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Distinctiveness and femininity, rather than symmetry and masculinity, affect facial attractiveness across the world

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Abstract

Studies investigating facial attractiveness in humans have frequently been limited to studying the effect of individual morphological factors in isolation from other facial shape components in the same population. In this study, we go beyond this approach by focusing on multiple components and populations while combining geometric morphometrics of 72 standardized frontal facial landmarks and a Bayesian statistical framework. We investigate preferences in both sexes for three structural components of other sex facial beauty that are traditionally considered indicators of biological quality: symmetry, sexual dimorphism, and distinctiveness (i.e., the opposite of averageness). Based on a large sample of faces (n=1550) from 10 populations across the world (Brazil, Cameroon, Czechia, Colombia, India, Namibia, Romania, Turkey, UK, and Vietnam), we found that distinctiveness negatively affects the perception of attractiveness in both sexes and that this association is stable across all studied populations. We corroborated some previous results indicating both a positive effect of femininity on male assessment of female facial beauty and a null or weak effect of masculinity on female evaluation of male facial attractiveness. Facial symmetry had no effect on facial attractiveness. In concert with other recent studies, our results support the importance of facial prototypicality but cast doubt on the role of symmetry as one of the key constituents of attractiveness in the human face.

Keywords

averageness; sex-typicality; facial beauty; symmetry; sexual selection; cross-cultural; fitness indicators; facial morphology

Introduction

Facial appearance affects mate evaluation and selection (Little, 2021; Roth et al., 2021; Toma & Hancock, 2010). Evolutionary studies investigated morphological characteristics that, across cultures, contribute to physical attractiveness. Based on this, the perceptual evaluation of facial attractiveness is thought to utilize major morphological parameters that are potential indicators of underlying individual quality, namely bilateral symmetry, sexual dimorphism, and averageness (Fink & Penton-Voak, 2002; Grammer et al., 2003; Little, 2021; Rhodes, 2006).

Bodily symmetry is considered a marker of developmental instability in humans (Thornhill & Gangestad, 1994; Van Dongen & Gangestad, 2011) and other species (Møller & Pomiankowski, 1993). However, the effects of sexual selection on symmetry may vary in different species with different ecological niches and mating systems (Kruuk et al., 2003). Despite being a subject of a long and ongoing debate (e.g., Weeden & Sasbini, 2005; Grammer et al., 2005), evidence suggests that facial symmetry increases facial attractiveness. Individuals with more bilaterally symmetrical faces are perceived as healthier and more attractive (e.g., Little et al., 2007; Perrett et al., 1999; Rhodes et al., 2001; Zaidel et al., 2005) and report fewer health problems (Thornhill & Gangestad, 2006).

Sexual dimorphism is another ancient property of metazoans (Kopp, 2012); it appeared no later than gonochorism (Sasson & Ryan, 2017) and is influenced by sexual selection across animal species (Janicke & Fromonteil, 2021). In humans, the femininity of women's faces is considered attractive to men, but preferences for masculinity in men's faces vary across studies (e.g., Stephen et al., 2018). Some evidence indicates that sexual dimorphism is related to general health, fecundity, and pathogen resistance (Law Smith et al., 2005; Rhodes, 2006; Rhodes et al., 2003; Thornhill & Gangestad, 2006), but other studies find no consistent association between sexual dimorphism and health/fecundity (Boothroyd et al., 2013, 2017; Lidborg et al., 2022; Rantala et al., 2013; Zaidi et al., 2019).

Averageness (i.e., prototypicality, or its logical opposite, distinctiveness) is another relevant facial feature for attractiveness research. It measures how close an individual's facial proportions are to (or how far they are from) the average proportion in a given population. As soon as recognition of individuality evolved (Leopold & Rhodes, 2010), the degree of distinctiveness would be available for assessment in social and mating contexts. Arguably, it could indicate the level of inbreeding and/or the extent of kin network present in a population. In humans, the positive impact of averageness can be demonstrated by facial morphing, where the more different faces of the same sex contribute to an averaged composite, the more attractive it is considered (Little, 2021; Rhodes, 2006); this effect likely derives at least partly by correcting individual imperfections, up to roughly 30 faces (Langlois & Roggman, 1990). Averageness is rapidly processed by the brain (Trujillo et al., 2014) and could also tap into a preference for familiarity (Bohrn et al., 2013). Moreover, facial averageness is cross-culturally preferred—not only across various European populations but also in the Hadza of Northern Tanzania (Apicella et al., 2007)—which suggests universality.

