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Original Article

Cues to fertility: perceived attractiveness and facial shape predict reproductive success

Lena S. Pflüger[a,*], Elisabeth Oberzaucher[a], Stanislav Katina[b,c], Iris J. Holzleitner[a], Karl Grammer[a]

[a]Department of Anthropology, University of Vienna, Althanstrasse 14, A-1090, Vienna, Austria
[b]School of Mathematics and Statistics, University of Glasgow
[c]Department of Applied Mathematics and Statistics, Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava

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Abstract

Attractive facial features in women are assumed to signal fertility, but whether facial attractiveness predicts reproductive success in women is still a matter of debate. We investigated the association between facial attractiveness at young adulthood and reproductive life history—number of children and pregnancies—in women of a rural community. For the analysis of reproductive success, we divided the sample into women who used contraceptives and women who did not. Introducing two-dimensional geometric morphometric methodology, we analysed which specific characteristics in facial shape drive the assessment of attractiveness and covary with lifetime reproductive success. A set of 93 (semi)landmarks was digitized as two-dimensional coordinates in postmenopausal faces. We calculated the degree of fluctuating asymmetry and regressed facial shape on facial attractiveness at youth and reproductive success. Among women who never used hormonal contraceptives, we found attractive women to have more biological offspring than less attractive women. These findings are not affected by sociodemographic variables. Postmenopausal faces corresponding to high reproductive success show more feminine features—facial characteristics previously assumed to be honest cues to fertility. Our findings support the notion that facial attractiveness at the age of mate choice predicts reproductive success and that facial attractiveness is based on facial characteristics, which seem to remain stable until postmenopausal age.

Keywords: Facial attractiveness; Facial shape; Reproductive success; Fluctuating asymmetry; Geometric morphometrics

1. Introduction

Female faces are assumed to display honest cues to fertility by means of facial attractiveness (Grammer, Fink, Møller, & Thornhill, 2003). Previous studies support the notion that the perception of women's facial attractiveness is based on morphological indicators of physiological and developmental condition. For instance, small random deviations from perfect bilateral symmetry (Van Valen, 1962), so-called fluctuating asymmetries (FAs), are known to negatively affect ratings on facial attractiveness (Grammer & Thornhill, 1994; Rhodes, Proffitt, Grady, & Sumich, 1998; Mealey, Bridgstock, & Townsend, 1999). As these small morphological deviations develop early during embryogenesis as an outcome of genomic and environmental stress, a low level of FA has been linked to developmental stability (Parsons, 1992; Gangestad, Thornhill, & Yeo, 1994; Thornhill & Møller, 1997) and health (see meta-analysis of Van Dongen & Gangestad, 2011). Other anthropometric indicators are so-called hormone markers. In humans, the basic facial proportions are affected by prenatal sex steroides. For instance, the influence of oestrogene leads to 'typically female' features (e.g., less robust jaws, high eybrows, and fuller lips), which are known to positively affect ratings on female attractiveness and are supposed to serve as reliable indicators of fecundity (Johnston & Franklin, 1993; Fink et al., 2005).

Even though the impact of facial attractiveness on human mate choice is well documented and theoretically discussed, no distinctive facial characteristics, which

* Corresponding author.
E-mail address: lena.pflueger@univie.ac.at (L.S. Pflüger).

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covary with female reproductive success, have been identified so far. Three previous studies investigated the relation between *perceived* facial attractiveness at the age of young adulthood and final number of children. Hill and Hurtado (1996) showed that facial attractiveness correlates with the number of children in a hunter and gatherer society. Pawlowski, Boothroyd, Perrett, and Kluska (2008) and Jokela (2009) investigated the association between facial attractiveness at youth and postmenopausal number of children in samples of contemporary women. Jokela's findings indicate that, for women living in industrialized settings, physical attractiveness is related to the number of children, while Pawlowski et al. (2008) failed to show any association.

