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Facial symmetry is not a reliable cue of aggressive behavior

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Abstract

Some evolutionary psychologists argue that facial symmetry provides cues as to the behavioral tendencies of the target. The present study examined the relationship between facial symmetry and aggressive behavior in healthy young people. To this end, the frontal photographs of 158 male and 154 female university students were taken and recent version of Buss & Perry aggressiveness questionnaire was used for detecting self reported aggressive behavior. The analysis of facial symmetry from pictures was done on the basis of 14 somatometric landmarks in NIH-Image 1.62 by using Spearman's rank correlation analysis no significant relationship was found between composite asymmetry and any component of aggressiveness. The results of the study suggest that facial symmetry is not a reliable cue of self reported aggressiveness in young males and females living in Ankara, Turkey.

Keywords: *Facial symmetry, Fluctuating asymmetry, self-reported aggressiveness, developmental instability*

Introduction

Deviations from perfect symmetry in bilaterally paired morphological traits have long been of interest to evolutionary biologists and psychologists. Across a population, signed asymmetries (i.e., signed difference between right and left side) on many bilateral features tend to show a normal or leptokurtic distribution where the mean is zero and individuals with relatively large asymmetry are rare (for review Swaddle, 2003). At the population level, asymmetry has been shown to increase in response to various forms of environmental and genetic stress encountered during development (Møller and Swaddle, 1997; Thornhill and Møller, 1997; Graham et al., 2010). There are three main asymmetry types on the population level: fluctuating asymmetry (FA), directional asymmetry (DA) and antisymmetry (AS) (VanValen, 1962; Van Dongen, 2006). FA refers to small random deviations from perfect symmetry in bilaterally paired structures and it reflects an organism's ability to cope with genetic and environmental stress during development. FA has been used as an indicator of individual quality and developmental stability in studies of natural and sexual selection

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(Palmer and Strobeck, 2003). Developmental stability is defined as the ability of an organism to buffer its development against genetic or environmental disturbances encountered during development to produce selected phenotypes. As for both DA and AS, the bilateral variation may have an unknown genetic basis, and thus may not solely reflect pure developmental noise. These two types of asymmetry are generally not used as indicators for developmental stability (Palmer and Strobeck, 2003; however see Graham et al., 1993; Møller, 1994).

In humans it is known that an association exists between protein homozygosity and inbreeding (Schaefer et al., 2006), poor maternal health (Kieser et al., 1997; Singh and Rosen, 2001), some genetic diseases (Malina and Buschang, 1984; Townsend, 1987), and various neurological disorders (Reilly et al., 2001; Burton et al., 2003) and FA (for general review Thornhill and Møller, 1997; Graham et al., 2010). According to evolutionary psychologists, symmetrical people generally have greater emotional and psychological health, and symmetrical people were also found to have greater physiological health than their asymmetrical counterparts (Manning et al., 1996; Shackelford and Larsen, 1997). Furthermore, symmetrical men and women are more physically attractive than asymmetric individuals (e.g., Grammer and Thornhill, 1994; Gangestad and Thornhill, 1997).

Level of body symmetry may also provide cues as to the behavioral tendencies of the target. Both animals and humans share many of the same types of social behavior such as aggression and violent behavior. Gender is a factor that plays a role in both human and animal aggression. In general, males are more physically aggressive than females and the differences between them emerge at a very early age (Coie and Dodge, 1997; Buss, 2005). This is one of the most robust and reliable behavioral sex differences, and it has been found across many different age groups and cultures. Some researchers suggest that symmetrical adult (Furlow et al., 1998) and adolescent (Manning and Wood, 1997) males are more aggressive; but in a recent study by Benderlioglu, Sciulli, and Nelson (2004) suggest that asymmetrical people are more aggressive. Studies on this subject reveal conflicting results. In the present study the relationship between facial symmetry and aggressiveness was studied on university students living in Ankara, Turkey.

