton-Voak, Burt, & Perrett, 2002 for further discussion of the distinction between face preferences expressed in the contexts of short- and long-term relationships). For this reason, it is not obvious that factors affecting the attractiveness of faces will affect their perceived trustworthiness in the same way.

To investigate the extent to which adaptation to faces has similar effects on attraction to novel similar faces and perceptions of their trustworthiness, here we compared the effect of adaptation to faces varying in sexual dimorphism of 2D shape on attraction with sexual dimorphism in male faces and attributions of the trustworthiness of masculine and feminine male faces. Male faces were used because attraction to sexual dimorphism in male faces is known to be variable (see Fink and Penton-Voak, 2002 and Penton-Voak and Perrett, 2000 for reviews), and therefore, ceiling effects on preferences are less likely to mask face aftereffects than if female faces were used, and because sex-contingent face aftereffects have previously been reported (Little et al., 2005). Sexual dimorphism of 2D shape was manipulated using computer graphic methods (prototype-based transformations; Rowland and Perrett, 1995; Tiddeman, Burt, & Perrett, 2001) that have been previously used to investigate attraction (Jones, Little, Boothroyd, DeBruine, et al., 2005; Little et al., 2001, 2002; Penton-Voak et al., 1999) and attributions of personality characteristics (Perrett et al., 1998) to masculine and feminine faces as well as to manufacture stimuli for studies of face aftereffects (Little et al., 2005). The adaptation paradigm we used was a slightly modified version of that used by Little et al. (2005) to demonstrate that adaptation to faces varying in sexual dimorphism of 2D shape influences attraction to masculine and feminine faces.

2. Methods

2.1. Stimuli

Male and female prototype face images were manufactured by averaging the shape and color information from 20 young (17–23 years old) adult male faces (to create a male prototype face image) and 20 young (18–23 years old) adult female faces (to create a female prototype face

image) using methods reported in Perrett et al. (1998) and elsewhere (Rowland and Perrett, 1995; Tiddeman et al., 2001). Following Little et al. (2005), the 20 male face images were then transformed by +50% of the differences in 2D shape between the male and female prototypes to create masculinized versions and by −50% of the differences in shape to create feminized versions (see Rowland and Perrett, 1995 and Tiddeman et al., 2001 for technical details of this method and Jones, Little, Boothroyd, DeBruine, et al., 2005, Little et al., 2001, 2002, 2004, and Penton-Voak et al., 1999 for other studies that have used this method to manipulate sexual dimorphism in faces). This procedure generates masculinized and feminized versions of the male faces that differ equally from average, differ only in 2D shape and are matched in terms of identity (see Little et al., 2005 and Perrett et al., 1998 for discussions of these issues). An example of a masculinized and feminized face used in the experiment is shown in Fig. 1. It is noteworthy that while other methods for manipulating masculinity of faces have been used in some other studies (e.g., manipulating facial appearance using composites of faces perceived to be high or low in terms of masculinity; Johnston et al., 2001), these methods produce effects on face perceptions that are equivalent to those produced using the methods used in our current study (DeBruine et al., 2006).

2.2. Participants

Fifty-five participants (mean age=22.46 years, S.D.=3.22 years, 34 females) took part in the experiment.

2.3. Procedure

To assess attraction or attributions of trust to masculinity in male faces prior to the adaptation phase, we showed participants five pairs of male face images where each pair

Fig. 1. Examples of masculinized (left) and feminized (right) versions of a male face image used in the experiment. Note that the faces differ in sexual dimorphism of 2D shape but are matched in other regards (e.g., identity).

consisted of a masculinized and feminized version of the same identity. Twenty-six of the participants were asked to choose the face in each pair that they considered more attractive and to indicate the strength of this preference by choosing from the options "much more attractive," "more attractive," "somewhat more attractive," and "slightly more attractive." The remaining 29 participants were shown the same pairs of faces and were asked to choose the face in each pair that they considered more trustworthy and to indicate the strength of this preference by choosing from the options "much more trustworthy," "more trustworthy," "somewhat more trustworthy," and "slightly more trustworthy." Pairs of faces were presented in a random order, and the side of the screen on which any particular image was shown was also randomized. Following this preadaptation test phase, participants viewed a slideshow of 15 face images where each face was shown twice and for 2 s on each occasion. Participants were instructed to "watch the faces and try to remember them." Twenty-eight of the participants viewed masculinized versions of the face images, and the remainder viewed feminized versions of the same face images. After this adaptation phase, participants repeated the preadaptation test. Twelve participants viewed feminized faces in the adaptation phase and made attractiveness judgements, 15 participants viewed feminized faces in the adaptation phase and made trustworthiness judgements, 14 participants viewed masculinized faces in the adaptation phase and made attractiveness judgements, and 14 participants viewed masculinized faces in the adaptation phase and made trustworthiness judgements.

2.4. Initial processing of data

For participants who made attractiveness judgments in the pre- and postadaptation phases of the experiment, responses were recoded using the following eight-point scale (with high scores indicating a strong preference for the type of face seen in the adaptation phase and low scores indicating a relatively weak preference for the type of face seen in the adaptation phase):

0=The type of face that was not viewed in the adaptation phase (i.e., masculine or feminine) was rated *much more attractive* than the type of face viewed in the adaptation phase.
1=The type of face that was not viewed in the adaptation phase (i.e., masculine or feminine) was rated *more attractive* than the type of face viewed in the adaptation phase.
2=The type of face that was not viewed in the adaptation phase (i.e., masculine or feminine) was rated *somewhat more attractive* than the type of face viewed in the adaptation phase.
3=The type of face that was not viewed in the adaptation phase (i.e., masculine or feminine) was rated *slightly more attractive* than the type of face viewed in the adaptation phase.
4=The type of face viewed in the adaptation phase (i.e., masculine or feminine) was rated *slightly more attractive* than the type of face that was not viewed in the adaptation phase.
5=The type of face viewed in the adaptation phase (i.e., masculine or feminine) was rated *somewhat more attractive* than the type of face that was not viewed in the adaptation phase.

