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# Facial Beauty and the Correlation of Associated Attributes: An Empirical Aesthetic Database Study

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**Background:** The pursuit of understanding facial beauty has been the subject of scientific interest since time immemorial. How beauty is associated with other perceived attributes that affect human interaction remains elusive. This article aims to explore how facial attractiveness correlates with health, happiness, femininity, and perceived age. We review the existing literature and report an empirical study using expert raters.

**Methods:** A peer-reviewed database of 2870 aesthetic female faces with a global ethnic distribution was created. Twenty-one raters were asked to score frontal images on the attributes of health, happiness, femininity, perceived age, and attractiveness, on a Likert scale of 0–100.

**Results:** Pearson correlation coefficients ("r") were calculated to correlate attributes, with multiple regression analyses and $P$ values calculated. Strong positive correlation was found between attractiveness and health ($r = 0.61$, $P < 0.05$), attractiveness and femininity ($r = 0.7$, $P < 0.05$), and health and femininity ($r = 0.57$, $P < 0.05$); medium positive correlation between health and happiness ($r = 0.31$, $P < 0.05$); and small positive correlation between happiness and femininity ($r = 0.21$, $P < 0.05$). A neutral relationship was observed between perceived age and happiness ($0.01$, $P = 0.75$), and medium negative correlation between perceived age and attractiveness ($-0.32$, $P < 0.05$), health ($-0.36$, $P < 0.05$), and femininity ($-0.31$, $P < 0.05$).

**Conclusions:** Our study illustrates a positive correlation between the positive attributes of health, happiness, femininity and attractiveness, with a negative correlation of all characteristics with increasing perceived age. This provides insight into the complexity of human interaction and provides a holistic view of attraction as being a gateway to the reflexive perception of other attributes. The implications encourage an aesthetic focus on facial reconstruction. *(Plast Reconstr Surg Glob Open 2024; 12:e5382; doi: 10.1097/GOX.0000000000005382; Published online 10 January 2024.)*

## INTRODUCTION

The pursuit of understanding and maximizing facial beauty has occupied the minds of humanity since time immemorial. The importance of this reflects a deeper insight into human interaction; the reflexive assumed perceptions of other associated attributes that color human interaction.[1] The intuitive aesthetic sense within us is a result of undetermined analyses and computation,[2] understanding how facial aesthetics relate to other attribute perceptions will help provide insight into the complexities of human interaction, and support the need for an aesthetic focus on facial reconstructive surgery, in symbiosis with function.

Attractiveness is amongst the first attributes we perceive and will be the anchor of this study. Humanity has attempted to give an objective morphological categorization of attractiveness, from Polykleitus in 400 BCE proposing that the ideal face length should be one-tenth the body height to the division of the face into equal vertical fifths and equal horizontal thirds in the ancient world.

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The most widely believed mathematical principle in facial beauty is that of phi, the golden ratio (1.618),[2] which is prevalent throughout the natural world, and found in masterpieces such as da Vinci's Mona Lisa. Using head height as an example, if the distance between the hairline and the nasal apex was 1.618 times the distance between the nasal apex and the menton, the head conforms to the golden ratio. However, studies attempting to manipulate these simple ratios have been unsuccessful, showing the most attractive ratios are not phi.[3–6]

The Marquardt phi mask is one such example, which applies phi to many facial dimensions.[7] The mask outlines specific proportions and dimensions for a set of facial features, and aims to define an aesthetically balanced and attractive face. For example, it suggests that the distance between the eyes should be 1.618 times the width of a single eye.

Although there may be subjective variations in what is deemed attractive, at population level there are undeniable trends in facial beauty preference, which are widely accepted in beauty competitions around the world. Psychological studies have shown that even across different racial and cultural backgrounds, strong agreement exists in facial beauty judgments.[3,5,6,8] Langlois et al have illustrated how even the gaze of young babies lingered statistically longer on faces deemed "beautiful" than those deemed "not beautiful," which was consistent for attractive faces across all races, genders, and age.[8] These findings lend credence to the assumption that facial attractiveness is not purely subjective, nor solely determined by nurture over nature, and that its recognition is likely present from birth.

The belief that a person's characteristics can be determined from their facial appearance is termed "physiognomy" and can be found in ancient Greece, Rome, and China.[9] To understand how attractiveness relates to first impressions and human interaction, we intend to explore the relationship between facial attractiveness and other attributes. Therefore, the objective of this study is to investigate potential correlations between facial attractiveness and attributes such as happiness, health, femininity, and perceived age, thus elucidating these correlations and discussing their importance in facial reconstruction.