The aim of the present study was to shed light on the signalling value of female facial attractiveness in terms of reproductive success. In contrast to previous research, we applied a new approach of landmark-based geometric morphometric methodology (GMM) in order to analyse female facial shape corresponding to reproductive success. We hypothesized that if perceived attractiveness at the age of young adulthood predicts female reproductive success, faces must possess anthropometric measurable indicators, which have driven the perception at young age.

2. Materials and methods

2.1. Data collection

Questionnaire data and facial photographs were collected from 88 women of a rural community of 1868 inhabitants in Carinthia (Austria). All women were at postmenopausal age (mean±S.D.=61.04±8.70 years) and in a long-term relationship with their current partner (mean age at the start of the partnership±S.D.=20.07±4.01 years). Subjects were interviewed about their total number of children. Besides the biological offspring, reproductive success was measured by estimating number of pregnancies, taking (induced) abortions into account.

In order to control for potentially confounding variables, we collected the following information: age of participants, years of marriage to their husband (father of their children), education of subject and corresponding husband, income of subject and corresponding husband before pension, family contact of subject while raising children, and religiosity of subject. Additionally, women were asked about the use of hormonal contraceptives (HC) during their fertile years.

We collected facial portraits showing participants at young adulthood (aged 19–23 years). Images were mostly wedding pictures taken by the same photographer. Additionally, we took standardized frontal pictures (constant in lightning condition, camera-to-subject distance, and focal length) of women's present-day faces while participants showed neutral expressions (i.e., having mandible relaxed with teeth not touching and lips closed freely).

2.1.1. Sample subdivision

For the analysis of facial shape, portraits which were not exactly frontally imaged (N=10) were excluded (e.g., when heads were rotated vertically or horizontally). This resulted in a total of 78 women used for the assessment of the relation between FA and facial attractiveness. Two women had to be excluded in the analyses considering reproductive success due to missing data (husbands did not fill out the questionnaire). For the analysis considering facial attractiveness and reproductive success, the sample was divided into women who used HCs (N=46) and women who never used HCs (N=40) during their fertile years.

2.2. Attractiveness rating

Facial pictures showing participants at young adulthood were aligned in colour, size, tonal value, and contrast. Hair and accessories were masked with an oval frame. One hundred twenty-five male students (mean age±S.D.=23.47±3.90 years) of the University of Vienna evaluated the female faces on the items 'attractive' and 'sexy' with sliders ranging from 1 (*not attractive/sexy*) to 100 (*highly attractive/sexy*). From past experience, we expected that the evaluation of 88 stimuli easily overtaxes participants and leads to exhaustion. In order to prevent such bias, each male participant was requested to evaluate a subset of 20 randomly chosen faces. The rating study resulted in at least 20 ratings per woman.

2.3. Statistical analyses

Statistical analyses were performed in *R* (R Development Core Team, 2010). All univariate two-variable associations were estimated by Spearman correlation coefficient r_s, and the test of zero correlation (9999 permutations) was used to test this association. We controlled for the confounding effect of age, years of marriage, income of husband, and own income while estimating the association between facial attractiveness and number of children by Spearman partial correlation coefficient r_s. The test of zero partial correlation (9999 permutations) was used to test this association. The mean levels of facial attractiveness (attractiveness/sexy) between women who used HCs and women who did not were compared by the two-sample Wilcoxon test (9999 permutations). The effect of family contact, education of subject, education of husband, and religiosity (church appendance) on number of children was tested by the Kruskal–Wallis test (9999 permutations).

2.4. Landmark-based GMM

Landmark-based GMM deals with the analysis of geometrical information about the form (also called geometric morphometrics; Bookstein, 1991). Digitizing (semi)landmarks on facial representations [two-dimensional (2D) portraits] provides individual geometric information of each specimen based on (semi)landmark coordinates. The main idea of GMM analysis is to adjust Cartesian