6=The type of face viewed in the adaptation phase (i.e., masculine or feminine) was rated *more attractive* than the type of face that was not viewed in the adaptation phase.
7=The type of face viewed in the adaptation phase (i.e., masculine or feminine) was rated *much more attractive* than the type of face that was not viewed in the adaptation phase.

The mean strength of preference for the type of face viewed in the adaptation phase was calculated for each participant and calculated separately for the pre- and postadaptation tests. These values were then converted to a percentage of the maximum possible strength of preference for the type of face that was seen in the adaptation phase. Corresponding values were calculated for participants who judged the trustworthiness of faces in the pre- and postadaptation phases.

3. Results

Responses were analyzed using a mixed-design ANOVA [dependent variable: strength of preference for the type of face viewed in the adaptation phase; within-subject factor: phase (preadaptation, postadaptation); between-subject factors: sex of the participant (male, female), judgement made by the participant (attractiveness, trustworthiness), type of face shown in adaptation phase (masculine, feminine)]. This analysis revealed a main effect of phase (F=5.52, df=1,47, p=.023). Preferences for the type of face viewed in the adaptation phase were stronger in the postadaptation test phase (mean percentage of the maximum possible strength of preference for the type of face that was seen in the adaptation phase=52.9, S.E.=1.6) than in the preadaptation test phase (mean=50.5, S.E.=1.6). There were no significant effects (all F<2.515, all p>.12) other than an interaction between the type of judgement made by a participant and the type of face shown in the adaptation phase (F=5.83, df=1,47, p=.020). Because this interaction did not qualify the main effect of phase we observed (i.e., was not at all related to the experimental manipulation) and was, therefore, most likely to reflect individual differences in attitudes to sexual dimorphism in male faces (see Fink and Penton-Voak, 2002 and Penton-Voak and Perrett, 2000 for a discussion of this), we did not analyze it further.

4. Discussion

Exposure to masculine or feminine male faces increased both attraction to faces of the type seen in the adaptation phase and attributions of trustworthiness to these faces relative to preadaptation phase tests. It is unsurprising that the effects of visual adaptation to faces were relatively subtle because the duration of the adaptation period was short and the duration of adaptation is positively and logarithmically related to the magnitude of face aftereffects (Leopold et al., 2005). Thus, effects of adaptation on face perceptions that occur as a consequence of longer real-life social interactions are likely to be considerably more pronounced. The effect of adaptation to masculine and feminine faces on subsequent

preferences for sexual dimorphism in male faces complements attractiveness aftereffects observed for adaptation to sexual dimorphism of 2D shape (Little et al., 2005), identity (Little et al., 2005), and expanded or compressed features (Rhodes et al., 2003) and is consistent with the proposal that face preferences are recalibrated according to recent visual experience with faces (Little et al., 2005; Rhodes et al., 2003). The effect of adaptation to masculine and feminine faces on subsequent attributions of trustworthiness, however, demonstrates that face aftereffects also influence attributions of trustworthiness and (potentially) attributions of other personality characteristics that are also important for social interactions and mate choice. Furthermore, that visual adaptation to faces elicits identical effects on attributions of trustworthiness and attraction to novel similar faces supports the proposal that visual exposure alone cannot explain the context specificity of attitudes to self-resembling faces (see DeBruine, 2005). While DeBruine (2005) demonstrated that self-resembling faces were perceived as more trustworthy, but less attractive, than other-resembling faces, we show, in this study, that adaptation to faces produces equivalent effects for attraction and trustworthiness judgments. This supports DeBruine's proposal that attitudes to self-resembling faces are not simply a by-product of visual adaptation (DeBruine, 2004).

While previous studies of variations in attitudes to masculine faces have emphasized the importance of hormone-mediated attraction to masculinity in male faces (Jones, Little, Boothroyd, DeBruine, et al., 2005; Penton-Voak et al., 1999) and attributions of male-sex typical personality characteristics (Macrae, Alnwick, Milne, & Schloerscheidt, 2002), here we emphasize the role of recent visual experience with masculine and feminine faces in shaping these preferences and attitudes. It has previously been noted that adaptation effects are likely to play an important role in the development of face preferences within individuals (Little et al., 2005; Rhodes et al., 2003) and may be the proximate mechanism that underpins phenomena such as attraction to parental characteristics (e.g., imprinting-like effects; Little, Penton-Voak, Burt, & Perrett, 2003; Perrett et al., 2002) and condition-dependent face preferences (e.g., matching for attractiveness in face preference tests where there is no possibility of actual rejection; Jones, Little, Boothroyd, Feinberg, et al., 2005; Little et al., 2001). In other words, positive regard for parental characteristics may be a consequence of individual differences in the type of faces individuals are adapted to (e.g., individuals with older parents are likely to have more visual experience of older faces than individuals with relatively younger parents will, Perrett et al., 2002), and matching for attractiveness on face preference tests may be a consequence of attractive individuals' being more likely to associate with other attractive individuals than are relatively unattractive individuals (see Feingold, 1988 for evidence of this). Furthermore, our findings indicate that adaptation to faces also influences the development of social stereotypes within individuals that are also important for partner and associate choices. For example, while Perrett et al. (1998) reported that masculine faces are generally perceived to be less trustworthy than feminine faces, the effect of adaptation to faces on perceptions of trustworthiness that was observed in the current study indicates that the extent to which masculine faces are perceived as untrustworthy is, to some extent, dependent on recent visual experience with masculine faces.

Acknowledgments

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