ISSN-L 1618-3169 · ISSN-Print 1618-3169 · ISSN-Online 2190-5142

Experimental Psychology

www.hogrefe.com/journals/exppsy

HOGREFE

Experimental Psychology

Research Article

Similarities in Human Visual and Declared Measures of Preference for Opposite-Sex Faces

Jack A. F. Griffey and Anthony C. Little

School of Natural Sciences, University of Stirling, UK

Abstract. Facial appearance in humans is associated with attraction and mate choice. Numerous studies have identified that adults display directional preferences for certain facial traits including symmetry, averageness, and sexually dimorphic traits. Typically, studies measuring human preference for these traits examine declared (e.g., choice or ratings of attractiveness) or visual preferences (e.g., looking time) of participants. However, the extent to which visual and declared preferences correspond remains relatively untested. In order to evaluate the relationship between these measures we examined visual and declared preferences displayed by men and women for opposite-sex faces manipulated across three dimensions (symmetry, averageness, and masculinity) and compared preferences from each method. Results indicated that participants displayed significant visual and declared preferences for symmetrical, average, and appropriately sexually dimorphic faces. We also found that declared and visual preferences correlated weakly but significantly. These data indicate that visual and declared preferences for manipulated facial stimuli produce similar directional preferences across participants and are also correlated with one another within participants. Both methods therefore may be considered appropriate to measure human preferences. However, while both methods appear likely to generate similar patterns of preference at the sample level, the weak nature of the correlation between visual and declared preferences in our data suggests some caution in assuming visual preferences are the same as declared preferences at the individual level. Because there are positive and negative factors in both methods for measuring preference, we suggest that a combined approach is most useful in outlining population level preferences for traits.

Keywords: preference, faces, eye-tracking, attractiveness, mate choice

The face represents an important source of social information in humans. For example, faces provide cues to attention, emotion, age, and identity (e.g., Bruce & Young, 1986; Burt & Perrett, 1995; Ekman & Friesen, 1976; Little, Jones, & DeBruine, 2011b). The face is also thought to play an important role in sexual attraction and mate choice and many researchers have adopted an evolutionary approach which posits that certain facial traits can be indicators of mate value such as good health, fertility, and physical or behavioral dominance (for reviews see Little, Jones, & DeBruine, 2011a; Rhodes, 2006; Thornhill & Gangestad, 1999). To date, numerous experimental studies conducted into human preferences for facial stimuli suggest robust and reliable preferences for a number of facial traits and characteristics, including preferences for bilateral symmetry, similarities in shape between the left and right sides of the face (Grammer & Thornhill, 1994; Perrett et al., 1999); facial averageness, faces which possess traits with mathematically average values for a population (Langlois & Roggman, 1990; Little & Hancock, 2002), and sex appropriate sexually dimorphic traits, at least for feminine traits in female faces (Little, Jones, DeBruine, & Feinberg, 2008; Perrett et al., 1998). Many of these preferences have been demonstrated in both unmanipulated (Grammer & Thornhill, 1994; Langlois et al., 2000) and computer generated (Langlois & Roggman, 1990; Little & Hancock, 2002; Perrett et al., 1998) faces and are agreed upon both within cultures and cross-culturally (Apicella, Little, & Marlowe, 2007; Cunningham, Roberts, Wu, Barbee, & Druen, 1995; Langlois et al., 2000; Little, Apicella, & Marlowe, 2007; Perrett et al., 1998).

Typically, studies measuring human preferences for various facial traits utilize a methodology involving declared preferences in which images are presented to a participant individually (Grammer & Thornhill, 1994; Little & Hancock, 2002), in pairs (Little et al., 2008; Perrett et al., 1999), or as continua (Perrett et al., 1998). During single image experimental designs faces are presented sequentially and in a random order and participants are instructed to rate all faces on the dimension in question, or for general "attractiveness," using a rating scale (e.g., a 7-point Likert scale, 1-low, 4-medium, 7-high). Generally, images are displayed on computer monitors and each participant's response is recorded by the computer. Many studies of facial preference also utilize a design involving the simultaneous presentation of pairs of images to the participant, often referred to as a two alternative forced choice (2AFC) paradigm. This methodology involves the simultaneous presentation of pairs of versions of one face identity (e.g., symmetrical vs. asymmetrical face), often via a

DOI: 10.1027/1618-3169/a000248

computer monitor. Participants are then asked to indicate, typically via a keyboard, computer mouse, or verbally, which of the two faces they prefer. Those studies that employ a continuum of faces in order to assess facial preference typically display a number of faces each manipulated to differing degrees along the dimension in question on a computer monitor and simply instruct participants to select the most attractive face from the continuum. Based upon the participant's selection and the degree to which manipulation of the trait was applied a general preference for that trait can be ascertained. Based upon the selections made by participants preference for various facial traits can be determined.