## METHODS

A peer-reviewed database of aesthetic female individuals, with a global ethnic distribution was created using annual "top 100 most beautiful women" lists released by FHM magazine, for the past 20 years. These are peer-reviewed by an internal panel and voted on by members of the public. Miss Universe and Miss World are international competitions involving vigorous selection processes at national and international levels by panels of judges and public vote, of which a factor is physical beauty. For the past 15 years, lists of finalists were compiled.

Duplications were removed, leaving a total of 2870 individuals. An online search was performed to obtain

### Takeaways

**Question:** How does facial attractiveness correlate with social attributes such as health, happiness, femininity, and perceived age?

**Findings:** Positive correlations were found between attractiveness and health, attractiveness and femininity, and health and femininity. Negative correlations were found between all characteristics with increasing perceived age.

**Meaning:** This study provides insight into the complexity of human interaction, with attraction being a gateway to the reflexive perception of other attributes. The implications encourage an aesthetic focus on facial reconstructive surgery from purely function based, to both functional and aesthetic.

high-resolution photographs of each individual from the time period they were rated on these lists. Neutral poses in frontal, left oblique, right oblique, left lateral, and right lateral positions were downloaded. These images were screened for quality by five independent individuals to ensure quality.

Frontal images were then separated and used for this experiment. This was designed online using Gorilla SC software, where 21 raters viewed all 2870 images and rated them according to attractiveness, perceived age, health, femininity, and happiness using a sliding Likert scale of 0–100.

The 21 raters were all volunteers from University College London, and not aesthetic medicine or plastic surgery practitioners. Eleven of the raters were men, and the median age of raters was 20. They were randomly collated from university-wide advertisements and were the individuals who produced complete datasets for the 2870 face database. Rater training was given at an induction using a random sample of 10 faces, which were not included in the main face database. At induction, the process of rating images was explained, as were the attributes. As some faces in the database were those of celebrities, it is possible that raters recognized them, potentially influencing their rating.

Pearson correlation coefficients were used to assess the strength and direction of linear relationships between pairs of attributes. Multiple regression analyses were calculated to determine statistical significance of any identified correlations. All statistical analysis was conducted with the use of SPSS, version 27 (IBM, Armonk, N.Y.). For the experimental psychology aesthetic database evaluation, the median face score for each attribute was compared using correlation matrices and linear regression models to quantify relationships.

This project was reviewed and received ethical approval from the Department of Experimental Psychology at University College London, United Kingdom.

## RESULTS

Pearson correlation analyses were performed to quantify the relationship between the five variables, using
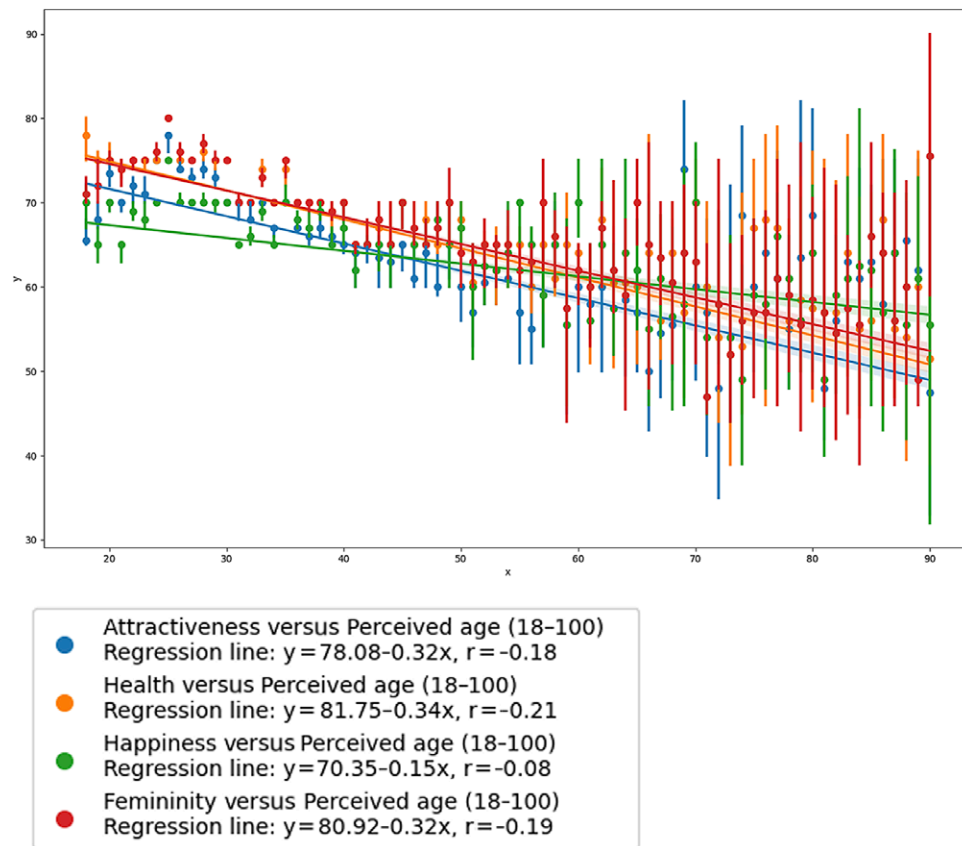
Fig. 1. Negative regression analyses between perceived age and attractiveness, health, happiness, and femininity.

