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Facial attractiveness: Variation, adaptiveness and consequences of facial preferences

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ABSTRACT This review embraces the following topics: intra- and inter-populational variation of facial preferences, relationship between facial attractiveness and mate value, biological and social effects of the perception of facial attractiveness, credibility of the adaptive perspective on facial preferences, and the phylogeny of facial attractiveness. Its main conclusions are as follows: (1) Many sources of inter-individual variation in assessments of facial attractiveness have been identified, e.g., the age, sex, biological quality, physiological state, personality, and living situation of the judge, as well as previously observed faces, physical similarity of the focal face to the judge's face, and acquaintance with and knowledge of the face owner. (2) Inter-populational consistency in perception of facial attractiveness is substantial and possesses both a biological and a cultural basis. (3) Facial attractiveness is a reliable cue to biological quality of the face owner, e.g., better parasite resistance, physical fitness, reproductive fitness, longevity, less mutational load, higher intelligence and better mental health. (4) Facially attractive people have more sexual partners, marry at a younger age, and remain single less frequently. Thereby, they have higher reproductive success than unattractive individuals. (5) As a whole, research supports the thesis that facial preferences are adaptive, that is, they evolved during the course of biological evolution because they assisted an individual in choosing a mate with good genes or a good personality.

KEY WORDS: physical attractiveness, aesthetic preferences, human face, beauty

Although many facial features have been proven to enhance attractiveness (e.g., average proportions, skin smoothness *etc.*), there is obviously no perfect unanimity of the viewers in the assessment of facial beauty. Thus, one focus of this paper is the amount of individual preference in facial attractiveness perception as well as determinants of such individual preference. Human populations differ both morphologically and culturally, so inter-population similarities and differences in the perception of facial attractiveness is also involved.

Another focus is reasons for valuing some facial features and reasons for the

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context-dependence of attractiveness criteria. The traditional view is that cultural norms and fashion shape people's preferences. Another concept is that modes of sensory organ and nervous system functioning underpin patterns of facial preferences (the so-called perceptual bias). Yet, an adaptation-oriented explanation of facial preferences has recently become the most popular one. It posits that facial preferences are evolutionary adaptations, that is, they arose by natural selection. They direct their owner to individuals of high mate value and are therefore advantageous to him/her.[1]

The final focus of this paper is the consequences of perceiving facial attractiveness. The importance of attractiveness in various contexts in regard to reproductive success (e.g., popularity, formation of short- and long-term bonds, marriages, fertility) is discussed. In addition, well-known social consequences of attractiveness are presented as having a biological foundation.

Within-population variation of preferences

Consistency or diversity of preferences

It is a popular view that the perception of facial beauty is a matter of individually diversified taste rather than a universal mechanism. Half a century ago it was falsified by studies that proved a substantial inter-individual agreement in judging facial attractiveness (FacA) [ILIFFE 1960, UDRY 1965]. When a group of (n) judges assess attractiveness of a group of (k) faces, then the total variation of these ($n \times k$) judgments consists mainly of the following components:

1. Inter-judge agreement. For example, if face *A* is generally assessed as higher than face *B*, it reflects some agreement between the judges. Thus, inter-judge agreement results in variation of average assessments between faces (inter-face variation). Research has shown that most judges prefer faces characterized by geometrical averageness, symmetry, sexually dimorphic features, smooth skin and a positive expression [KOŚCIŃSKI 2007].

2. Inter-judge disagreement (inter-judge variation). This reflects the individual tastes of the judges. For example, judge *K* prefers face *A* to face *B*, and judge *M* prefers face *B* to face *A*.

3. Disagreement of a judge with himself (intra-judge variation). When a judge assess a group of faces again after some interval, the repeated judgments are not exactly the same as the original. This variation increases the total variation of assessments of FacA, but it cannot be regarded as an component of individual taste (the individual taste should be relatively constant in time).

Inter-judge agreement explains about 25% of total variation of attractiveness assessments [FEINGOLD 1992; STRZAŁKO and KASZYCKA 1988, 1992; JONES 1996; THORNHILL and GANGESTAD 1999*a*; HÖNEKOPP 2006]. Within the remaining 75% of variation, only 25% comes from variation in individual taste between judges, and as much as 50% is variation within judges [FAURE *et al*. 2002, MAPLE *et al*. 2005, HÖNEKOPP 2006, BRONSTAD and RUSSELL 2007].