Materials and Methods

Study sample

The study sample was comprised of 158 male (mean age = 20.25±1.48 years) and 154 female students (mean age = 20.04 ± 1.25 years) recruited from the Baskent University in Ankara, Turkey. In order to avoid the effect of environmental stresses in FA, the sample is composed of individuals with high socioeconomic status. The sexes did not differ in average age ($P > 0.05$).

Aggression questionnaire

In the study, a recent version of the Buss & Perry Aggressiveness Questionnaire was used (34 items) to examine self-reported aggressive behavior (Buss and Warren, 2000). This Aggression Questionnaire is the most widely used self-report measure of trait aggression (e.g., Meesters et al., 1996; Haris, 1995; Maxwell, 2008). It contains five subscales: physical aggression (9 items), verbal aggression (5 items), anger (7 items), hostility (8 items) and indirect aggression (5 items). Responses were made on scales anchored at 1 (extremely uncharacteristic of me) to 6 (extremely characteristic of me). High scores on these measures are considered reliable and valid self-report indices of trait aggressiveness (e.g., Bernstein and Gesn, 1997; Tremblay and Eward, 2005). A Turkish version of the AQ translated by Can (2002) was used. Inter-item reliability was high; between 0.76-0.87 across the subscales.

Photographs

Two photographs were taken of each individual with a digital camera (Nikon D40) from a distance of 1.5 meters at a resolution of 1600 x 1200 pixels. Before being photographed, subjects' hair was removed from the face, shoulders, and neck region; glasses, makeup and jewelers were also removed. Participants were asked to look straight into the camera and maintain a neutral facial expression with their mouth closed and eyes opened. Particular attention was paid to maintain an even illumination of the face, as all photographs were taken under the same (symmetric) lighting conditions against a white background. Two facial photographs of each individual were taken. Prior to the facial symmetry analysis, all photographs were transferred to Adobe Photoshop CS3. Their levels of light and color were adjusted and they were rotated so that both pupil centers were located on the same y coordinate. Prior to measurement, they were then rotated by 180^0 to eliminate any potential bias from familiarity with facial features (Farah et al., 1995). Reliability of landmark placement was tested and found high in a subset of 120 faces (60 males and 60 females, all r = 0.71 to 0.93, all $P < 0.001$). Photographs that did not meet the standards in terms of positioning of the head, facial expression or image quality were excluded (n = 16). A two way mixed model ANOVA (individuals [random] * sides [fixed]) was used for estimating repeatability of the asymmetry (Palmer and Strobeck, 2003). For this analysis two photos of 60 subjects (30 males and 30 females) were measured. This test demonstrated that the sides * individuals MS (interaction term) of all landmark displacements from the midline of the face is significantly greater than the among-photo variation (all $P < 0.001$).

Analysis of facial symmetry

The analysis of facial symmetry from pictures was done on the basis of 14 somatometric landmarks in NIH-Image 1.62 according to the method originally developed by Grammer and Thornhill (1994). These landmarks capture distinct morphological structures of the face, which are known to be reliably identifiable (Grammer and Thornhill, 1994; Rikowski and Grammer, 1999; Hume and Montgomerie, 2001; Fink et al., 2006). The sizes of left and right sides of eight distance traits [outer eyes (P1-P2), inner eyes (P3-P4), eye width (P2,4-P1,3), face width (P5-P6), nose width (P7-P8), cheek width (P9-P10), mouth width (P11-P12), and jaw width (P13-P14)] were calculated in relation to the symmetry plane as defined by the midpoints of all traits except for eye width trait. The midpoints of twelve lines were calculated using the formula (left point-right point) / 2 + right point. All measurements were made to the nearest pixel.

In the study, signed (SA; R-L), absolute (AA; $\sqrt{(R\text{-}L)^2}$), and composite asymmetries (CA; $\Sigma(\sqrt{(R\text{-}L)^2})/n$) were determined. To check for size dependence, absolute (i.e. unsigned) asymmetry values were regressed on trait size. There was no indication of size dependency for any of measures (all $P > 0.05$). For the subsequent statistical analyses, only the composite asymmetry index was used because composite scores often show stronger associations with fitness parameters than single trait asymmetry measures (Leung and Forbes, 1997; Gangestad and Thornhill, 1999). There was no significant relation of age with composite facial FA or any aggressiveness subscale for the total sample or either sex (all $P > 0.05$). The Spearman's rank correlation analysis was used to estimate relationship between CA and aggressiveness.