median values from 21 raters. Figures 1 and 2 are plotted on the median rating for the 2870 faces, with vertical lines representing confidence intervals when plotting this spread of central tendency. They illustrate a positive correlation between all positive attributes, and a negative correlation with perceived age. The Pearson correlation "r" coefficients are depicted in Table 1.

Effect size was taken as a general statistical rule to be large if Pearson correlation coefficient was more than ±0.5, medium if more than ±0.3, and small if more than ±0.1. There was a large effect size due to a strongly positive correlation between attractiveness and health (0.61), attractiveness and femininity (0.7), and health and femininity (0.57). There was a medium effect size due to a medium positive correlation between health and happiness (0.31), and a small effect size due to a small positive correlation between happiness and femininity (0.21). There was a neutral relationship between perceived age and happiness (0.01). There was a medium effect size due to a medium negative correlation between perceived age and attractiveness (−0.32), health (−0.36) and femininity (−0.31).

To determine statistical significance of these correlations, the t statistic and *P* value were calculated on multiple regression results, with a *P* value less than 0.05 taken as statistically significant (Table 2). All attributes were found to be statistically significantly correlated to each other, aside from happiness to perceived age.

Descriptive statistics for the facial attributes are presented in Table 3.

## DISCUSSION

There was a statistically positive correlation seen between the positive attributes of health, happiness, attractiveness, and femininity, illustrating a common grouping of these perceptions. Increasing age is seen as a negative attribute, reflected in our study results; older looking faces were perceived to be less attractive, less feminine, and less healthy, than younger looking faces. (**See Supplemental Digital Content 1,** which displays findings of other literature discussed in this article. **http://links.lww.com/PRSGO/C845.**)