Previous studies have analyzed effects of these facial components independently (for a review see, Rhodes, 2006; Little, 2021). However, everyday facial judgments likely consider them all simultaneously. Grammar et al. (2021) showed that attractiveness assessment integrates facial and bodily traits in a "fast and frugal" way according to a heuristic that has been described as "avoid the worst" – meaning that unattractive features are used for attractiveness decisions rather than highly attractive features. Hence, in order to increase ecological validity, different basic parameters of the face – such as skin texture and color, facial shape, eye and hair color, facial symmetry, and degree of sex-typicality – should be simultaneously investigated in the same study (Apicella et al., 2007; Little et al., 2007). Very few studies have proceeded with this extension of scope to examine relative contributions to facial attractiveness of certain features over others. For instance, Mogilski and Welling (2017) found that individuals prioritize cues to sexual dimorphism over symmetry and healthy coloration, particularly for male faces. In contrast, facial symmetry and healthy coloration were more important in preferences for female faces. Foo, Simmons and Rhodes (2017) evidenced the importance of sexual dimorphism, averageness, and symmetry in perception of attractiveness but reported only a weak association between health and facial cues to attractiveness. Jones and Jaeger (2019) found that averageness has a larger effect than symmetry when using manipulations or naturalistic paradigms, but when using machine learning algorithms attractiveness is predicted by shape averageness, dimorphism, and skin texture, but not shape symmetry.

Not so many studies have addressed preferences beyond a single or limited number of North American or Western European populations. Jones and Hill (1993) demonstrated in five populations that age-related traits and averageness (in both sexes) and neotenous and feminine features (in females) influence facial attractiveness. Using European faces, Kočnar et al. (2019) found that sex-typical and average facial traits were positively associated with attractiveness by raters across 10 cultures, while fluctuating asymmetry had no effect. The evidence based on Namibian and Cameroonian faces showed a similar pattern of null preference for fluctuating asymmetry and moderate preference for facial averageness (Kleisner et al., 2017). Using samples from five distant populations, Fiala et al. (2021) examined possible moderating effects of averageness, age, body mass, and facial width on human attractiveness. While women's perceived femininity was positively related to perceived attractiveness, shape sexual dimorphism and averageness were not associated with either perceived facial sexual dimorphism or attractiveness (Fiala et al., 2021). While certain studies evidenced the universality of attractiveness perception (Fink & Neave, 2005; D. Jones, 1995; Langlois et al., 2000), others acknowledged local variation influenced by sociocultural factors (Jackson, 1992; Kara & Özgür, 2023; Little et al., 2011; Voegeli et al., 2021)

We extend these approaches here, but our study is unique for three main reasons. First, many previous studies of the preferences of facial symmetry and typicality used facial stimuli from one or a small number of mostly WEIRD (i.e., Western, Educated, Industrialized, Rich, and Democratic) populations (Apicella & Barrett, 2016; Henrich et al., 2010). Second, very few of these studies compared large numbers of standardized natural facial portraits from various populations worldwide (e.g., Kleisner et al., 2021; Voegeli et al., 2021). Third, we investigate facial perception based on non-manipulated faces collected from members of the same local population. This is a critical point because the perception of faces in a specific population is neither evolutionarily nor socially independent from the variation of facial morphologies present in that population. Using local and non-manipulated faces, therefore, represents the most ecologically valid setting, sensitive to both morphological and perceptual components of facial variation. Thus, in summary, we aimed to investigate in both sexes the relative importance of facial distinctiveness, sex typicality, and symmetry in terms of their effects on human facial mate preferences from populations across the world.

Methods

Data sampling

The total sample consisted of 1550 faces from 10 different countries. The database of shape coordinates and mean attractiveness ratings from the pre-pandemic period consisting of Brazilian, British, Cameroonian, Czech, Colombian, Namibian, Romanian, and Turkish faces was published in a previous study (Kleisner et al., 2021). To increase the representativeness of the global population of facial morphologies, this dataset was additionally enriched with a sample of 136 Vietnamese facial configurations (from Pavlovič et al., *in press*) and a sample of 142 Indian faces from the CFD-INDIA database (Lakshmi et al., 2021). Facial attractiveness was operationalized as the mean rating of opposite-sex raters from the faces' own culture. Sample sizes of all facial photograph subsets are accessible in the Supplementary materials (Table S1). The sample used to fit the extended model with body height and BMI contained 1106 faces from 8 countries (see Supplementary material S1 for sample size decomposition and descriptive statistics). All procedures used in the study were approved by the Institutional Review Board of the Faculty of Science at Charles University (protocol ref. no. 04/2020).

Facial images were taken according to a standardized protocol within each population, using digital cameras, external light sources, and homogeneous white or grey backgrounds. Lighting conditions were not standardized across the samples but were uniform within each sample (population). All participants were instructed to adopt a neutral, non-smiling expression and to remove facial cosmetics, jewelry, or other adornments where possible. Participants were seated at a fixed distance from a digital camera and asked to look directly into it and avoid vertical and horizontal head tilting. The photographs were then edited to set the eyes horizontally at the same height and to leave a standard length of the visible neck.