Departures from normality

To determine the departures from normality, skewness and kurtosis (Sokal and Rohlf, 1995) for signed right − left values were calculated for all traits. One-sample t-tests were used to assess DA. Inner eye, jaw width and eye distance in males, mouth width and inner eye in females showed significant DA. However, none of the measures had antisymmetry were skewed or showed leptokurtic distribution. According to Graham, Roe, and West (1993) and Møller (1994), DA appropriate to use as indicators of developmental stability. Graham, Roe, and West (1993) found that fruit flies exposed to high dose benzene showed a transition from FA to DA, and also suggest that DA may be a potential indicator of DI. We used a principal components analysis (PCA) to control composite asymmetry for DA in our analysis, following the protocols of Graham et al. (1998) and Simmons et al. (2004).

Results

In this study, primarily a total 212 individuals were included in the evaluation and the results of the analyses interestingly demonstrated that a curve-linear relation exists between facial FA and physical aggression and anger subscales of males. In line with the constructive criticisms made for our study, the number of individuals was increased to 312 and then, the curve-linear relation was observed to disappear. Consequently, the article was re-written in accordance with the new findings.

AQ scores are presented in Table 1; scores for male subjects were higher for all components of aggressiveness when compared with females. The greatest sex difference was observed for physical aggression. Spearman's rank correlation analysis revealed no significant relationship between CA and any component of aggressiveness (all $P > 0.05$) (Table 2, Fig. 1-6).

Table 1: Means and standard deviations of self-reported aggressiveness scores

	Total (SD)	Males (SD)	Females (SD)	F
Physical	22.90 (6.81)	26.52 (6.52)	19.32 (6.70)	27.19***
Verbal	26.72 (5.87)	27.97 (5.97)	25.50 (5.72)	8.67**
Anger	25.52 (6.52)	26.42 (6.60)	24.51 (6.20)	5.75*
Hostility	23.85 (6.77)	24.98 (6.52)	22.80 (6.60)	4.00*
Indirect aggression	24.31 (6.90)	25.51 (6.70)	23.07 (6.70)	7.11**
Total	24.29 (5.22)	25.67 (5.08)	22.71 (5.28)	15.95***

*$P < .05$, **$P < .01$, ***$P < .001$

Table 2: Spearman's rank correlation results between composite asymmetry and self-reported aggressiveness

	Males	Females	Total
Physical	0.067	−0.058	0.080
Verbal	−0.084	−0.005	−0.004
Anger	−0.085	−0.113	−0.056
Hostility	−0.047	0.036	−0.033
Indirect aggression	−0.097	−0.060	−0.038
Total	−0.059	−0.057	0.015

Discussion

Some evolutionary psychologists argue that a well-developed, symmetrical phenotype indicates the capacity of an individual to resist the challenges by developmental stress (Møller and Swaddle, 1997). Hence, symmetrical traits may signal the ability of an individual to cope with developmental perturbations and may thus be considered a "health certificate" (Thornhill and Møller, 1997). However, there is comparably little evidence that human facial symmetry honestly advertises general health of an individual (see for review Rhodes, 2006; Van Dongen and Gangestad, 2012). Besides, evolutionary psychologists state that the degree of facial symmetry is an important basis for judgments about emotion, personality, motivational states and behavioral dispositions (Manning, 1995; Manning et al., 1996; Shackelford and Larsen, 1997). The results of the study indicates no significant relationship between self reported aggressiveness and CA in both sex.