Inter-judge agreement for attractive faces is as high as for unattractive ones [JONES 1996] and it is higher for assess-

[1] General patterns of facial preferences and theories of attractiveness are discussed in depth in KOŚCIŃSKI [2007].

ments of FacA from photos than from videos [DIENER *et al*. 1995]. The role of individual taste is greater when the group of judges is heterogeneous (e.g., ethnically) or the group of evaluated faces is homogeneous (e.g., beauty contest participants) [HÖNEKOPP 2006].

Inter- and intra-individual variations of preferences can partly be explained by the ambiguity of the term "attractive", and by the variation of the ecological, physiological and psychological conditions of judges (see below).

The meaning of attractiveness

It is important to discern attractiveness in the context of a short-term or long-term relationship. A short-term bond may lead to fertilization, but the ensuing child will be reared without the father. A long-term bond implies the possibility of both reproduction and common child-rearing. A short-term bond can bring a woman only indirect (genetic) benefits, and a long-term one – both direct (material) and indirect benefits. Therefore, women prefer highly masculinized male faces (which signal good genes but low readiness to invest) for a short- rather than to a long-term bond [JOHNSTON *et al*. 2001, LITTLE *et al*. 2002, BURT *et al*. 2007], but an opposite pattern occurs for faces with a positive expression [BURT *et al*. 2007, LUEVANO and ZEBROWITZ 2007]. Men display a stronger preference for highly feminized female faces (which give an impression of worse personality) in the short-bond context, but for smiling faces in the long-bond context [BURT *et al*. 2007].

It is noteworthy that mating interests may also be involved while assessing same-sex persons (leaving aside homosexuality): one can look at own-sex faces with the eyes of opposite-sex individuals – this is important for assessing how competitive own-sex people are in the mate market. However, assessments of FacA are sometimes undoubtedly unrelated to reproductive interest, e.g., when judging the face of a child or an old man. Regardless of the age of the face owner, from a biological point of view it is important how one's non-sexual interactions with that person will affect one's biological fitness (e.g., someone may help us and someone else may infect us). If some facial features signal health / intelligence / social status *etc.*, then it is reasonable to seek positive relations with people possessing such features, and these features, through natural selection, become attractive to observers [THORNHILL and GANGESTAD 1999*a*].

Examples of facial preferences underpinned by motives other than gaining a good partner (with good genes and/or good personality) are: (1) pregnant women especially strongly prefer faces with a healthy-looking skin so as to protect the fetus against infections [JONES *et al*. 2005*a*], (2) people with faces similar to the judge's face (thus suggesting kinship) are regarded as more attractive physically and socially (trustworthy), but less attractive sexually [DEBRUINE 2004*a*, 2005*a*,*b*]. Therefore, facial attractiveness may be conceived in various ways (erotic, marital, social) and this fact surely contributes to inter-judge variation in the assessment of FacA.

A specific kind of judging of FacA is the assessment of one's own face. A proper self-assessment of one's FacA allows one to locate oneself among other people of own sex and therefore to adopt an adequate mating strategy. However, women (especially those "objectively"

attractive) frequently overestimate their physical attractiveness [BREWER *et al*. 2007, DONAGHUE and SMITH 2008]. Women's self-assessment of attractiveness diminishes after watching beautiful female faces [CASH *et al*. 1983, WADE and ABETZ 1997, LITTLE and MANNION 2006]. Self-assessment of one's FacA is negatively correlated with neurotic perfectionism [DAVIS *et al*. 2001], and positively with life satisfaction and self-esteem [DIENER *et al*. 1995], narcissism [GABRIEL *et al*. 1994, BLESKE-RECHEK *et al*. 2008], sex drive [WELLING *et al*. 2008*a*], and the perceived importance of physical attractiveness [SWAMI *et al*. 2007]. Surprisingly, self-assessment of FacA is poorly correlated with FacA assessed by others ($r \approx 0.3$), both from photos and videos [RAND and HALL 1983, FEINGOLD 1988, 1992, DIENER *et al*. 1995, DAVIS *et al*. 2001, PENTON-VOAK *et al*. 2003, CLARK 2004, BREWER *et al*. 2007].

Characteristics of a judge

Age

Facial attractiveness is the most important for young adults (i.e., at an age of maximum reproductive ability and activity), and of little importance for old people [BUSS 1999]. The older a person is the older the faces they prefer, and the effect is more pronounced in female judges [BUSS 1999]. Children and the youth assess FacA similar to adults, except that adults are more consistent with one another than children [KISSLER and BAUML 2000, SAXTON *et al*. 2006]. COOPER *et al*. [2006] found that 4- and 9-year-old children preferred more childish faces (i.e., with a smaller lower part) than 12-years-old children and adults. In spite of a substantial similarity of tastes among people of different ages, people past their fifties are less consistent than younger people, and less consistent among themselves [ILIFFE 1960, UDRY 1965].