The usefulness of declared preferences, however, depends upon a participant's ability to understand the task presented and the concept of "*preference*." However, as these skills require a level of cognitive and motor complexity, other proxies of preference and stimulus attractiveness must be employed in order to successfully study the preferences of those subjects, such as human infants and nonhuman primates (NHPs), who are unable to express their preferences verbally, or whose motor actions are not sufficiently developed to be used to accurately reflect their preferences for visual stimuli. Due to such restrictions, one measure that is widely utilized as a proxy for human infant and NHPs stated preference is visual preference. This is commonly determined via looking behavior (e.g., looking duration, looking frequency, and number of visual fixations) and has been used to study human infants (Dion, 1977; Langlois et al., 1987; Turati, Valenza, Leo, & Simion, 2005) and NHP (Waitt & Little, 2006) preferences for faces, NHP preference for facial coloration (Cooper & Hosey, 2003), and human and NHP preferences for conspecific faces (Fujita & Wantanabe, 1995; Pascalis & Bachevalier, 1998). Typically these studies involve the display of single images (Cooper & Hosey, 2003) or paired images (Waitt & Little, 2006) to a subject whose subsequent looking behavior in response to these images may be recorded either remotely, via video recording equipment (Waitt & Little, 2006), or with the aid of eye-tracking equipment and software (Turati et al., 2005) which automatically records and analyzes looking behavior in order to determine visual preference.

Given the methodological gap between studies of preference in human adults and NHPs/human infants, it is important to examine the relationship between visual and declared preferences, and in particular the degree to which we may consider these measures analogous to one another. To date, a number of studies suggest visual preferences do appear to be correlated to a certain extent with various measures of declared stimuli attractiveness. For example, Quinsey, Ketsetzis, Earls, and Karamanoukian (1996) found that male and female subjects viewing times of opposite-sexed images to be positively correlated with the sexual attractiveness rating of the image for images ranging from children to adults. Similarly, Landolt, Lalumiere, and Quinsey (1995) found adult male and female viewing times to increase linearly with the attractiveness ratings assigned to opposite-sexed head and shoulder images. However, although these studies provide support for the notion that looking time is related to preference, in both studies the duration that images were displayed for was controlled by the participant themselves via the amount of time they chose to illuminate images on a projector. While this provides some indication of a participant's visual preference it is a less accurate measure than those employed in subsequent studies which, for example, used eye-tracking technology to determine visual preference. Methodological issues concerning the stimuli used in these looking time studies also confound their findings. For example, the experimental images used by Landolt et al. (1995) were rated by a different group of participants for attractiveness and then subsequently grouped and presented to test participants according to these ratings. Therefore viewing times were correlated with the attractiveness ratings of other participants and consequently cannot be said to reflect participants own declared preferences for stimuli attractiveness. Quinsey et al.'s (1996) stimuli set was also somewhat unusual in scope and consisted of nude images of individuals from three different age categories (adult, pubescent, and children). Viewing images across these three very different age categories is likely to have significantly affected the attractiveness ratings and viewing times of participants, particularly as two of the categories of stimuli (children and pubescent) are unlikely to have been viewed within a mate choice context. Therefore the declared and visual preferences identified in these studies may not truly reflect those that human adults display when assessing the facial attractiveness of a potential mate.

Another reason why we might expect to see a discrepancy between declared and visual preferences is because visual preferences may not show the same linear relationship with attractiveness as declared preferences. Unusual or novel stimuli also draw attention and so visual preferences also measure simple interest. For example, one eye-tracking study has shown that individuals preferentially attend to images of bodies with tattoos over plain, scarred, or accessorized bodies (Wohlrab, Fink, Pyritz, Rahlfs, & Kappeler, 2007). Likewise, another study has shown that attention is drawn to the face of disfigured individuals, likely to be considered as very low in attractiveness (Ackerman et al., 2009). These studies, while showing clear visual preferences for tattooed and disfigured images, may not reflect declared preferences based on attraction and instead may be interpretable as individuals finding tattooed or disfigured images more interesting than the other images. In this way visual preferences may not reflect declared preferences and, as in the above examples, it can be possible to predict a negative relationship between declared and visual preferences in some circumstances.

To date, the degree to which the visual preferences that adults display for facial stimuli and the extent to which this corresponds with the *actual* preferences they state or make during preference tests (i.e., the comparison between explicit and implicit preferences) remain untested. Consequently, the following experiment investigated the relationship between declared and visual preferences in human adults for opposite-sex facial stimuli. We focused on opposite-sex images judged by heterosexual participants because recent studies have highlighted that face processing can be influenced based on the sex of image used and the participants sex or sexuality (Steffens, Landmann, & Mecklenbräuker, 2013). Here declared preferences were ascertained using a 2AFC design rather than subjective rating scales and visual preferences between pairs of stimuli remotely recorded and measured using eye-tracking technology in order to obtain the most accurate visual preference data possible. We also focused on the particular facial traits thought to influence attractiveness rather than general attractiveness ratings. In order to accurately evaluate similarities between visual and declared preferences we experimentally tested the visual and declared preferences of male and female subjects to opposite-sex faces manipulated across three separate dimensions (symmetry, averageness, and sexual dimorphism) and compared the preference data obtained from each method.

Methods

Participants

Participants were 22 male (*M* = 21.45 years, *SD* = 2.28) and 34 female (*M* = 20.12 years, *SD* = 1.02) heterosexual Caucasian undergraduate students recruited from the University of Stirling. Subjects were recruited via an online sign-up system. All participants received partial course credit for their participation in the experiment.