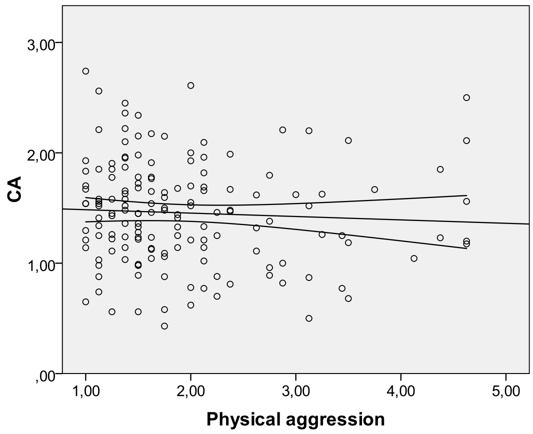

Fig. 1: Association between composite asymmetry (CA) and physical aggression subscale in males (left graph) and females (right graph)

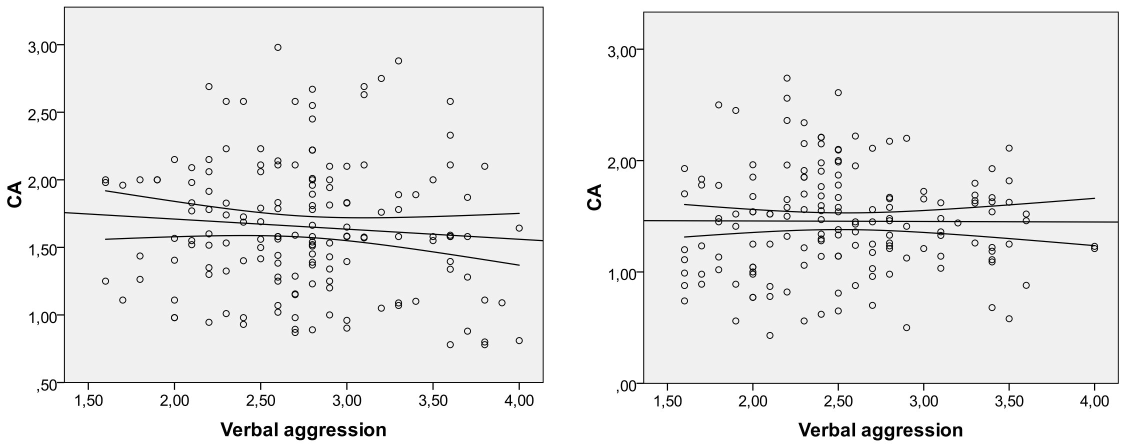

Fig. 2: Association between composite asymmetry (CA) and verbal aggression subscale in males (left graph) and females (right graph)

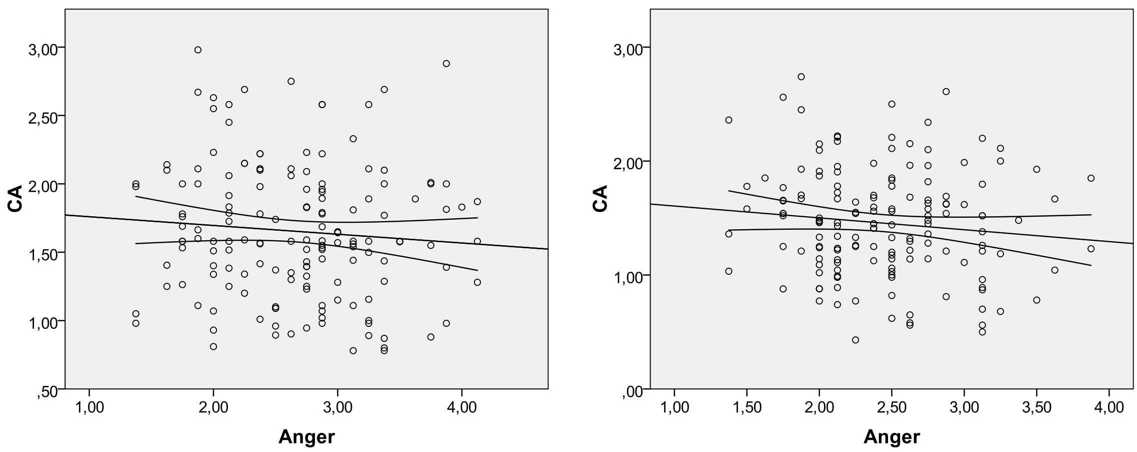

Fig. 3: Association between composite asymmetry (CA) and anger subscale in males (left graph) and females (right graph)

