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Fluctuating Asymmetry and personality

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ABSTRACT

The relationship between Fluctuating Asymmetry (FA) and personality can cast light on the fitness consequences and selective benefits underlying personality. However few studies have investigated the topic and these have rendered inconsistent findings. Theoretically predicted relationships of FA to personality include linear associations and curvilinear associations (with low FA leading to average—not extreme—personality trait levels). Evidence for no association would suggest that personality has no consequences for general fitness. We summarise the findings to date, adding two new studies, testing each of the hypothesised models with well-validated measures of FA, and personality traits. No consistent associations were found. Though it remains possible that low FA is weakly related to conscientiousness and openness to experience, the major personality domains seem unrelated to FA.

1. Introduction

Variation in personality is under biological influence and may reflect selective pressures. The nature of these pressures is unclear. By contrast with intelligence, which is believed to be associated with increased fitness (Bates & Shieles, 2003; Furlow, Armijo-Prewitt, Gangestad, & Thornhill, 1997), theories diverge as to the predicted relationships of personality to fitness (see Penke, Denissen, and Miller (2007) and commentaries). Common predictions variously describe high, average, or low levels of each personality trait being adaptive. Alternatively, balancing selection may favour a distribution of phenotypes, none of which have a net relationship to fitness.

One method to test the evolutionary basis of personality is to measure its links to measures of fitness such as developmental stability (Waddington, 1957). Developmental stability reflects the ability to maintain a normal developmental course despite stress (Van Valen, 1962). A measure of developmental stability is Fluctuating Asymmetry (FA: an organism's deviation from bilateral symmetry). Here we use FA to test evolutionary models of personality. We briefly review the existing literature, and then describe two new samples including a sample of healthy older adults: a population that has not been studied previously in this field of research.

1.1. Personality and fitness

From an evolutionary perspective, desirable mate characteristics such as low-mutation load and high economic investment, parenting and emotional commitment are ranked most important cross-culturally, and are related to attractiveness (Buss & Shackelford, 2008). This suggests two possible associations between personality and FA. First, the major traits of personality such as Neuroticism (N), Extraversion (E), Openness to Experience (O), Agreeableness (A), and Conscientiousness (C) may be linearly associated with FA, with greater developmental stability promoting, for instance, higher levels of warmth and activity reflected in E. In the strongest case for such links, it has been argued that personality contains a general factor of personality, analogous to the g-factor in intelligence, and which like the g-factor (Bates, 2007; Prokosch, Yeo, & Miller, 2005) may reflect genetic fitness (Rushton, 1990). If so, low FA should be associated with high scores on the general factor of personality.

A second promoted fitness link for personality (unpublished data described in Gangestad (2010)) suggests that mean trait-levels reflect appropriate development. Under this model, high mutational load (and therefore higher FA) is predicted to be associated with a deviation from the population mean in personality and high FA should be associated with both very low and very high scores on personality traits.

Existing published data address these questions at best partially or, in the case of non-linear models, not at all. To date, only three reports have examined associations between FA and self-reported personality, and none has examined for non-linear associations. Moreover, none has used standard bodily measures of FA.

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Shackelford and Larsen (1997) examined associations between facial FA and a range of measures in 101 college undergraduates, including Eysenck Personality Questionnaire (EPQ) scales. FA was positively associated with extraversion in women ($r = .32$), and with neuroticism in men ($r = .49$). By contrast, a similar study of facial FA by Fink, Neave, Manning, and Grammer (2005) in 120 students given the NEO-FFI (Costa & McCrae, 1992) found that higher facial FA was associated with lower E ($r = -.21$), and higher A ($r = .23$) and O ($r = .30$) scores, with a trend towards higher N ($r = .17$) that was not significant. Finally, Pound, Penton-Voak, and Brown (2007) reported the largest sample to date ($n = 294$), assessing personality with an adjectival rating measure of the big five traits and again assessing facial FA. The sole significant association was for lower E ($r = -.21$). The results to date, then, are at best mixed, with E and FA correlating negatively in two samples (Fink et al., 2005; Pound et al., 2007), but in the opposite direction and in women only in another (Shackelford & Larsen, 1997). Similarly N was associated with FA in men only (Shackelford & Larsen, 1997), and not at all in either the Pound et al. or Fink et al. Studies. Only Fink et al. found significant associations with O or A. Past findings, and their directions, can be found in Table 1.

1.2. The present studies

To expand the available data on FA and personality we collected two new samples, assessing standard bodily FA, examining both linear and curvilinear associations between FA and the big five personality traits, as well as the hypothesized general personality factor. The personality inventories used in each study are comparable to each other and inventories used in past research (Gow, Whiteman, Pattie, & Deary, 2005a). All previous samples have been restricted to young samples – here we use both a young and an old-aged group allowing us to examine the generalizability of associations of personality with FA. To our knowledge, no studies have tested these relationships among elderly populations, where both FA and personality are known to be in flux (see e.g. Otremski, Katz, Livshits, & Cohen, 1993; Roberts & Mroczek, 2008). Furthermore, as at least some personality traits are associated with mortality risk (see e.g. Kern, Friedman, Martin, Reynolds, & Luong, 2009), assessing the fitness-relevance of such personality traits in the aged may be particularly important.