Geometric morphometrics

For geometric morphometrics, we manually applied 72 landmarks on each of the faces. The definition of landmarks and semi-landmarks is available in our previous studies (Kleisner, 2021; Kleisner et al., 2021). Landmarks are corresponding locations that can be anatomically or geometrically defined on all objects in the sample. While landmarks reflect homologous structures and locations on the faces of different individuals, semi-landmarks denote curves and outlines. Shape coordinates were superimposed by a Generalized Procrustes analysis (GPA) using the "gpagen" function implemented in the geomorph package in R (Adams & Otárola-Castillo, 2013). GPA standardized the size of the objects and removed rotational and translational effects while minimizing distances between homologous landmarks. The "gpagen" function was also used to align sliding semi-landmarks using the minimum bending energy criterion.

To assess facial averageness (or its logical opposite, distinctiveness), the Procrustes distances between the mean shape and individual facial configurations were computed separately for each population. A lower facial averageness score, therefore, indicates a configuration's closer proximity to the mean shape.

In order to assess asymmetry, the aligned coordinates obtained through Procrustes fitting were initially mirrored along the midline axis. This involved relabeling the paired landmarks on the left and right sides of the faces, swapping the numeric labels of landmarks on the left side with those from the right side, and vice versa (Mardia, Bookstein, & Moreton, 2005). Procrustes distances were then computed between the original configuration and the mirrored (reflected and relabeled) configuration. Larger values of these distances indicate a higher degree of facial asymmetry.

The degree of individual expression of facial traits contributing to sexual shape dimorphism (SShD) was assessed using Procrustes residuals obtained from a Procrustes fit of the combined symmetrized facial configurations of men and women. To examine the morphological differences between men and women, the face of each individual was projected onto the vector between male and female means. The position of each projected face on the sex-specific vector can be numerically expressed as a score that determines the individual's degree of sexually dimorphic traits. This was done separately for each population. To ensure that higher scores represented greater sex typicality, with men exhibiting a more masculine shape and women displaying a more feminine shape, the scores for women were multiplied by -1 to invert them.

Statistical analysis

We conducted a multilevel linear regression with facial attractiveness as the outcome and sex-typicality (measured as a perpendicular projection of facial shape on a vector connecting male and female mean shape, multiplied by -1 in females to convert geometric maleness/femaleness of facial shape into facial sex-typicality), asymmetry (Euclidean distance between original and mirrored landmark configuration), and distinctiveness (measured as a distance between facial shape and mean shape per sex per nation) as predictors. For the subsample of data where information on body height and BMI (body weight/squared body height) was available, the original model was compared with an extended model that contained these physical variables using WAIC (Widely Applicable Information Criterion) to assess the potential importance of these two additional variables.

We employed Bayesian inference to evaluate the joint posterior distribution of nested varying effects using rethinking R package (McElreath, 2020) with Stan's (Stan Development Team, 2018) MCMC (Markov Chain Monte Carlo) infrastructure. The model included potentially correlated varying intercepts and slopes at the national level, which allowed us to estimate both overall (labeled "hyperparameters" following the naming convention outlined in Statistical Rethinking) and population-level parameters. All intercept and slope hyperparameters were characterized by permissive unbiased priors.

The sex of the target entered the analysis as an index variable, in essence a "switch" (of value = 1 if the target is female and 2 if the target is male) that determined which of the two intercepts and which three (or five in the extended model) slopes were used to predict the average rating of a given target. Distributions of differences between sexes were calculated from these samples.

To illustrate models' predictions, counterfactual plots were obtained by linking simulated data with the sampled posterior distributions. See Supplementary material S2 for details on statistical analysis.

To demonstrate the robustness of our findings, we also evaluated two more models: (i) a further extension of the model with BMI and Height that included a direct effect of target age, and (ii) a model that treated individual attractiveness rating between one and seven as the unit of analysis (see Supplement S9 for details). The analysis was conducted using R version 4.0.1. The code and data can be found at https://github.com/costlysignalling/Distinctiveness.

Results

Distinctiveness rather than Asymmetry

The estimated posterior probability of regression parameters is displayed in Figure 1. The numerical summarization of the joint posterior distribution can be found in Supplement S4.