Sex

Facial attractiveness of a potential partner is more important for men than for women [BUSS 1989, FEINGOLD 1990]. One may find it surprising, because in a majority of animal species it is females, as the sex more investing in offspring, that are more choosy about mates than males [BUSS 1999]. Also, in humans females are the more fastidious, but the attractiveness of a candidate is not only physical, but also psychological (personality, intelligence) and social (resources, status). These non-physical aspects of male attractiveness signal his ability and willingness to invest in offspring – the traits that women appreciate in a potential partner very highly. For men, in turn, the most important trait of a woman is her physiological reproductive ability, and this is suggested by her youthful and healthy appearance. Indeed, fertility of a man is important for women, but this trait is not clearly visible in his face. Therefore, there is no contradiction between general attractiveness being valued more by women and physical attractiveness – by men [GOTTSCHALL 2007].

The attractiveness of a female face is regarded more highly than that of a male face, according to both males and females [RHODES *et al*. 1999, HUME and MONTGOMERIE 2001, O'DOHERTY *et al*. 2003, FISHER 2004]. Male faces are assessed more highly by men than women, and female faces are assessed equally highly by men and women [CROSS and

CROSS 1971, HUME and MONTGOMERIE 2001, FISHER 2004]. Men and women assess the attractiveness of particular faces very similarly [ILIFFE 1960, UDRY 1965, ZEBROWITZ *et al*. 1993]. Women prefer more feminized faces of both women and men than men do [RHODES *et al*. 2000].

Biological quality

The mate value of a person depends strongly on their biological quality, i.e., health, reproductive ability, mutational load *etc*. For every individual, it would be favorable to mate with a person of high biological quality, yet for a person of high biological quality, it is not favorable to mate with every willing individual. So, it does not pay for low-quality individuals to court a high-quality person, because their efforts will end in failure (plus costs such as wasting of time). Therefore it would be adaptive if person *A* considered the attractiveness of person *B* not only in terms of the mate value of person *B* for person *A*, but also in terms of the mate value of person *A* for person *B*. Hence, one can expect that facial cues to biological quality should be preferred especially strongly by high-quality individuals.

A strong preference for attractive, masculinized and symmetric male faces is displayed by women who have a high opinion of their own attractiveness [LITTLE *et al*. 2001, CORNWELL *et al*. 2006, LITTLE and MANNION 2006] as well as by women with "objectively" attractive faces or low (i.e., attractive) waist-to-hip ratio [PENTON-VOAK *et al*. 2003]. Healthy men and women prefer more pronounced sexual features in the opposite-sex face than their less healthy counterparts [SCOTT *et al*. 2008]. JONES *et al*. [2005*b*] found that women with a low waist-to-hip ratio or in good psychological condition show a relatively strong preference for healthy-looking male faces. WELLING *et al*. [2007] observed that people regarding themselves sensitive to infections displayed a stronger preference for healthy-looking faces (but not for those determinants of FacA which are relatively weakly connected to health, e.g., smile).

Physiological state

In a woman, the levels of estrogen and progesterone change with phase of the menstrual cycle. These hormones have various physiological effects and also act on the mind, hence the phase of the cycle may influence women's preference for male faces. The phase of the cycle is connected with the probability of fertilization and, thereby, with various adaptive interests in the sphere of interpersonal relationships. Therefore, there may exist an adaptive dependence of facial preference depending on the phase of the menstrual cycle.

In the fertile phase of the cycle (the periovulatory period) women display stronger preference for masculinized male faces than in the infertile phase [PENTON-VOAK *et al*. 1999*a*, PENTON-VOAK and PERRETT 2000, JOHNSTON *et al*. 2001, JONES *et al*. 2005*a*, SCARBROUGH and JOHNSTON 2005, LITTLE *et al*. 2008]. This effect characterizes women at age 14 to 50, is stronger in the context of a short-term bond than a long-term one, stronger in women being in a stable relationship, and is absent in women taking pills [PENTON-VOAK *et al*. 1999*a*, PENTON-VOAK and PERRETT

2000, JOHNSTON *et al*. 2001]. These results suggest that women possess an evolutionarily shaped proclivity to so called cryptic polyandry, that is, seeking a supplementary high-quality partner for reproductive purposes. Such a search in the infertile phase of the menstrual cycle would be maladaptive because of lack of benefits (no fertilization) and risk of loss (the reaction of the primary partner in the case of discovering the infidelity). In the fertile phase, women also prefer dark-complexioned men [FROST 1994], which is a kind of preference for masculinity as well.