Original Stimuli

Following the methodology of previous preference studies in humans (Apicella et al., 2007; Little & Hancock, 2002; Little et al., 2007, 2008; Perrett et al., 1998, 1999) and NHPs (Waitt & Little, 2006) manipulated experimental stimuli were constructed via the use of computer transformation techniques and graphic software (Psychomorph) whereby key locations (174 points) were manually marked around the main features (e.g., nose, eyes, mouth) and outline of each individual face (e.g., jawline, hairline) (Benson & Perrett, 1991, 1993; Tiddeman, Burt, & Perrett, 2001). Three separate manipulations (bilateral symmetry/sexual dimorphism/facial averageness) were then applied to these base faces via alteration of the position of these points on each face. Forty original images (20 male, 20 female) were selected at random from a larger, preexisting set, of experimental stimuli for manipulation. All images were full color, front view faces with neutral expressions taken with a digital camera under standardized lighting conditions replicating methodological procedures of previous stimuli collection (Grammer & Thornhill, 1994; Little & Hancock, 2002; Perrett et al., 1998, 1999). All images were unfamiliar to the experimental participants. The size of all manipulated images was matched by standardization of the interpupil distance and each image was cropped around the face and presented against a standardized black background (see, e.g., Figure 1). Details of each specific manipulation conducted upon these original stimuli can be found below.

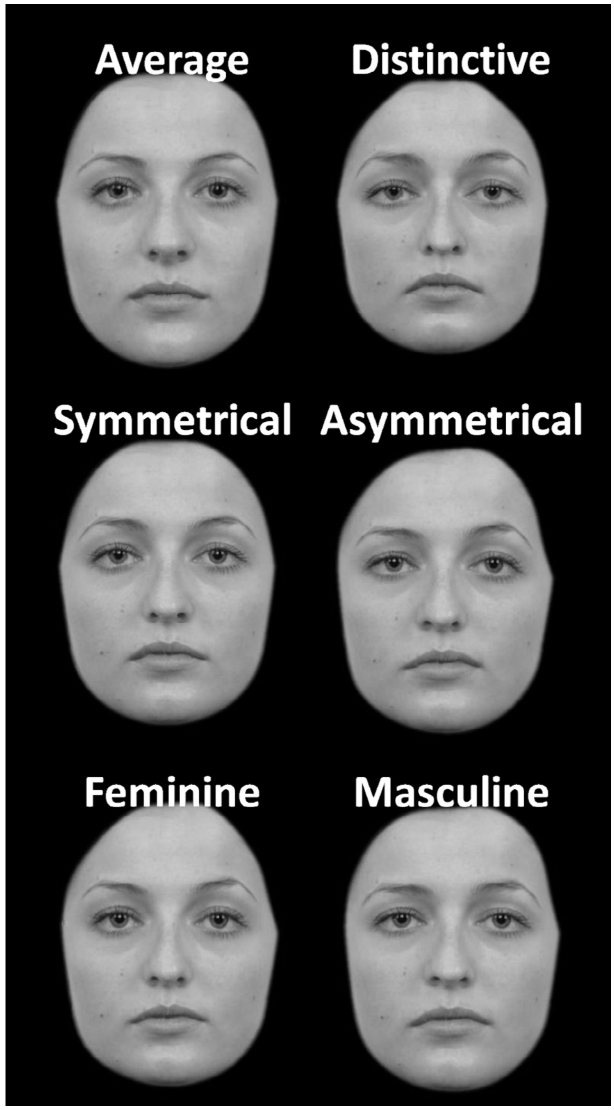

Figure 1. Examples of paired composite (top) average (left) and distinctive/nonaverage (right); (middle) symmetrical (left) and asymmetrical (right); and (bottom) feminized (left) and masculinized (right) versions of female faces. Example transformed female image is from Langner, Dotsch, Bijlstra, Wigboldus, Hawk, and van Knippenberg (2010).

Stimuli Manipulations

Averageness

Average and nonaverage versions of each individual image were created by applying the vector difference in shape alone between the features of a 50-image composite, an image created by combining the average shape and colour of multiple images (Benson & Perrett, 1991, 1993; Tiddeman, Burt, & Perrett, 2001), and an original image of the face selected for manipulation. The resulting transformations represented ±50% the difference between the

50-image composite and the original face. Each image was made perfectly symmetrical in shape prior to transformation. The completed stimuli set of 40 pairs of images (20 male, 20 female) consisted of one average and one nonaverage version of the same original face (see Figure 1 top).

Symmetry

Symmetrical versions of each individual base face were created by averaging the height and lateral position (relative to the midline, perpendicular to, and bisecting the interpupillary line) of each corresponding pair of feature markers on the left and right sides of the face. Using this method each of the 40 original faces (20 male, 20 female) could be remapped into their corresponding symmetric shape (see, e.g., Perrett et al., 1999). Asymmetrical versions of each face were also produced by utilizing the linear difference between the feature points of the symmetric and original images and manipulating each original image 50% toward asymmetry. The completed stimuli set of 40 pairs of images (20 male, 20 female) consisted of one perfectly symmetrical and one +50% asymmetric version of the same original face (see Figure 1 middle).

Sexual Dimorphism

Each of the original 40 base faces was transformed for sexual dimorphism by using the vector difference in shape between an average male (a composite of 50 males faces) and an equivalent average female (a composite of 50 females faces). The resulting transformations represented ±50% the difference between these average male and female composites to create feminized and masculinized versions of each of the original faces (see, e.g., Perrett et al., 1998). Each image was made perfectly symmetrical in shape. The completed stimuli set of 40 pairs of images (20 male, 20 female) consisted of one masculinized and one feminized version of the same original face (see Figure 1 bottom).