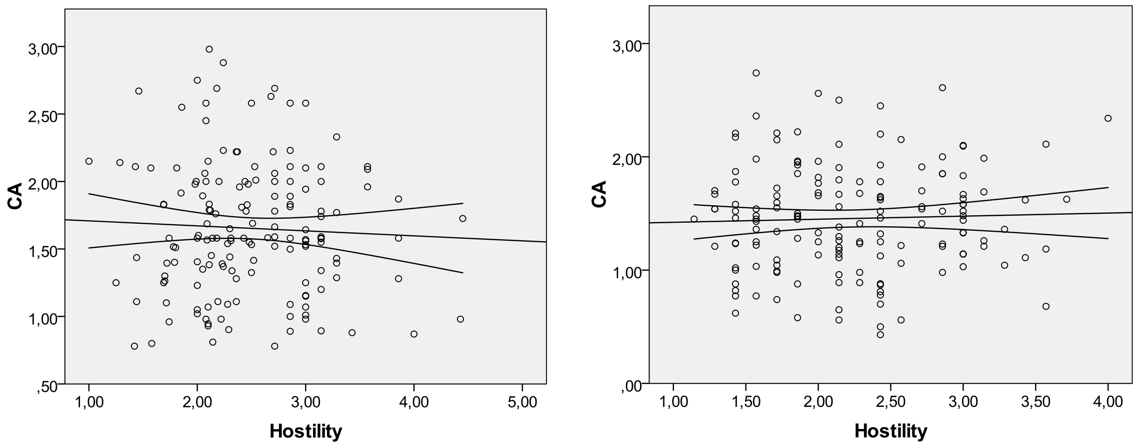

Fig. 4: Association between composite asymmetry (CA) and hostility subscale in males (left graph) and females (right graph)

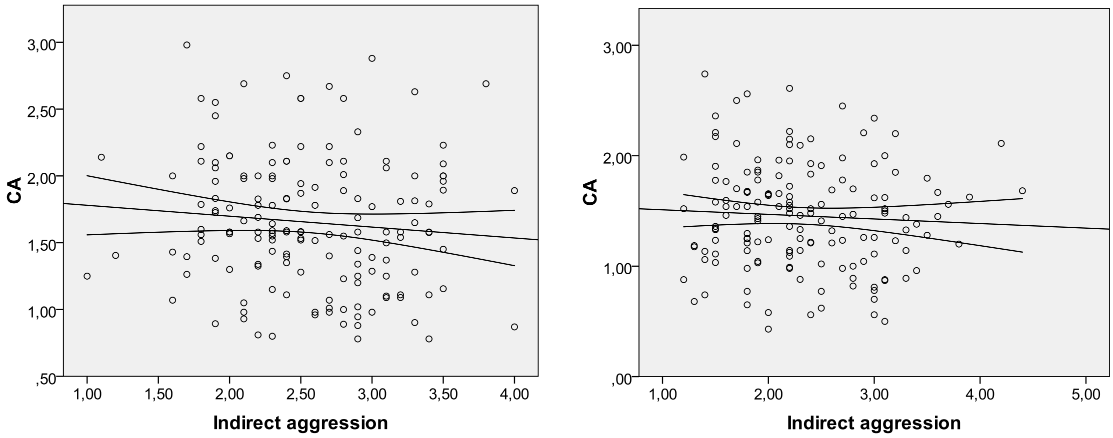

Fig. 5: Association between composite asymmetry (CA) and indirect aggression subscale in males (left graph) and females (right graph)

