Acta Psychologica 131 (2009) 136–142

Contents lists available at ScienceDirect

Acta Psychologica

journal homepage: www.elsevier.com/locate/actpsy

Averageness or symmetry: Which is more important for facial attractiveness?

Masashi Komori [a,*], Satoru Kawamura [b], Shigekazu Ishihara [c]

[a] Faculty of Information and Communication Engineering, Osaka Electro-Communication University, 18-8 Hatsucho, Neyagawa, Osaka 572-8530, Japan
[b] School of Human Sciences, Osaka University, 1-2 Yamadaoka, Suita, Osaka 565-0871, Japan
[c] College of Psychological Science, Hiroshima International University, 555-36, Kurose-Gakuendai, Higashi-Hiroshima, Hiroshima 724-0695, Japan

ARTICLE INFO

Article history:
Received 27 April 2008
Received in revised form 23 March 2009
Accepted 24 March 2009
Available online 25 April 2009

PsycINFO classification:
2323

Keywords:
Face perception
Generalized Procrustes method
Facial attractiveness
Facial averageness
Facial symmetry

ABSTRACT

Effects of averageness and symmetry on the judgment of facial attractiveness were investigated using a generalized Procrustes method and multiple regression analyses. Participants ($n = 114$) rated attractiveness of 96 photographs of faces with neutral expressions. Through a generalized Procrustes method, the faces and their mirror-reversed versions were represented as points on a hyperplane. Both averageness and symmetry of each individual were defined as distances on the plane. A multiple regression analysis was performed to examine the effect of symmetry and averageness for each gender. For male faces, both symmetry and averageness affected attractiveness ratings positively , and there was no difference between the effects of averageness and symmetry. On the other hand, for female faces only averageness affected attractiveness, whereas symmetry did not. However, these effects were not large.

1. Introduction

A number of studies have investigated empirically how facial attractiveness is influenced by characteristics of facial shape,[1] with the result that many facial features have been proposed as determinants of the perceived facial attractiveness. Among these, two particularly controversial ones concern features based on averageness and symmetry.

Averageness refers to the degree to which a given face resembles the majority of faces within a given population. This property has attracted much interest as a determining factor of facial attractiveness. The "average hypothesis", which holds that more typical faces are more attractive, can be traced back to Galton (1878). He projected multiple component faces onto a single photographic plate to create composite faces and found that composite faces were more attractive than component faces. Many of the more recent studies concerned with facial averageness also use such facial blending techniques to combine photographs of individual faces. Nowadays, however, photographs are digitally coded and various computer image processing techniques are employed. Nevertheless, consistent with the average hypothesis, studies using such computer blending techniques have found that composite faces were evaluated as more attractive than the component faces from which they were created (Langlois & Roggman, 1990; Little & Hancock, 2002; Rhodes, Yoshikawa, et al., 2001). Similarly, the effect of averageness was confirmed by a study using line drawings (Rhodes & Tremewan, 1996), as well as by a study examining the correlation between ratings of averageness and attractiveness (Light, Hollander, & Kayra-Stuart, 1981). The latter studies have also found a positive effect of averageness on attractiveness judgments of both male and female faces. However, in an early critique of the average hypothesis, Alley and Cunningham (1991) claimed that digitally averaged faces have a high degree of symmetry and that this compounding of the averageness and symmetry properties could be responsible for the averaged faces seeming more attractive.

Bilateral symmetry, or the extent to which one half of a face is similar to the other half, is considered to be at least as important as averageness. Many studies that were designed to explore the relationship between symmetry and facial attractiveness have also used computer blending techniques to compare original faces with blended faces. Most studies using the chimera technique, a procedure that replaces one side of the face with the mirror image of the other, have shown no positive effect of symmetry on attractiveness (Kowner, 1996; Langlois, Roggman, & Musselman, 1994; Samuels, Butterworth, Roberts, Graupner, & Hole, 1994). However, as Perrett et al. (1999) and Rhodes, Proffitt, Grady, and Sumich (1998) have pointed out, this mirror reflecting technique can introduce structural abnormalities that create faces that are abnormal in appearance. More recent studies compared original faces with faces that

* Corresponding author. Tel.: +81 72 820 9005; fax: +81 72 824 0014.
E-mail address: komori@isc.osakac.ac.jp (M. Komori).

[1] In this paper, when referring to relative spatial relationships of facial elements, the term "facial shape" is used.

0001-6918/$ - see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.actpsy.2009.03.008

have been warped into symmetric images using landmarks on both sides of the face. These studies have reported a preference for symmetrical faces in facial attractiveness judgments of both male and female faces (Koehler, Rhodes, & Simmons, 2002; Perrett et al., 1999; Rhodes et al., 1998; Rhodes, Yoshikawa, et al., 2001; Rhodes, Zebrowitz, et al., 2001). Conversely, others have claimed that the effect of facial symmetry is not an essential cause of attractiveness (e.g., Rubenstein, Langlois, & Roggman, 2002). Relevant to the above debate, it is worth noting that studies which show a positive effect of symmetry on facial attractiveness have mainly adopted a type of averaging technique in which a normal face is averaged with its mirror image (Koehler et al., 2002; Perrett et al., 1999; Rhodes et al., 1998; Rhodes, Yoshikawa, et al., 2001; Rhodes, Zebrowitz, et al., 2001). Using this mirror image technique to create symmetric faces may result in more averaged faces, namely faces closer to the mean of the population.