## FACIAL ATTRACTIVENESS AND FEMININITY

Our study showed a strong positive correlation between facial attractiveness and femininity (r = 0.71, *P* < 0.05), supported by a body of literature upholding the positive correlation between sexual facial dimorphism and facial attractiveness. Foo et al had participants rate photographs of men and women on various attributes, finding that femininity predicted facial attractiveness in women, and masculinity predicted facial attractiveness in men (sexual dimorphism predicted for facial attractiveness).[10]
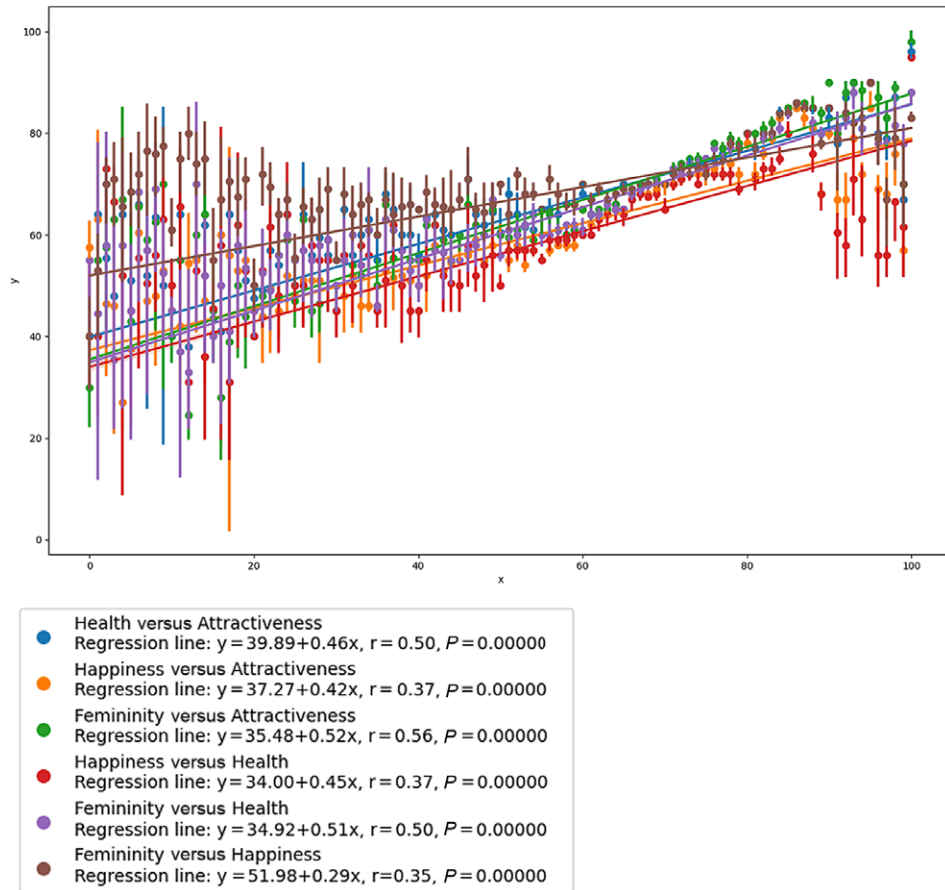
**Fig. 2.** Positive regression analyses between perceived attractiveness, health, happiness, and femininity.

**Table 1. Correlation Matrix between Five Variables Using Pearson Correlation Values**

| | Perceived Age | Attractiveness | Health | Happiness | Femininity |
|---|---|---|---|---|---|
| Perceived age | 1.00 | | | | |
| Attractiveness | −0.32 | 1.00 | | | |
| Health | −0.36 | 0.61 | 1.00 | | |
| Happiness | 0.01 | 0.14 | 0.31 | 1.00 | |
| Femininity | −0.31 | 0.70 | 0.57 | 0.21 | 1 |

**Table 2. $P$ Values for Statistical Correlation Strength between Attributes**

| | $P$ |
|---|---|
| Attractiveness—health | <0.05 |
| Attractiveness—happiness | <0.05 |
| Attractiveness—femininity | <0.05 |
| Attractiveness—perceived age | <0.05 |
| Health—happiness | <0.05 |
| Health—femininity | <0.05 |
| Health—perceived age | <0.05 |
| Happiness—femininity | <0.05 |
| Happiness—perceived age | 0.75 |
| Femininity—perceived age | <0.05 |

**Table 3. Descriptive Statistics Illustrating Means and SDs of the Facial Attributes on a Likert 0–100 Scale**

| | No. Faces | Mean | SD |
|---|---|---|---|
| Perceived age, y | 2870 | 31.27 | 4.20 |
| Attractiveness | 2870 | 67.95 | 5.40 |
| Health | 2870 | 70.99 | 4.16 |
| Happiness | 2870 | 65.61 | 6.78 |
| Femininity | 2870 | 71.00 | 4.77 |

Komori et al found the same statistically significant correlation,[11] with a similarly designed study by Rhodes et al[12] revealing the same correlations in women, though they found masculinity did not significantly correlate with facial attractiveness in men. Van Dongen found that masculinity was negatively correlated with facial attractiveness in women,[13] a result that backed up the earlier findings of Thornhill and Gangestad.[14] Hu et al found that high femininity scores were correlated with increased facial attractiveness in less attractive women, but not in the group that

scored highly for facial attractiveness.[15] It is not known if this finding was present in the other studies, as they did not stratify results by attractiveness score.

Buckingham et al took images of men and women and created masculinized and feminized versions of those images.[16] There was no statistically significant difference in the image chosen to be most attractive between the masculinized and feminized images, for either men or women. Their method (creating new, sexually dimorphic images) may be the reason their findings diverge from the literature.