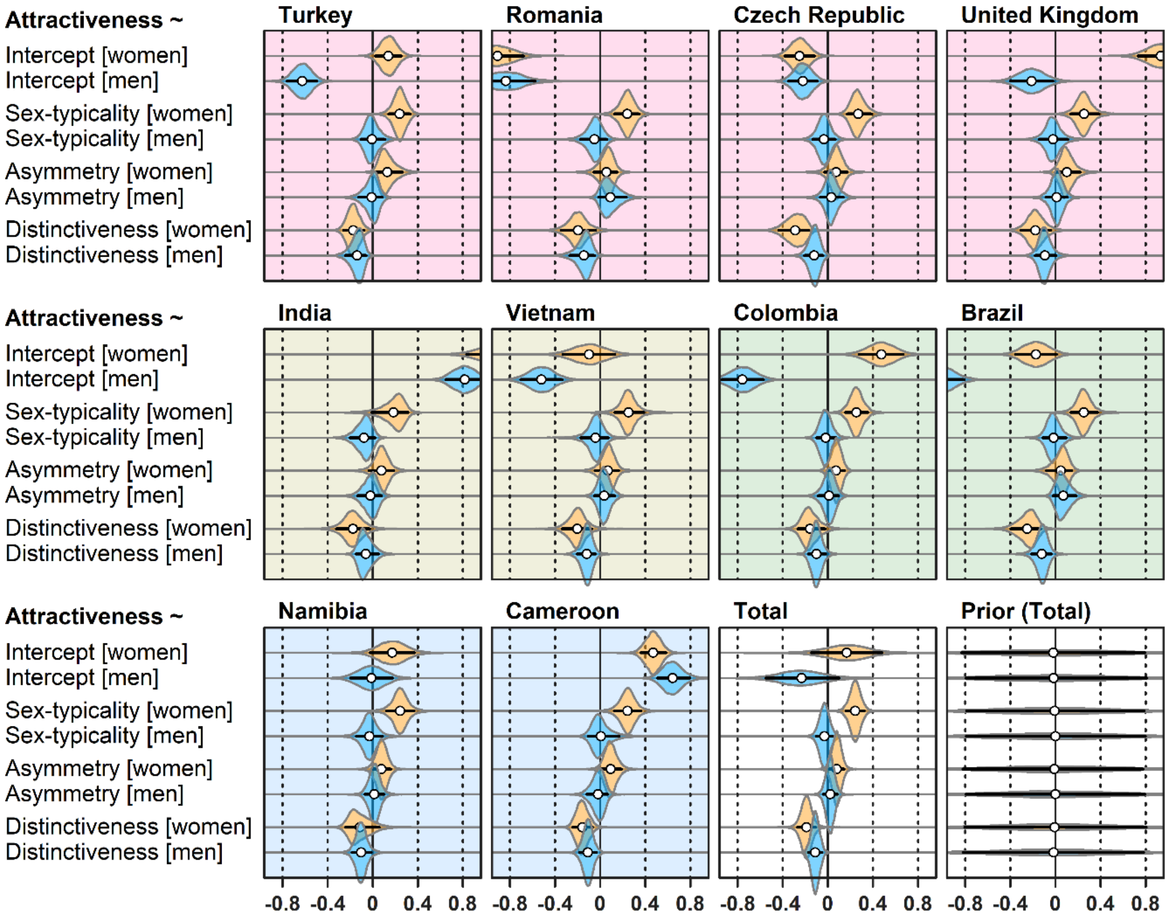

Figure 1. Posterior distribution of parameter values in the model predicting facial attractiveness from Sex-typicality, Asymmetry, and Distinctiveness. *Density diamonds outline distributions of plausible parameter values, white points mark means of these distributions, black lines span 89% percentile-based Compatibility Intervals. The panel of total estimates shows posterior distribution of means that characterize the multivariate normal distribution from which vectors of varying effects for population samples (background color indicates continent of data collection) are drawn.*

Distributions of distinctiveness slope estimates do not overlap zero, while the distributions of likely asymmetry slope values are centered near zero for men and at low positive numbers for women. This pattern suggests that distinctiveness—rather than asymmetry—drives the perceived attractiveness of the human face in both sexes. These two predictors are frequently correlated (in our sample, the correlation between asymmetry and distinctiveness was 0.29 in women and 0.27 in men, see correlograms in Figure 2); thus, if the multiple regression is not conducted properly, researchers might conclude that there is a negative causal relationship between asymmetry and attractiveness. Of course, asymmetry increases distinctiveness, but the direct causality from predictors to attractiveness is monopolized by distinctiveness (see counterfactual predictions in Figure 3). The raw correlation between attractiveness and asymmetry in our sample was near zero (Figure 2). For this reason, when both predictors enter the model, the relationship between asymmetry and attractiveness may appear weakly positive (as in women in our sample; but note that the effect is more likely to be relatively weak, see Table S5). This estimate refers to the effect of asymmetry when distinctiveness is held constant, similarly to how the distinctiveness slope reports the effect of distinctiveness when asymmetry is held constant. As we show in the Supplementary material S10, it is almost impossible to create an asymmetric face without making it distinctive, while the opposite is quite easy. Any adaptation of preferences that guards against mating with distinctive partners, also automatically guards against mating with asymmetric partners. Asymmetric faces may be rated as less attractive, not because of their asymmetry (Figure S11), but because they are more distinct (Figure 3).