An issue of some dispute in this research concerns the relative importance of averageness versus symmetry in determining facial attractiveness. Most studies of facial attractiveness have relied predominantly on facial blending procedures. However, as mentioned above, this technique does not allow us to distinguish between the effects of averageness and those of symmetry. Several studies have shown that both averageness and symmetry affect facial attractiveness independently by manipulating facial averageness and symmetry of facial images, respectively (Jones, DeBruine, & Little, 2007; Rhodes, Sumich, & Byatt, 1999). However, conventional methods render it difficult to ascertain precisely the extent to which averageness and symmetry contribute separately to facial attractiveness. To address this issue, a measurement-based approach, or an approach that examines the relationships between evaluated attractiveness of real faces and morphologically defined averageness or symmetry, should be more appropriate than facial blending approaches.

Several researchers have used real facial images in their studies. Grammer and Thornhill (1994) examined the relationship between naturally occurring human facial asymmetry and attractiveness. They estimated facial asymmetry in original male and female faces by adding up every horizontal distance between mid-points of lateral feature points. They found that the horizontal symmetry of the faces was correlated with attractiveness judgments of both male and female faces. Grammer and Thornhill (1994) also reported that whereas averaged faces were judged to be more attractive than originals for female faces, originals were preferred to averaged faces for male faces, and they argued that attractiveness is affected by symmetry but not by averageness. Other studies that measured facial asymmetry did not find consistent correlations between symmetry measures and ratings of face attractiveness. Jones et al. (2001) reported a positive correlation between facial symmetry and attractiveness for both male and female faces, whereas Scheib, Gangestad, and Thornhill (1999) found a positive relationship only for male faces but not for female faces. Weeden and Sabini (2005) conducted a meta-analysis of data from 13 publications to assess the relationship between measured asymmetry and attractiveness. They concluded that effects of facial symmetry on attractiveness were small for male faces (weighted average $r = -.14$) and were essentially absent when female faces were used (weighted average $r = -.06$).

However, there may be several methodological problems with conventional measurement-based approaches. The majority of studies that have followed such an approach used few locations (e.g., pupils) as anchoring points to align the faces (e.g., Grammer & Thornhill, 1994). While measuring facial asymmetry, the pupils were aligned horizontally in order to create the horizontal axis, then facial asymmetry was calculated either by summing the distances from all the feature points to the midline that is orthogonal to the horizontal axis (Hume & Montgomerie, 2001; Jones et al., 2001; Rhodes et al., 2001) or by summing the differences in horizontal locations between all mid-points of all paired feature points (Grammer & Thornhill, 1994; Scheib et al., 1999). One problem with this procedure is that aligning anchoring points results in the increasing of the variance of certain facial element locations, namely those located far from the anchoring points (e.g., pupils), while it does not generate increased variability for the locations of facial elements near anchoring points. Thus, the farther a facial element is from the anchoring points, the stronger their impact will be on some measures of averageness or symmetry. Another problem with conventional measurement procedures is related to an increased likelihood of asymmetry of pupil locations affecting asymmetry of all other facial elements. For example, consider an original face that is perfectly symmetric except for the locations of the pupils. If conventional procedures are used to standardize this face by aligning pupils as anchor points, this will result in the whole face incorrectly displaying a strong asymmetry, in spite of the fact that the original face was almost symmetric. Thus, several problems arise if faces are standardized by aligning specific feature points. The present study aims at solving these difficulties by using geometric morphometrics (Bookstein, 1991; Dryden & Mardia, 1998; Marcus, Corti, Loy, Naylor, & Slice, 1996) to examine the relationship between measured averageness and symmetry of individual facial elements and their evaluated attractiveness.

Geometric morphometrics has been developed in the field of paleontology to statistically analyze shapes of ancient fossilized remains and recently it has been applied to psychological research on human faces (Valenzano, Mennucci, Tartarelli, & Cellerino, 2006). In modern geometric morphometrics, a generalized Procrustes method (Dryden & Mardia, 1998) is commonly used. A generalized Procrustes method does not necessitate specific anchoring points to standardize faces; instead, this procedure converts shapes into normally distributed values that can be statistically analyzed. Here the effects of both distinctiveness (the converse of averageness) and asymmetry (the converse of symmetry) are measured using a generalized Procrustes method and multiple regression analyses. Through a generalized Procrustes method, 96 faces and their mirror versions are each represented as a point on the same hyperplane. We defined asymmetry of each individual face as the Euclidean distance between the face and its mirror-reversed face, and distinctiveness of each individual face as the Euclidean distance from the origin of the plane to the mid-point between a face and its mirror-reversed face. Consequently, facial variations were categorized into distinctiveness and asymmetry, and were represented as Euclidean distances on the same plane. Using these measures as independent variables, we performed multiple regression analyses on the rated attractiveness for each gender. Providing that both averageness and symmetry affect facial attractiveness, the coefficients for both distinctiveness and asymmetry should exhibit significantly negative values. Our analyses in the present study also took the perceived facial masculinity/femininity into consideration, because Gangestad and Thornhill (2003) have reported a positive correlation between facial masculinity and male facial symmetry. Investigations designed to assess the extent to which both averageness and symmetry affect facial attractiveness have the potential to offer clues to understanding how these respective preferences might arise.

2. Methods

2.1. Facial shape analysis

2.1.1. Materials

Japanese undergraduates ($n = 96$, 48 men and 48 women; age 18–26 years, mean age = 20.88, SD = 1.70) provided the facial