Procedure

Prior to starting the experiment participants were asked to complete a consent form and questionnaire which asked participants for information regarding their age and sexual orientation. The procedure of this experiment was split into two sections both based on a two alternative forced choice paradigm whereby pairs of manipulated versions of each face identity (e.g., a symmetrical vs. asymmetrical version of the same face) were presented to participants via the use of an eye-tracker to ascertain visual preference and then via a computer monitor in order to ascertain declared preference.

In both sections of the experiment, order of image presentation was randomized between subjects and left-right presentation of images was counterbalanced within subjects. Subjects viewed opposite-sexed images only. The eye-tracker section of the experiment was always conducted before the preference section of the experiment so that individuals were visually naive to the facial stimuli for visual preferences.

Visual Preference

Each participant completed three separate visual preference experiments. Each experiment consisted of 20 trials in total and involved the sequential presentation of 20 pairs of opposite-sexed faces manipulated for one of three dimensions (sexual dimorphism, facial averageness, and bilateral symmetry). Before testing began each participant was individually calibrated to the eye-tracker monitor to ensure accurate visual data were recorded. Calibration procedures were conducted using Clearview software (TOBII Technology, Sweden) allowing an optimal accuracy of 0.5 degrees and participants visual behavior and fixations were recorded via infrared light sources and cameras integrated into the TOBII monitor. Images were presented sequentially to subjects in 24-bit color (image size = 531 × 511 pixels) within a testing cubicle on a 17″ thin film transistor technology (TFT) monitor (TOBII 1750) situated approximately 50–60 cm from the participants. Timing and presentation of images was controlled via eye-tracker specific software (TOBII Technology, Sweden). Each pair of images was displayed for 5 s followed by an intertrial duration (a fixation-cross) of 1 s. Participants were asked via on-screen instruction to "Please observe the images displayed on the monitor." In total each participant viewed 60 pairs of faces across three sets of trials (20 pairs of faces in each set). Using corneal reflection techniques the TOBII eye-tracker recorded the X and Y coordinates of the participant's eye position in relation to the monitor which was used to ascertain an individual's visual behavior. During each trial, an individual's looking behavior in relation to these images, including the number, sequence, and duration of gaze fixations, was recorded.

Once the test was complete, the eye-tracker software allowed us to define areas of interest (AOIs) on stimuli in order to compare the looking behavior displayed toward each pair of faces. The two AOIs for each face pair defined were equal in area (48.46% of the total area) and encompassed the entire face in all presentations. We focused here on simply comparing visual attention to either of the two faces because this is often how visual attention is measured in studies of infants and NHPs and we were interested in visual preference to particular faces independent of the specific face features that may cause the preference. Following completion of the eye-tracker test the subjects completed a declared preference test for the same set of 60 manipulated opposite-sexed faces.

Declared Preference

Declared preference data was obtained following a methodology similar to previous preference tests conducted on human participants (e.g., Little, Burt, Penton-Voak, & Perrett, 2001; Little & Hancock, 2002; Perrett et al., 1999). Utilizing a methodological procedure of identical design to the previous eye-tracker experiment, participants completed three separate preference experiments in total. Each experiment involved the sequential presentation of pairs of 20 opposite-sexed faces manipulated for one of three dimensions (sexual dimorphism, facial averageness, and bilateral symmetry). Images were presented sequentially to subjects in 24-bit color (image size = 531 × 511 pixels) within a testing cubicle via a computer and a single color monitor situated approximately 50–60 cm from the participants. Each pair of images was displayed for 5 s followed by an intertrial duration (a fixation-cross) of 1 s. Timing and display of stimuli was controlled via computer software (E-prime version 2.0.8.22). Participants were asked via on-screen instruction simply to "select the face they preferred" via two alternate choices on a computer keyboard ("A" key for face on left side; "F" key for face on right side). Participants viewed 60 pairs of faces in total across all three sets of trials (20 pairs of faces in each experiment). Following completion of the second part of the experiment, subjects were fully debriefed regarding the nature and purpose of the studies.

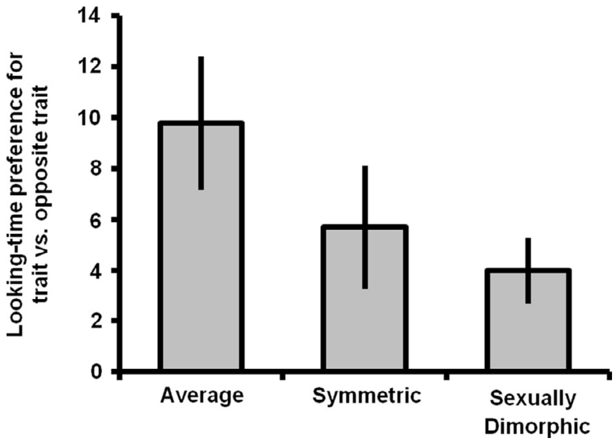

Figure 2. Mean looking time difference (±1 *SE*) based on fixation length (in seconds) as a measure of visual preference for average, symmetric, and sexually dimorphic face traits.