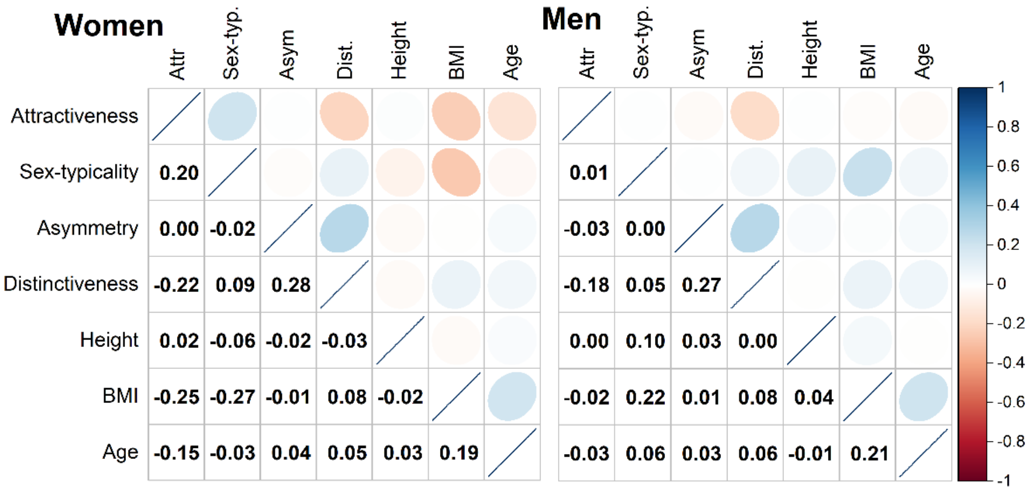

***Figure 2. Correlograms of morphometric/physical measurements and attractiveness**. All variables were standardized within each nation and sex before the analysis.*