2. Study 1

2.1. Subjects

Participants were drawn from the Lothian Birth Cohort 1921 (LBC1921). The initial recruitment and testing of this 550-strong sample has been described in detail elsewhere (Deary, Whiteman, Starr, Whalley, & Fox, 2004).

2.2. Personality and FA assessments

Subjects were assessed on the 50-item version of the International Personality Item Pool (IPIP) Big-Five Factor markers (Gow, Whiteman, Pattie, & Deary, 2005b) at age 81. This test has 10 items for each of the personality traits: Extraversion (E), Agreeableness (A), Conscientiousness (C), emotional stability (ES) and intellect/imagination (O). It can be compared to the factors of the NEO-FFI as the correlations between the equivalent traits are high to acceptable (Gow et al., 2005a).

Fluctuating Asymmetry was assessed at clinic visits at age 87. Due to different completion rates for each measure, participant numbers were as high as 209 for some measures, and 173 participants (80 males, 93 females) completed all measurements. Using digital callipers, ear height, ear width, wrist circumference, elbow circumference, and ankle circumference were measured three times each for the left and right side of the body. We calculated mean values across the three measurements. Reliability was assessed using the intra class correlations (ICC) between the three repeated measurements of each body part. Reliability was very high ($r = .998$). All participants had their hands scanned by a digital flatbed scanner, giving high resolution images of the hands. Lengths and widths of the digits (excluding the thumb), along with the lengths of the palms, were measured digitally using image editing software. Where fingers were curved, measurements were taken between each individual joint and then added together, to ensure that finger length was not inappropriately shortened as a result of failing to take account of curvature. Common reasons for exclusion included unacceptable image quality (such as movement during the scan causing distortion) or too few measurements. A subset of 25 images was measured twice by the same rater prior to the rest of the sample being measured. The ICC between the two measurement occasions was again excellent indicating high reliability of the hand FA measure ($r = .999$).

While measurements of the fingers were taken by calliper, high curvature in the fingers of the participants made the callipers less reliable for the fingers than the other body parts. Consequently, the final outcome measure was established by combining the calliper measurements of the body with the digital measurements of the hands. The 14 separate measurements were then combined using the standard formula for FA ($\sum(|(\text{left} - \text{right})/(\text{left} + \text{right})/2|)$, which is used in most past research (Bates, 2007; Furlow et al., 1997; Prokosch et al., 2005) to produce an absolute percentage to create the outcome variable of combined FA. The values were then log transformed for normality.

3. Results

Mean FA (before being transformed for normality) was .01% ($SD = .004$). No significant sex differences in FA were found

Table 1
Summary of studies examining linear associations of FA and personality.

Study	Sample size	E	N	A	C	O
Shackelford and Larsen (1997)	101	.15	.03	–	–	–
Fink et al. (2005)	120	−.21*	.17	.23*	−.07	.31**
Pound et al. (2007)	294	−.21***	.03	−.05	−.01	−.04

Note: Shackelford and Larsen measured FA in the face via photographs. They measured FA by establishing bilateral points about a midline drawn through the centre of the face. Fink et al. measured FA in the face via photographs, and established FA through image analysis rather than human measurement. Pound et al. measured FA in the face as symmetry of bilateral points about a midline drawn through the centre of facial photographs. E = Extraversion, N = Neuroticism, C = Conscientiousness, A = Agreeableness, O = Openness to Experience.

* Indicates significance at .05 (two-tailed).

** Indicates significance at .01 (two-tailed).

*** Indicates significance at .001 (two-tailed).

Table 2
Linear regression models of FA on personality score, adjusting for age and sex. Numbers are: B (SE), with standardised β below.

	Study 1						Study 2					
	E	N	C	A	O	General Factor	E	N	C	A	O	General Factor
FA	.13 (1.91) .01	.45 (2.00) .02	.41 (1.44) .02	.28 (1.11) .02	−2.67 (1.35) **−.16***	−.09 (.24) −.03	−2.03 (1.68) −.08	1.24 (1.42) .06	−3.56 (1.62) **−.15***	−.92 (1.29) −.05	−1.53 (1.84) −.06	−.57 (.29) −.14
Adjusted R^2	.04	−.02	−.01	.20	.02	.07	.06	.13	.06	−.01	.001	.02

Note: *$p < .05$. Significant values are indicated in bold. FA = Fluctuating Asymmetry, E = Extraversion, N = Neuroticism, C = Conscientiousness, A = Agreeableness, O = Openness to Experience.

Table 3
Linear regression models of FA on participant's deviation from mean personality score, adjusting for age and sex. Numbers are: B (SE), with standardised β below.