Results

For visual preferences, we computed average fixation lengths at symmetric, average, and sex appropriate sexually dimorphic (masculine for female participants and feminine for male participants) faces. We then computed a difference score reflecting relative visual attention by subtracting scores for asymmetric, nonaverage, and inappropriate sexual dimorphism images from the relevant scores for symmetric, average, and appropriate sexual dimorphism. Positive scores indicate longer fixation lengths at symmetric, average, and sexually dimorphic faces while negative scores indicate longer fixation lengths at asymmetric, less average, and less sexually dimorphic faces. For declared preferences, we computed proportion of trials on which the symmetric, average, and sexually dimorphic faces were chosen over the asymmetric, less average, and less sexually dimorphic faces.

Visual Preference

One-sample *t*-tests against chance (0 = no preference) revealed that, overall, participants displayed a significant visual preference for symmetrical versus asymmetrical versions of faces, $M = 5.69$, $SE = 2.42$, $t(55) = 2.35$, $p = .022$; average versus nonaverage versions of faces, $M = 9.77$, $SE = 2.61$, $t(55) = 3.75$, $p < .001$; and for sexually dimorphic versions of faces, $M = 3.98$; $SE = 1.29$, $t(55) = 3.06$, $p = .002$. Men displayed a significant visual preference for facial femininity, $M = 5.37$, $SE = 2.47$, $t(21) = 2.17$, $p = .042$, and women displayed a significant visual preference for facial masculinity, $M = 3.07$, $SE = 1.43$, $t(33) = 2.15$, $p = .039$.

A mixed model ANOVA was conducted on the visual preference data in order to assess the relative strength of participant's visual preferences for each of the manipulations, and the effect of gender on these preferences. Trait (averageness, symmetry, and sexual dimorphism) was entered as within-participant factors and sex of the participant (male, female) was entered as a between-participants factor. Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(2) = 9.84$, $p < .05$; therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = .86$). This analysis demonstrated that there was no significant main effect of trait, $F(1.7, 92.3) = 2.68$, $p = .082$, although this was close to significant. There was no significant effect of sex of participant, $F(1, 54) = .76$, $p = .388$, and no significant interaction between sex of participant and trait, $F(1.7, 92.3) = .19$, $p = .80$ (Figure 2). There was a significant linear effect of trait, $F(1, 54) = 7.98$, $p = .007$. Examining Figure 2, visual preferences were strongest for averageness, weaker for symmetry, and weakest for sexual dimorphic traits.

Declared Preference

One-sample *t*-tests against chance (0.5 = no preference) revealed that, like visual preferences, overall, participants displayed a significant declared preference for average versus nonaverage versions of faces, $M = 0.93$, $SE = .021$, $t(55) = 20.25$, $p < .001$; symmetrical versus asymmetrical versions of faces, $M = .91$, $SE = .022$, $t(55) = 18.47$, $p < .001$; and for sexually dimorphic versions of faces, $M = .75$, $SE = .032$, $t(55) = 7.71$, $p < .001$. Like visual preferences, men displayed significant declared preferences for femininity, $M = .60$, $SE = .046$, $t(21) = 2.22$, $p = .037$), and women displayed significant declared preferences for masculinity, $M = .85$, $SE = .036$, $t(33) = 9.56$, $p < .001$.

A mixed model ANOVA was conducted on the declared preference data in order to assess the relative strength of participant's declared preferences for each of the manipulations, and the effect of gender on these preferences. Trait (averageness; symmetry; and sexually

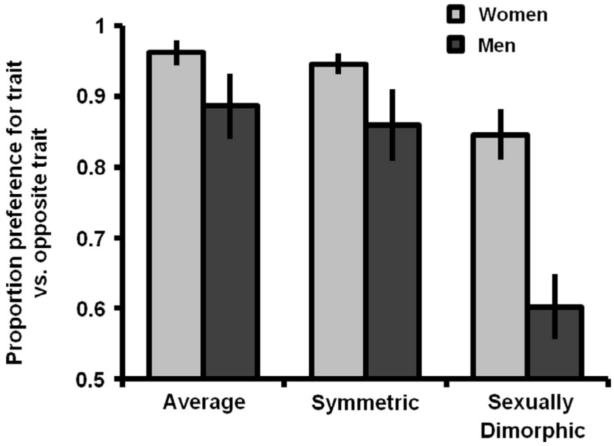

Figure 3. Mean proportion of choices of one face trait over the other (±1 *SE*) as a measure of declared preference for average, symmetric, and sexually dimorphic face traits split by rater sex.

dimorphic) was entered as within-participant factors and gender of the participant was entered as a between-participants factor. Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(2) = 29.66$, $p < .001$; therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = .70$). This analysis showed that there was a significant main effect of trait, $F(1.4, 75.6) = 48.67$, $p < .001$, and a significant effect of gender of participant, $F(1, 54) = 10.47$, $p = .002$. There was also significant interaction between gender of participant and trait, $F(1.4, 75.6) = 8.90$, $p < .001$ (Figure 3). Examining Figure 3, declared preferences were similar for men and women for averageness and symmetry while men had stronger preferences for sexually dimorphic traits than women. Preferences were weakest for sexually dimorphic traits compared to symmetry and averageness preferences.