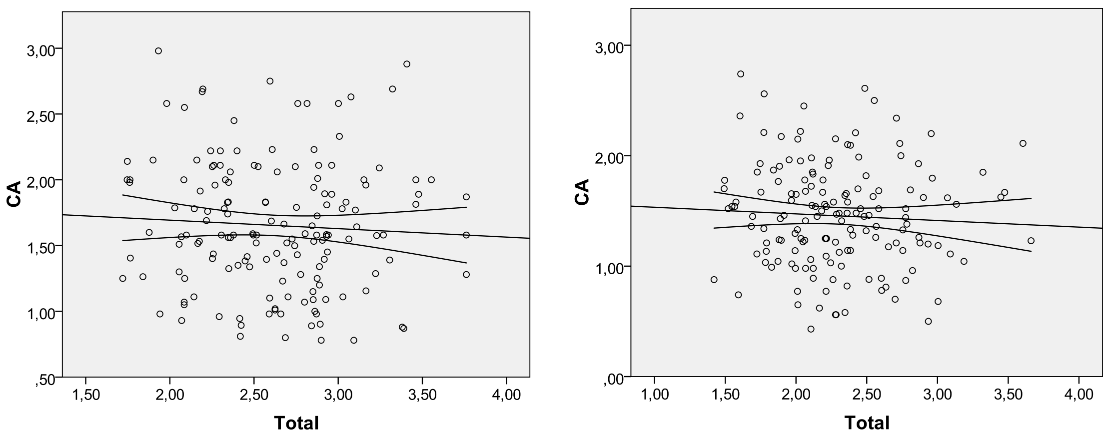

Fig. 6: Association between composite asymmetry (CA) and total aggression score in males (left graph) and females (right graph)

Studies on facial asymmetry and aggressiveness in the scientific literature are limited, and the studies were focused on different behavior patterns (i.e., big five personality traits; see Fink et al., 2005; Nor and Evans, 2003). Three remarkable studies take place in the literature related with aggressiveness and the non-facial trait asymmetries (Benderlioğlu, Sciulli, and Nelson, 2004; Furlow, Gangestad, and Armijo-Prewitt, 1998; Manning and Wood, 1998). Two different studies published in 1998 by Manning and Wood, and Furlow, Gangestad, and Armijo-Prewitt revealed a negative relationship between aggressive behavior and non-facial traits of FA while Benderlioğlu, Sciulli, and Nelson (2004) suggested that individuals with an asymmetrical body structure were tend to be more aggressive. In their study Furlow, Gangestad, and Armijo-Prewitt (1998) argued that body FA and number of fights in the previous three years were significantly negatively correlated in male undergraduate students, but not in females. Furthermore, FA was associated with fight initiation in males, even after intelligence, ethnicity, and weight were statistically controlled. The authors suggest that their findings contest the notion that human aggression is a compensatory behavior for "genetic inferiority" and instead support the notion of "alpha-male" dominance behavior. Manning and Wood (1998) replicated this finding in boys aged 10−15 years. According to the latter researchers, testosterone and/or cortisol effects on soft-tissue asymmetry and behavior may explain this correlation. Stress hormone interactions with phenotypic development may contribute to greater FA among boys growing up under socially stressful conditions (see Manning and Wood, 1998). According to Benderlioğlu, Sciulli, and Nelson (2004), stressors during pregnancy may lead to asymmetrical body parts and same stressors will also affect development of the central nervous system, which involves impulse control and aggression. In our study we have not found any relationships between facial symmetry and aggressiveness. Differences between studies may arise as a result of: (*a*) differences between characters; (*b*) differences in statistical power; (*c*) differences in genetic/ethnic structures among the populations; (*d*) differences in measurement methods of aggressiveness. It is widely accepted that the Buss and Perry AQ is one of the most reliable self report aggressiveness evaluation questionnaires. But many times "self-report" does not agree with "behavioral" or "physiological" measures, even if the various measures have some validity (Archer, 1991; Pope et al., 2000). In addition, aggression comes in many types, and aggressiveness questionnaire is capturing many of these subtypes of aggression, some of which may or may not be related to the competition aggression/reactive aggression. The absence of a relation between facial symmetry and aggression could also indicate that facial symmetries might not be a good sign for aggression. Asymmetries on face and body could be indicators of different factors. However, there is no study supporting this idea. As a consequence, according to the results of this study investigating the relationship between facial symmetry and aggression, it can be claimed that there is no such relation between facial symmetry and self-reported aggressive behaviors.

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