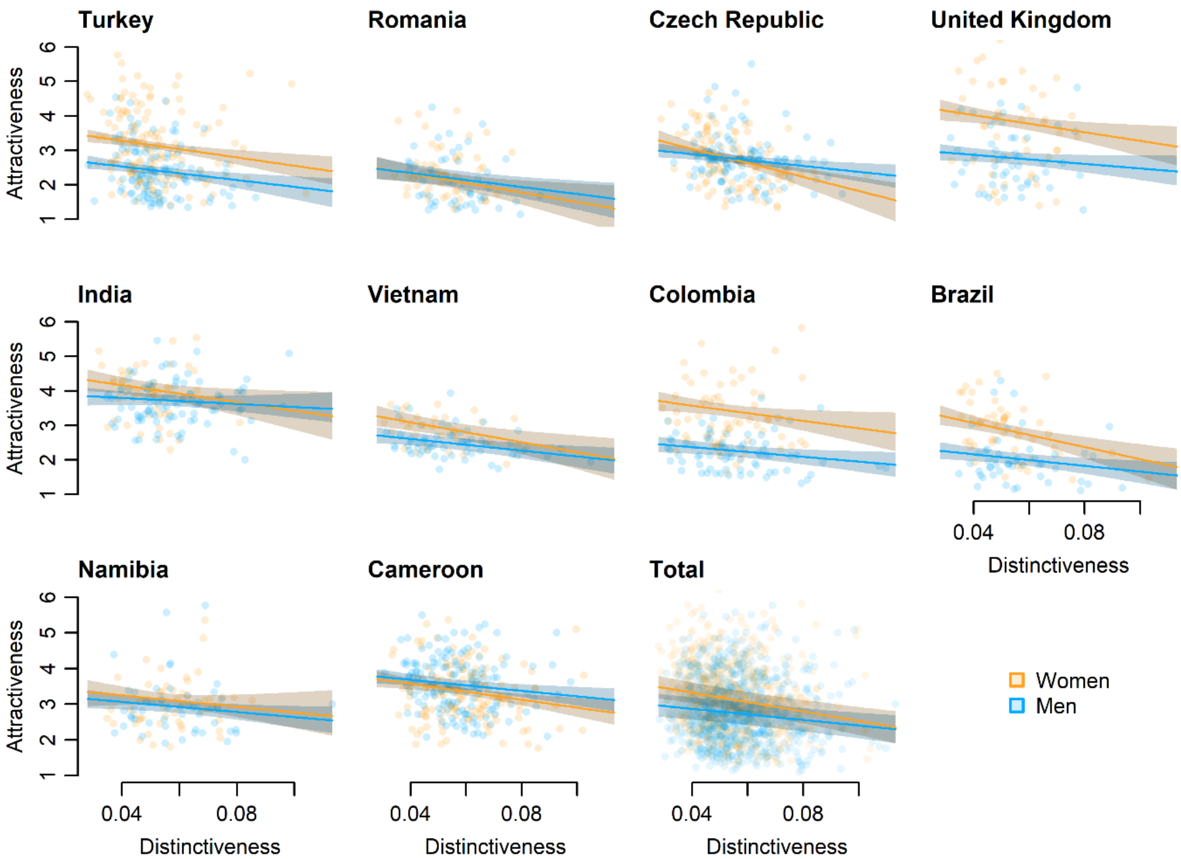

***Figure 3. Linear predictions with 89% compatibility corridors in the relationship between distinctiveness and attractiveness.** Dots represent raw data, the slopes are based on parameter estimates from multiple regression in Figure 1. The shaded corridors indicate 89% compatibility intervals. Predictions are based on a counterfactual situation, where Distinctiveness changes along the range of empirical values and all other independent variables are held at average (equivalent plots for other predictors can be found in Supplement S8).*

Sex-typicality is desirable only in female faces

Female faces with higher sex-typicality (femininity) were universally rated as more attractive ($\mathrm{bST_F} = 0.24\ [89\%\ \mathrm{CI}: 0.16, 0.32]$). However, attractiveness does not change with increasing masculinity in the faces of men ($\mathrm{bST_M} = -0.03\ [89\%\ \mathrm{CI}: -0.10, 0.05]$).), which is consistent with previous findings (Kleisner et al., 2021). The overall explained variance was 33% $[89\%\ \mathrm{CI}\ 29\%, 37\%]$ ($\mathrm{SD_{residuals}} = 0.82\ [89\%\ \mathrm{CI}\ 0.80{,}84]$).

Differences in intercepts are large and meaningful

Women were rated as more attractive than men in most samples (see intercept estimations in Figure 1). The difference was pronounced in South American samples, Turkey, and the United Kingdom. Interestingly, culture seems to have the capacity to influence how high or low ratings people grant to their conspecifics of the opposite sex (the standard deviation of female intercepts: $\mathrm{SD_{int\_F}} = 0.65\ [89\%\ \mathrm{CI}: 0.44, 0.96]$, SD of male intercepts: $\mathrm{SD_{int\_M}} = 0.69\ [89\%\ \mathrm{CI}: 0.46, 1.01]$), but does not strongly modify the effects of facial features on the differences in ratings (largest SD in varying effects, the SD of the female face Distinctiveness slope, was $\mathrm{SD_{bD\_F}} = 0.1\ [89\%\ \mathrm{CI}: 0.01{,}0.21]$); see Supplementary material S3 for a complete overview of the standard deviation of varying intercepts and slopes and correlations between varying effects across nations.

BMI also predicts facial attractiveness

The model with body height and BMI showed a better expected out-of-sample fit than the baseline model without these variables when fitted on the subsample of data where all measures were available (see Table 1). Nonetheless, we decided to report the model on the complete dataset in the main article because the inclusion of body height and BMI did not change any of the conclusions reported above. In fact, compared to the baseline model (without BMI and height), most parameter estimates—including varying intercepts and slopes—remain virtually unchanged in the extended model, fitted for comparison only on the restricted subsample of faces where body height and BMI were available (See Supplementary materials S5 and S6).

Lower BMI predicted higher facial attractiveness in women $\mathrm{bBMI_F} = -0.18\ [89\%\ \mathrm{CI}: -0.29, -0.08]$ except for women from the African samples. In men from Namibia, higher BMI predicted higher facial attractiveness ($\mathrm{bBMI_{M,NAM}} = 0.24\ [89\%\ \mathrm{CI}: 0.05, 0.44]$, see Supplementary material S6 and S7). The model with body height and BMI explained 42% of the variance in the restricted sample $[89\%\ \mathrm{CI}\ 38\%, 46\%]$.