Correlations Among Declared Preferences

Pearson's correlation coefficient (two-tailed) revealed that participants declared preferences were found to be significantly positively correlated with one another. Declared preferences for averageness were significantly correlated with declared preferences for sexual dimorphism, $r = .54$, $p < .001$, and symmetry, $r = .83$, $p < .001$, and preferences for symmetry were significantly correlated with preferences for sexually dimorphic traits, $r = .59$, $p < .001$.

Correlations Among Visual Preferences

Participants visual preferences for each of the three traits examined were also found to be significantly positively correlated with one another. Visual preferences for averageness were found to be significantly correlated with visual preferences for sexual dimorphism, $r = .68$, $p < .001$, and symmetry, $r = .34$, $p = .007$. However, individual's preferences for sexually dimorphic traits were found to correlate with symmetry at a level that was only close to significance, $r = .26$, $p = .057$.

Visual Preferences vs. Declared Preferences

Using Pearson's correlations, we investigated the correlation between participants declared and visual preferences for manipulated faces.

Correlations between visual and declared preferences for facial traits considering visual and declared preferences for the three traits in a combined analysis, in which participants contributed visual and declared preferences for all three traits ($N = 168$), identified a significant correlation between the visual and declared preferences displayed by participants, $r = .18$, $p = .020$. A partial correlation controlling for sex revealed a similar correlation, $r = .26$, $p = .005$. Because this analysis involves the same individuals entered more than once, we also computed average visual and declared preferences for attractive face traits (mean of averageness, symmetry and sexual dimorphism preference scores). The correlation between average visual and declared preferences for attractive faces ($N = 56$) was not significant, $r = .20$, $p = .142$, but was significant when controlling for sex, $r = .30$, $p = .023$.

When the relationship between declared and visual preferences was examined for the three traits tested separately ($N = 56$), nonsignificant positive correlations were found between declared and visual preferences for averageness, $r = .11$, $p = .42$, sexual dimorphism, $r = .25$, $p = .07$, and symmetry, $r = .14$, $p = .30$. The strongest correlation coefficient (for sexually dimorphic traits), however, was not found to significantly differ from either the coefficient for averageness, $Z = .75$, $p = .45$, or symmetry, $Z = .59$, $p = .56$. Partial correlations controlling for sex revealed a similar pattern of results for averageness, $r = .13$, $p = .36$, sexual dimorphism, $r = .35$, $p = .01$, and symmetry, $r = .18$, $p = .18$.

Further, we split the data by gender and found a sex difference in the correlation between participant's visual and declared preferences. A significant correlation was found between men's visual and declared preferences, $r = .32$, $p = .01$, whereas a nonsignificant correlation was found for women, $r = .14$, $p = .17$. These two correlation coefficients, however, were not found to significantly differ, $Z = .65$, $p = .52$.

Discussion

We found that participants displayed equivalent patterns of preferences across declared and visual preferences: significant visual and declared preferences were seen for the symmetrical, average, and sex appropriate sexually dimorphic versions of faces. These patterns of preferences are in line with past studies of preferences for these same traits (for reviews see Little et al., 2011a; Rhodes, 2006; Thornhill & Gangestad, 1999). Importantly, we also found that when collapsed across each of the three traits tested, participants declared and visual preferences correlated significantly, although weakly, with one another suggesting that visual and declared preferences for facial traits are suitably proxies for one another. Consequently we may assume that both measures provide an indicator of an individual's preference for facial stimuli. Our findings then suggest it may be valid to use visual behavior as a proxy for declared preference because longer looking time toward a stimulus reflected attraction, at least in human adults. Our data also suggest that such visual paradigms may be useful as a proxy for attraction where declared preferences are unavailable (e.g., NHP and infant studies), and generally support the methodological design and interpretation of those human and NHP studies that have investigated preference for stimuli using visual behavior (Langlois et al., 1987; Turati et al., 2005; Waitt & Little, 2006).

At the sample, or population level, it is appropriate to conclude that either measure will generate similar directional preferences for traits, as seen here. For example, if we wanted to know if individuals prefer symmetric over asymmetric faces, then examining either our results for declared or visual preference would yield the same conclusion: that individuals in the current experiment preferred the symmetric images. Such logic is in line with previous studies comparing population level preferences of groups. For example, using a standard visual preference technique, whereby pairs of images are simultaneously presented onto a single screen, Langlois et al. (1987) identified that infants between the ages of 2–3 months and 6–8 months displayed a significant visual preference for facial attractiveness as judged by adults. Similarly, Waitt and Little (2006) investigated the visual behavior displayed by rhesus macaques (*Macaca mulatta*) for conspecific facial symmetry. Using a visual paired comparison (VPC) task Waitt and Little found that rhesus macaques displayed a visual preference for symmetrical versus asymmetrical versions of conspecific faces, a finding in line with declared preferences for symmetry in humans looking at human faces.

Alongside the overall similarities between declared and visual preferences, there were other similarities. Looking at correlations among preferences, there were positive interrelationships observed among the three traits for both measures of preference. For example, those with high preferences for symmetry also displayed high preferences for averageness and sexually dimorphic traits in both declared and visual measures of preferences. Such interrelationships are consistent with previous studies demonstrating that symmetry and sexual dimorphic trait preferences are correlated (Little et al., 2008). Such interrelationships suggest that the traits used are related to some underlying factor that mediates attractiveness. For example, all three traits could influence how healthy a face looks and so all measure health preferences (Little et al., 2008). Alternatively, the three traits may all be independently associated with attractiveness of faces and some factor of the judge's results in them being more or less discriminating of all three traits. For example, attractive individuals may be more discriminating in selecting attractive versions for all three traits than those who are lower in attractiveness (Little et al., 2001).