## FACIAL ATTRACTIVENESS AND HEALTH

Studies have investigated how facial attractiveness interacts with physical health, both actual and perceived, supporting our results of a strong positive correlation (r = 0.61, $P < 0.05$). Voegeli et al rated images of female participants for various traits, finding that facial attractiveness positively correlated with improved perceived health.[17] Foo et al found that facial adiposity significantly negatively predicted facial attractiveness. However, in their study, facial adiposity was not correlated significantly with perceived health, suggesting there is more to whether a face looks healthy than simply adiposity.[10]

Żelaźniewicz et al ranked participants by facial attractiveness and then took blood samples for analysis, finding that facial attractiveness was significantly negatively correlated with serum triglyceride levels, but was not correlated with glucose metabolism, liver function, or inflammatory markers.[18]

Thornhill and Gangestad measured health by administering a self-report questionnaire,[14] which asked about recent infections and antibiotic use, a medical history, sexual history, and socioeconomic status. They did not find associations between facial attractiveness and any of the physical health measures they investigated. Hönekopp et al used fitness tests to measure physical fitness and found that facial attractiveness did indicate for physical fitness,[19] though this is not necessarily the same as physical health.

Cai et al used questionnaires to investigate the frequency of which participants experienced infections such as common colds or ear infections, and also analyzed salivary samples for secretory IgA.[20] They did not find any association between facial attractiveness and the health measures they tested for. Overall, attractiveness correlates strongly with perceived health, though particular quantifiable clinical measurements of "health" remain undetermined.

## FACIAL ATTRACTIVENESS AND PERCEIVED AGE

Our study illustrated a medium-scale, negative correlation (r = 0.31, $P < 0.05$) between facial attractiveness and perceived age. This is supported in the literature with Voegeli et al finding facial attractiveness to be negatively correlated to perceived age,[17] with Korthase and Trenholme backing up these findings.[21] Further, He et al found older faces were scored as less attractive than younger faces.[22]

## FEMININITY AND HEALTH

Our study found a strong positive correlation between femininity and health (r = 0.57, $P < 0.05$), supported by the literature. Foo et al[10] found femininity positively predicted for perceived health. This result was replicated by Rhodes et al.[23]

Thornhill and Gangestad[14] found that in women, facial masculinity significantly positively predicted the number of respiratory infections and the number of days unwell with respiratory infections. The cause of this association is unclear, but the assumption is that increased masculinity correlates negatively with health, with sexual dimorphism correlating to opposite attribute perceptions.

## FACIAL ATTRACTIVENESS, HAPPINESS, FEMININITY, AND TRUSTWORTHINESS

Our study found a positive correlation between attractiveness and happiness (r = 0.14, $P < 0.05$), consistent with the findings of Mathes and Kahn[24] that in female participants, physical attractiveness correlated strongly with increased happiness, increased self-esteem, and decreased neuroticism ($P < 0.05$).

Studies have investigated how different traits affect the trustworthiness rating of faces. Ma et al found that high attractiveness was correlated to high trustworthiness,[25] and Hu et al found no difference in trustworthiness of high femininity or low femininity faces.[15] The study by Buckingham et al using masculinized and feminized images found no significant difference in the images chosen to be most trustworthy, for either gender.[16] These illustrate the sometimes dichotomous nature of attribute perception for trustworthiness.

## WHAT IS BEAUTIFUL IS GOOD

The psychological determination of personal attributes is determined within 100 milliseconds of viewing a face,[26] which holds true for attractiveness, likeability, trustworthiness, competence, and aggressiveness. Additional time only increases confidence in these judgments. This follows the seminal article by Dion et al, which coined the phrase "what is beautiful is good" and demonstrated that more attractive people were expected to attain more prestigious occupations and be more competent spouses, with happier marriages, than unattractive people, correlating attractiveness with social desirability.[27] Lorenzo developed this idea, finding that perceivers' impressions of a target's attractiveness were positively related to the positivity and accuracy of impressions, implying that a beautiful face prompts closer inspection and deeper and more positive analysis, meaning physically attractive people are seen more positively and accurately.[28] The importance of the association between personality attributes and facial appearance ("physiognomy") has been of long interest, even being used by Lombroso, the father of criminal anthropology, as testimony in trials with the belief that criminals could be identified by physical characteristics.[8]

Understanding the association between facial appearance and the perception of associated characteristics

has implications for reconstructive surgery, the make-up industry, facial aesthetics, politics, subliminal messaging, and even our everyday interactions.

## FACIAL SURGERY AND ATTRIBUTE PERCEPTION

Facial reconstruction forms a significant portion of the workload for plastic and reconstructive surgeons. It is needed after congenital defects, cancers, and trauma. Multiple stages of tissue manipulations are often required with disfiguring intervening steps. The end-goal should be holistic, not merely functionally repairing defects, but also maximizing attractiveness to improve the perception of other attributes.