Table 1. Model comparison on the subset of data where information on Body height and BMI was available

model	WAIC	SE	dWAIC	dSE	pWAIC	weight
mBMI	2573.53	54.24	0	NA	45.14	1
m1	2593.91	54.97	20.39	10.13	32.87	0

WAIC = Widely Applicable Information Criterion, SE = Standard Error of the WAIC estimation, dWAIC = distance from the best model, dSE = Standard Error of the distance estimation, pWAIC = penalty term

All findings hold when the direct effect of age is included in the model (Supplement S7), which means that no reported effect is due to covariance between (omitted) age and the investigated morphological variable. The total effect of age may be higher because it influences BMI. Age did not covary with any other variables in our sample, but one should not—without due caution—extend this conclusion to samples that span wider age ranges, (see the age homogeneity of most of our samples in Table S2). In samples with more age diversity, the attractiveness of female faces tended to decline with age, and some of this effect could not be reduced to the investigated morphological variables (Figure S7, Figure S14).

More variance between individuals than between population samples

All conclusions from the main model hold when individual attractiveness rating (1,2,3…, or 7) is treated as the unit of analysis instead of mean rating (Supplement S9). This model provides additional insight that ratings differ similarly between targets (SD_{target}=11.75 [89% CI: 10.14, 13.46]; note that the effects are on the scale of log-odds in ordered-logit link function, see Supplement S9 for details) and between raters (SD_{rater}=12.24 [89% CI: 10.57, 14.11]) within population samples. Variance of intercepts between samples is lower than both sources of individual variation ($SD_{int.women}$=6.72 [89% CI: 4.68, 9.28], $SD_{int.men}$=7.14 [89% CI: 4.99, 9.62])

Discussion

Using a large sample of facial portraits from ten different populations across the world, we investigated the effect of facial distinctiveness, sex-typicality, and symmetry on attractiveness assessment. In agreement with several recent studies (Jones & Jaeger, 2019; Kočnar et al., 2019; Phalane et al., 2017), we found that the importance of facial symmetry for human mate choice might have been previously exaggerated. Facial symmetry does not seem to be a crucial component of facial attractiveness (Hume & Montgomerie, 2001). On the other hand, facial distinctiveness, measured as the distance of a face from its population mean, had a negative effect on facial attractiveness in all tested samples. Sex-typicality showed mixed results, with a moderate preference for feminine facial shape in female faces but an absence of preference for any sex-specific facial traits in male faces (Puts, 2010). All three components of facial morphology showed relatively consistent associations with attractiveness ratings across all ten researched populations.

Questioning the fitness indicator bases of human facial morphology

From an adaptationist perspective, perceivers in a mate choice context are expected to prefer facial characteristics that provide cues to aspects of potential partner quality. For instance, more average (prototypical) faces may indicate heterozygosity, and more symmetrical faces higher developmental stability, and both averageness and symmetry should thus be preferred in mate choice (Thornhill & Gangestad, 1993). However, the empirical evidence on the associations between given facial characteristics and proposed quality remains controversial (Davis & Arnocky, 2022; Prum, 2010).

Nevertheless, facial preferences can also be influenced by some more general cognitive processes (Bartlett & Tanaka, 1998; Tanaka & Corneille, 2007; Trujillo et al., 2014). Similarly, other preferences might not be specific to mate choice and may work across different contexts and be shared by different species. For instance, both human infants and three-month-old rhesus macaques (*Macaca mulatta*) attended more to prototypical faces of infants of their own species, suggesting an ancient and shared preference for protypicality in primates (Damon et al., 2017). Thus, preferences may reflect an array of historical evolutionary events, involving various secondary co-options of traits that may or may not reflect present evolutionary benefits.

Why isn't facial symmetry more important?

There are several possibilities to explain why facial symmetry—directly measured from standardized, unmanipulated faces—has no effect on the perception of facial attractiveness. A first possibility is that people do not regard symmetrical features as crucial for mate choice as theoretically predicted. Only serious departures from bilateral symmetry might be penalized in mate choice, while the average levels of asymmetry within populations might not be strong enough to decrease facial attractiveness. A second possibility is that facial symmetry remains an important cue to fitness but is concealed by noisy (yet natural) facial variation that prevents us from detecting the effect. A possible solution would be to control for individual variation by using manipulated facial images to disentangle the causative effects in facial morphology. However, if this solution is successful, studies using manipulated faces should converge in their results, which is not always the case (Lee et al., 2021).

Moreover, some previous investigations based on manipulated faces confounded asymmetry with averageness. To avoid such confusion, Swaddle and Cuthill (1995) manipulated faces so that the level of symmetry was changed, but the mean size of facial features remained unaltered. When faces manipulated in this way were rated on attractiveness, the less symmetrical faces were perceived as more attractive. Asymmetry may thus contribute to overall facial attractiveness. Faces that are too symmetrical likely look unnatural and emotionless and therefore less attractive (Swaddle & Cuthill, 1995). This brings us to another problem of facial manipulations: we never know what level of manipulation is optimal to compromise the variation while at the same time keeping the stimuli ecologically valid. Over-manipulation may provoke perception in unnaturally excessive ways and cause overreaction to abnormal or supernormal stimuli (Tucciarelli et al., 2022).