While we did find an overall correlation between declared and visual preferences at the level of the individual, this correlation was weak. Indeed, when preferences for each of separate facial traits are examined on an individual basis the correlations between visual and declared preferences became nonsignificant. This suggests that while visual and declared preferences are related they are not necessarily interchangeable. Indeed, there were some differences, such as the sex by trait interaction for declared preference which was absent for visual preferences. We do note, however, that we had declared and visual preferences measured separately in different parts of the experiment. It is possible that measuring preference simultaneously would produce stronger relationships because by selecting an image as more attractive this may cause increased inspection. Measuring the preferences nonsimultaneously is a more conservative means of assessing the relationship, but better reflects methods used in infants and NHPs, who do not express declared preferences concurrently with visual preferences (Langlois et al., 1987; Waitt & Little, 2006).

By examining declarative versus visual preferences it might be expected that we would conclude one is a more valid or reliably measure than the other. In fact, our data is neutral to this question because there was no objective measure of preference for comparison against. Indeed, it may be wrong to assume there is a "best" way to assess preference. Declared preferences appear very appropriate to measure preference in human adults. Such studies and experiments are comparatively easy to deploy, are less time consuming, and do not require additional, expensive, technology required to measure visual preference. Visual preference on the other hand provides a window into the preferences of subjects who may not be able to provide declared preferences and may provide an insight into preferences that are not mediated by conscious interpretation of the stimuli (i.e., may be less prone to demand characteristics or other biases). One issue was that visual preferences were in fact somewhat nosier in terms of error than declared preferences. This may reflect a number of factors, as noted in the Introduction. For example, in declared preferences the choice was binary whereas in visual preferences the nonpreferred stimulus must always be looked at. In a similar way, boredom may play a greater role in visual tasks as participants are passive viewers which may lead to wandering eyes while participants in the declarative tests are more active. Additionally, inspection time may partially reflect interest in unusual, novel, or very unattractive stimuli (Ackerman et al., 2009; Wohlrab et al., 2007). Our data suggest visual preference positively correlates with declared preferences, at least for faces that are not at the extreme ends of the attractiveness continuum, validating the use of visual methods as a proxy for declarative methods for similar stimuli but note that the use of more extreme stimuli may decrease or even reverse this correlation. Overall, we would then recommend that neither method be seen as optimal and that future studies acknowledge both the strengths and weaknesses of the different approaches.

In summary, our data indicated that, generally, human visual and declared preferences for manipulated facial stimuli generate a similar pattern of directional preference and are related with one another. Both methods may therefore be considered appropriate with which to measure human preferences for faces and facial attractiveness. Clearly, there are advantages and disadvantages to both methods of preference measurement and we would caution researchers against assuming one measure may be better than another. Overall, a combined approach is likely to be most useful in determining genuine preferences. In other words, when results from both measures converge we can be confident that particular stimuli or traits of stimuli are preferred.

References

Ackerman, J. M., Becker, D. V., Mortensen, C. R., Sasaki, T., Neuberg, S. L., & Kenrick, D. T. (2009). A pox on the mind: Disjunction of attention and memory in the processing of physical disfigurement. *Journal of Experimental Social Psychology, 45*, 478–485. doi: 10.1016/j.jesp.2008.12.008

Apicella, C. L., Little, A. C., & Marlowe, F. W. (2007). Facial averageness and attractiveness in an isolated population of hunter-gatherers. *Perception, 36*, 1813–1820.

Benson, P. J., & Perrett, D. I. (1991). Synthesizing continuous-tone caricatures. *Image and Vision Computing, 9*, 123–129.

Benson, P. J., & Perrett, D. I. (1993). Extracting prototypical facial images from exemplars. *Perception, 22*, 257–262. doi: 10.1068/p220257

Bruce, V., & Young, A. W. (1986). Understanding face recognition. *British Journal of Psychology, 77*, 307–327.

Burt, D. M., & Perrett, D. I. (1995). Perception of age in adult Caucasian male faces: Computer graphic manipulation of shape and colour information. *Proceedings of the Royal Society of London, B, 259*, 137–143.

Cooper, V. J., & Hosey, G. R. (2003). Sexual dichromatism and female preference in Eulemur fulvus subspecies. *International Journal of Primatology, 24*, 1177–1188.

Cunningham, M. R., Roberts, A. R., Wu, C. H., Barbee, A. P., & Druen, P. B. (1995). Their ideas of beauty are, on the whole, the same as ours – Consistency and variability in the cross-cultural perception of female physical attractiveness. *Journal of Personality and Social Psychology, 68*, 261–279.

Dion, K. K. (1977). Incentive value of physical attractiveness for young-children. *Personality and Social Psychology Bulletin, 3*, 67–70.

Ekman, P., & Friesen, W. V. (1976). *Pictures of facial affect*. Palo Alto, CA: Consulting Psychological Press.

Fujita, K., & Wantanabe, K. (1995). Visual preference for closely related species by Sulawesi macaques. *American Journal of Primatology, 37*, 253–261.