	Study 1						Study 2					
	E	N	C	A	O	General factor	E	N	C	A	O	General factor
FA	.12 (1.19) .01	−1.78 (1.20) −.12	−.68 (.83) −.06	1.04 (.67) .12	−.25 (.77) −.03	.13 (.14) .08	.23 (.98) .02	−.15 (.89) −.01	−.19 (.97) −.01	1.04 (.74) .10	−.42 (1.14) −.03	.13 (.18) .05
Adjusted R^2	−.01	.003	−.003	−.003	−.02	−.01	−.01	−.01	−.01	.01	−.01	.01

Note: No findings are significant. FA = Fluctuating Asymmetry, E = Extraversion, N = Neuroticism, C = Conscientiousness, A = Agreeableness, O = Openness to Experience.

($t(171) = -1.31$, $p = .192$). Linear relationships of FA to each of the five personality traits were examined using regression controlling for age and sex (see Table 2). Of the five tests made, only one personality trait was nominally significant in a model which was, overall, non-significant: a marginal negative association between FA and O ($F_{3,161} = 1.82$, $p = .15$, adjusted $R^2 = .02$). Non-linear associations of FA and personality were examined as follows. The mean score on each personality dimension was calculated, and the absolute deviation of each participant's score on each domain was calculated. The higher the subsequent deviation score, the further the participant was from the mean – above or below. Using regression controlling for age and sex, no significant associations were found. Full details can be found in Table 3.

Finally, the hypothesis that FA would relate to a general factor of personality was tested. The first unrotated component of a factor analysis of five personality domains accounted for 38.2% of the total variance in personality. Scores on this first factor were calculated for each participant and the linear and curvilinear regression analyses repeated with scores on this general factor. No significant associations with FA were identified, whether linear or curvilinear (see Tables 2 and 3).

4. Study two

4.1. Subjects

Participants were adults recruited from the general population between 20 and 30 years of age (age $M = 23.8$ $SD = 2.9$, $N = 207$). Of these, 92 were male (age $M = 23.8$ $SD = 2.6$) and 115 female (age $M = 23.3$ $SD = 2.8$). For further details of the sample see Penke and Asendorpf (2008).

4.2. Personality and FA assessments

Participants completed the German version of the Big Five Inventory (BFI), details of which are available in Lang, Lüdtke, and Asendorpf (2001). Participants were measured across 12 body traits using digital callipers: the 2nd, 3rd, 4th and 5th digits along with foot breadth, ankle breadth, knee breadth, hand breadth, wrist breadth, elbow breadth, ear length and ear breadth. Each case was measured twice. If bones were reported as being broken or sprained in the areas of measurement, the participant was excluded. The results of the 12 traits were averaged using the same formula as in study one to create an outcome variable of combined FA. Reliability across the two sets of measurements of each body part, as indicated by the ICC, was high ($r = .999$).

5. Results

Mean FA (before being transformed for normality) was .02% ($SD = .01$). As in study one, data were log transformed prior to analysis. Male and female FA differed significantly by t-test ($t(205) = -3.28$, $p = .001$, $d = 0.48$) with women exhibiting higher FA.

We again examined linear and non-linear associations with each of the five major personality factors and a general factor. Results of tests of linear regression models for each personality trait and FA are shown in Table 2. Of the five tests conducted, one nominally significant result was found after controlling for age and sex: a negative association of FA and Conscientiousness in a model which was, overall, significant ($F_{3,203} = 5.01$, $p = .002$, adjusted $R^2 = .06$). Non-linear associations were again based on calculated deviations from the mean for each participant. As in study one, no associations approached significance (see Table 3).

In order to evaluate the possibility of FA relating to a general personality factor, we conducted the same factor analysis as in Study 1. The first unrotated component accounted for 33.5% of variance in the FFI. No significant associations between FA and the general personality factor were found (see Tables 2 and 3).

6. Joint discussion of studies one and two

In two studies we presented the first examination of personality traits and FA using standard bodily FA measures, and the first data exploring possible links of extreme personality scores to FA. The non-linear associations with personality were perhaps the most

interesting and theoretically novel hypotheses examined. Across two studies each examining six possible associations (including associations with the general factor) we found no support for any curvilinear associations between FA and any personality trait. The situation was similar when linear associations were tested: FA was linked to lower O in study one (older subjects), and to lower C in study two (younger subjects). The association between FA and Openness to Experience is in the opposite direction to that reported by Fink et al. (2005), but in the direction expected given the weak link of Openness to general ability. In summary, in the two studies presented with a total of 24 associations examined, just two were significant with no repeatability across studies. It seems most likely that two positive results reflect chance.

Taking the present data together with previous studies, it is clear that no personality trait has been reliably associated with FA. Such significant links as have been reported are not consistent across samples. The FA-O and FA-C associations may indicate higher scores on these traits are associated with fitness, but such a proposal is tenuous. Given the reliable association of FA with cognition, and the lack of reliable associations of FA with personality, the present results support models of personality as being unrelated to fitness (Penke et al., 2007).

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