Ultimately, human and non-human preferences for symmetric objects cannot be explained just by an evolutionarily shared, universal perceptual bias due to the computational ease of encoding and processing of symmetric information. If that were the case, both males and females of our species should possess the same encoding perceptual system. Although there is evidence that symmetry preferences can be extended to mate-irrelevant stimuli, it happens only in men (Shepherd & Bar, 2011).

Why prototypicality seems more important?

Like symmetry, prototypicality has been thought to be preferred due to its potential to signal a high level of genetic heterozygosity and the latter's benefits for immune function, parasite resistance, and overall health. While some studies of preferences for the faces of individuals with greater MHC heterozygosity brought supportive evidence (Roberts et al., 2005; Winternitz et al., 2017) other studies have failed to find any such connection (Coetzee et al., 2007; Thornhill et al., 2003). Either way, the assumption that facial averageness (not just attractiveness) is statistically associated with genetic heterozygosity, or any other genetic/developmental marker of biological quality, is mostly theory-driven (but see Lie et al., 2008). There is no reliable (i.e., repeatedly corroborated) empirical evidence of such a crucial link. In fact, the evidence often goes the other way around. For instance, Foo et al. (2017) reported a negative relationship between semen quality and facial averageness. Studies focused on testing the relationship between paternal age in birth (the putative predictor of mutation load) and children's facial averageness did not produce any conclusive results of such a relationship either (Lee et al., 2016; Klimek et al., 2022). Thus, the reason for the importance of prototypicality in facial judgments remains an open question.

Preference of BMI

A preference for facial adiposity is likely influenced by ecological and cultural factors, including the impact of environmental harshness (Batres et al., 2017), exposure to societal beauty standards through the media (Batres & Perrett, 2014), and the familiarity that individuals have with their own ethnicity (Batres et al., 2017; Coetzee et al., 2014). At the same time, people of various ethnic backgrounds converge in the ability to reliably estimate BMI from facial cues (de Jager et al., 2018).

Based on our results, a lower BMI, as reflected by facial appearance, was preferred in women across almost all populations, except for women of Namibian and Cameroonian origin. The preference for a larger body size in women within specific African communities has been consistently reported in previous studies (Coetzee et al., 2012; Coetzee & Perrett, 2011; Naigaga et al., 2018; Pradeilles et al., 2022). This effect is often interpreted as an evolutionary advantage linked to the frequent food shortages in the preindustrial era or as an adaptation to local survival and reproductive optima in harsher environments (Pradeilles et al., 2022; Tovée et al., 2006).

In the case of men, facial attractiveness was associated with higher BMI only in Namibian male faces (a similar trend was also present in Cameroonian men). In all the other populations outside Africa, BMI had either no effect on facial attractiveness or lower BMI tended to be preferred. In total, lower BMI tended to be preferred in women across most of the studied populations, but there was no effect, on average, on male facial attractiveness.

Limitations

Our study has several limitations. Although we managed to sample the majority of continents (i.e., Africa, America, Asia, and Europe), we did not sample Oceania or a more diverse set of countries in each continent. Conditions when taking the pictures for facial stimuli and collecting the attractiveness evaluations were not fully standardized among each country due to local infrastructure restrictions. We also did not collect perceived health evaluations so we cannot explore how symmetry, distinctiveness, and sex-typicality relate to this critical facet of individual quality. Future studies should try to overcome these limitations and expand this cross-cultural and multicomponent approach to facial attractiveness. Nonetheless, we hope to have offered a more global and ecologically valid approach to pin down the relative importance of each biologically based standard of facial attractiveness in humans.

Conclusions

Two main conclusions may be derived from our study. First, preferences for facial prototypicality, symmetry, and sex-typicality do not substantially vary across geographically and culturally diverse populations. Second, facial attractiveness is robustly predicted by only two shape characteristics. It is negatively associated with distinctiveness (the opposite of averageness) and positively with morphological femininity. Notably, and perhaps surprisingly, facial symmetry has no robust effect. Our results thus clearly show that facial prototypicality (population-specific distance from the mean) and female sex-typicality (morphological femininity) are universally preferred across the world. Previous research has provided evidence on possible adaptive roles of feminine traits in the faces of women, such as revealing underlying levels of steroid hormones and fertility (Law Smith et al., 2005; but see Puts et al., 2013); therefore, its universal preference is neither problematic nor surprising (e.g., Fiala et al., 2021; Fraccaro et al., 2010; Kleisner et al., 2017, 2021). However, the exact reasons why prototypical faces tend to be preferred across the world are less clear and remain to be discovered.

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