Grammer, K., & Thornhill, R. (1994). Human (*Homo sapiens*) facial attractiveness and sexual selection: The role of symmetry and averageness. *Journal of Comparative Psychology, 108*, 233–242. doi: 10.1037/0735-7036.108.3.233

Landolt, M. A., Lalumiere, M. L., & Quinsey, V. L. (1995). Sex-differences in intra-sex variations in human mating tactics – An evolutionary approach. *Ethology and Sociobiology, 16*, 3–23. doi: 10.1016/0162-3095(94)00012-v

Langlois, J. H., Kalakanis, L., Rubenstein, A. J., Larson, A., Hallamm, M., & Smoot, M. (2000). Maxims or myths of beauty? A meta-analytic and theoretical review. *Psychological Bulletin, 126*, 390–423.

Langlois, J. H., & Roggman, L. A. (1990). Attractive faces are only average. *Psychological Science, 1*, 115–121.

Langlois, J. H., Roggman, L. A., Casey, R. J., Ritter, J. M., Riser-Danner, L. A., & Jenkins, V. Y. (1987). Infant preferences for attractive faces: Rudiments of a stereotype? *Developmental Psychology, 23*, 363–369.

Langner, O., Dotsch, R., Bijlstra, G., Wigboldus, D.H.J., Hawk, S.T., & van Knippenberg, A. (2010). Presentation and validation of the Radboud Faces Database. *Cognition & Emotion, 24*, 1377–1388.

Little, A. C., Apicella, C. L., & Marlowe, F. W. (2007). Preferences for symmetry in human faces in two cultures: Data from the UK and the Hadza, an isolated group of hunter-gatherers. *Proceedings of the Royal Society B – Biological Sciences, 274*, 3113–3117.

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. *Proceedings of the Royal Society B – Biological Sciences, 268*, 39–44. doi: 10.1098/rspb.2000.1327

Little, A. C., & Hancock, P. J. B. (2002). The role of masculinity and distinctiveness in judgments of human male facial attractiveness. *British Journal of Psychology, 93*, 451–464.

Little, A. C., Jones, B. C., & DeBruine, L. M. (2011a). Facial attractiveness: Evolutionary based research. *Philosophical Transactions of the Royal Society B – Biological Sciences, 366*, 1638–1659.

Little, A. C., Jones, B. C., & DeBruine, L. M. (2011b). The many faces of research on face perception Introduction. *Philosophical Transactions of the Royal Society B – Biological Sciences, 366*, 1634–1637.

Little, A. C., Jones, B. C., DeBruine, L. M., & Feinberg, D. R. (2008). Symmetry and sexual dimorphism in human faces: Interrelated preferences suggest both signal quality. *Behavioral Ecology, 19*, 902–908.

Pascalis, O., & Bachevalier, J. (1998). Face recognition in primates: A cross-species study. *Behavioural Processes, 43*, 87–96.

Perrett, D. I., Burt, D. M., Penton-Voak, I. S., Lee, K. J., Rowland, D. A., & Edwards, R. (1999). Symmetry and human facial attractiveness. *Evolution and Human Behavior, 20*, 295–307.

Perrett, D. I., Lee, K. J., Penton-Voak, I. S., Rowland, D. R., Yoshikawa, S., Burt, D. M., . . . Akamatsu, S. (1998). Effects of sexual dimorphism on facial attractiveness. *Nature, 394*, 884–887. doi: 10.1038/29772

Quinsey, V. L., Ketsetzis, M., Earls, C., & Karamanoukian, A. (1996). Viewing time as a measure of sexual interest. *Ethology and Sociobiology, 17*, 341–354. doi: 10.1016/s0162-3095(96)00060-x

Rhodes, G. (2006). The evolutionary psychology of facial beauty. *Annual Review of Psychology, 57*, 199–226.

Steffens, M. C., Landmann, S., & Mecklenbräuker, S. (2013). Participant sexual orientation matters. *Experimental Psychology, 60*, 362–367. doi: 10.1027/1618-3169/a000209

Thornhill, R., & Gangestad, S. W. (1999). Facial attractiveness. *Trends in Cognitive Sciences, 3*, 452–460.

Tiddeman, B. P., Burt, D. M., & Perrett, D. I. (2001). Prototyping and transforming facial texture for perception research. *IEEE Computer Graphics and Applications, 21*, 42–50. doi: 10.1109/38.946630

Turati, C., Valenza, E., Leo, I., & Simion, F. (2005). Three-month-olds' visual preference for faces and its underlying visual processing mechanisms. *Journal of Experimental Child Psychology, 90*, 255–273. doi: 10.1016/j.jecp.2004.11.001

Waitt, C., & Little, A. C. (2006). Preferences for symmetry in conspecific facial shape among Macaca mulatta. *International Journal of Primatology, 27*, 133–145.

Wohlrab, S., Fink, B., Pyritz, L. W., Rahlfs, M., & Kappeler, P. M. (2007). Visual attention to plain and ornamented human bodies: An eye-tracking study. *Perceptual and Motor Skills, 104*, 1337–1349.

Received May 10, 2013
Revision received July 25, 2013
Accepted September 12, 2013
Published online December 19, 2013

Anthony Little

School of Natural Sciences
University of Stirling
Stirling, FK9 4LA
UK
E-mail anthony.little@stir.ac.uk