Plastic surgeons have shown how cosmetic facial interventions produce more positive perception of personality traits along with attractiveness.[29,30] In particular, attractiveness has been positively correlated with the perception of good health, and negatively with age, cross-culturally and universally.[9]

Othman et al looked at how dermal fillers improved attractiveness and certain perceived personality traits.[31] They found that fillers statistically significantly improved scores in every trait measured (including attractiveness), with the biggest improvements for nasolabial fold fillers being in happiness, youthfulness, facial symmetry and likeability, and the biggest improvements for lip fillers being in trustworthiness, likeability, and confidence.

Reilly et al[32] focused on invasive aesthetic surgery in women: in particular, face-lifts, upper blepharoplasties, lower blepharoplasties, eyebrow-lifts, neck-lifts, and chin implants. They found statistically significant increases in attractiveness, femininity, likeability, and perceived social skills. When stratifying results by procedure, they found only statistically significant increases in participants who had face-lifts and lower blepharoplasties in the above domains. There were no statistically significant differences found in the other individual procedures. Parsa et al used an analogous methodology to Reilly et al, but used male participants.[33] Their findings also illustrated statistically significant increases in attractiveness, likeability, trustworthiness, and sociability.

## EVOLUTIONARY BEAUTY PERCEPTION, FACIAL ATTRACTIVENESS, AND REPRODUCTIVE ACTIVITY

The concept of beauty perception relating to reproductive activity closely relates to the Darwinian theory of sexual selection,[34] centering around the idea that certain traits are considered attractive because they signal reproductive fitness. Facial attractiveness is an example of intersexual selection (where individuals choose a mate based on certain preferred traits). Traits such as symmetry, averageness, or clear skin have been found to transcend cultures, suggesting a biological basis for these preferences.[14] Evolutionary psychology offers insights into why these traits may be preferred. For example, symmetry may be considered attractive, as it can indicate a lack of developmental disruptions.[35] Similarly, blemishes or poor skin condition may suggest poor immune function or underlying health issues.[36] Thus, one must also consider the evolutionary basis, which influences our perception of attractiveness.

## LARGE DATA PROCESSING AND ARTIFICIAL INTELLIGENCE

The field of psychological attribute perception has been expanded by the introduction of data-driven computer modeling using principle component analysis. This is a data-reduction technique designed to reduce the dimensionality of datasets containing a large number of correlated variables, while preserving as much of the variance of the original data as possible.[37] The goal is to determine which facial features correlate to which perceptions. Models of social attributions rely on the statistical face space developed by Blanz and Vetter,[38] where faces are represented as points in a multidimensional face space derived from 3D scans of real faces. These data-driven models allow for experimental control of face stimuli and parametric manipulation as required.[8] Oosterhof and Todorov[9] have used PCA of trait judgments of faces to illustrate an orthogonal relationship between two traits: trustworthiness (valence) and dominance. They have been able to model extremes of these traits as physical models of human faces, and concluded that trustworthiness is sensitive to particular expressions reflecting approachability, and dominance is related to features signally physical strength. They conclude that face evaluation based on these models involves the "overgeneralization hypothesis" first put forward by Paul Secord (1958) that people use easily accessible facial information to make social attributions congruent with this information (ie, a smile means a nice person). Sutherland replicated this two-dimensional structure of social perceptions and found a novel, third dimension: youthfulness-attractiveness, needed to describe fully the structure of social perceptions from faces,[39] which is supported by our findings of younger age correlated with positive attributes.

Our study is limited by the fact that our database is derived from three aesthetic peer-reviewed sources, though this introduces some objectivity and consistent peer review, which is often difficult to obtain in this area of study. Our 21 reviewers were the maximum number of volunteers who were able to produce complete peer-reviewed datasets. A larger review including a variety of attractive faces would be the next step, though this introduces difficulties in rating faces in the middle order of attractiveness.

## CONCLUSIONS

Our study illustrates a positive correlation between the positive attributes of health, happiness, femininity, and attractiveness, with a negative correlation of all characteristics with increasing perceived age, when viewing frontal female images from an aesthetic face database. This provides insight into the complexity of human interaction and provides a holistic view of

attraction as being a gateway to the reflexive perception of other attributes. The implications are significant, and encourage an aesthetic focus on facial reconstructive surgery from purely function based, to both functional and aesthetic.

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## DISCLOSURE

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