Several studies were not able to demonstrate changes in preference for facial symmetry with phase of the menstrual cycle [KOEHLER *et al*. 2002, 2006, CARDENAS and HARRIS 2007, OINONEN and MAZMANIAN 2007]. However, LITTLE *et al*. [2007*c*] applied improved methods and found that preference for symmetry is stronger near ovulation, but only in women in stable bonds and only for attractiveness in the short-bond context. Facial symmetry signals genetic quality and, thus, the results strongly support the hypothesis about an innate proclivity to cryptic polyandry in women.

Interestingly, female preference for healthy-looking faces depends on the cycle phase which is the converse of that for the preference for masculinity – this preference being stronger in the luteal (i.e., infertile) phase than in the fertile one [JONES *et al*. 2005*a*,*c*]. This effect is stronger in the context of a short-term bond than a long-term bond, the preference for healthy-looking faces depends more strongly on the level of progesterone than on the probability of conception, and is especially prominent in pregnant women [JONES *et al*. 2005*a*,*c*]. Altogether, the results suggest that pregnant women possess an adaptive tendency to avoid erotic contact with a man who potentially could infect the fetus, and the menstrual fluctuation of the preference is a side effect of changes in the progesterone level [JONES *et al*. 2005*c*, 2008].

The female perception of male faces changes not only within a menstrual cycle but also between cycles. RONEY and SIMMONS [2008] found that among women in the same phase of their cycles, the strongest preference for faces of men with a high testosterone level was displayed by those with a high level of estrogen. This seems to be adaptive, because the estrogen level depends on the woman's energy balance and is very low during amenorrheic cycles. So, a low level of estrogen should motivate the woman to seek food or a man-caregiver rather than a man with good genes (which are signaled by a high testosterone level).

In men, the testosterone level fluctuates naturally, and a man's preference for female facial femininity is stronger when the testosterone level is higher [WELLING *et al*. 2008*b*].

Mental state, personality and cognitive efficiency

A relatively strong preference for masculinized male faces characterizes women with a strong sex drive [WELLING *et al*. 2008*a*] and women open to casual sex [WAYNFORTH *et al*. 2005, PROVOST *et al*. 2006, BURT *et al*. 2007]. In turn, men open to casual sex prefer more feminized female faces [BURT *et al*. 2007]. Men and women who highly appreciate assertiveness / extrovertism / emotional warmth in a potential partner, display a stronger preference for faces that appear to belong

to assertive / extroverted / warm persons [LITTLE *et al*. 2006*b*]. Highly anxious people strongly prefer faces with direct gaze (which is a cue to social interest) [CONWAY *et al*. 2008].

Men in a good mood prefer an attractive female face with a cold expression (maybe they believe that they could handle her coldness), and men in a bad mood prefer a less attractive face with a warm expression (maybe they seek mental rather than physical contact) [see CUNNINGHAM *et al*. 1995]. Men and women with experimentally induced anxiety or with a high level of chronic anxiety or stress prefer faces with small eyes. Small eyes signal maturity, maleness and power, and persons with those traits can give most aid [PETTIJOHN and TESSER 2005]. A moderate consumption of alcohol makes faces of the opposite (but not one's own) sex seem more attractive [JONES *et al*. 2003].

Profession does not influence the average assessment of female FacA, but people with a higher professional status are more consistent in their evaluation of FacA than people with a lower one [ILIFFE 1960, UDRY 1965]. Similarly, educational level does not affect the average assessment of female FacA, but people with higher education are also more consistent [UDRY 1965]. The professional status and educational level are indicators of general cognitive efficiency, so one can infer that the better the judges' cognitive ability is, the more consistent the judges are in evaluation of FacA.

Situational factors

Circumstances of the assessment of faces

Uncomfortable factors such as a high indoor temperature or a crowded room incline judges to give lower estimates of FacA [BYRNE and GRIFFITH 1973]. DEMATTÉ *et al*. [2007] found that the presence of unpleasant smells lowered female assessment of male faces, but nice smells did not increase it. Women assess the attractiveness of male faces higher when there is a subliminal amount of male pheromones in the room [THORNE *et al*. 2002].

Living situation

In comparison with people without a partner, those in a stable bond assess lower the FacA of young persons of the opposite sex (but not of their own sex or of older persons) [SIMPSON *et al*. 1990]. HESS *et al*. [2007] observed that women having sex with their partners more frequently (a measure of bond quality) gave lower assessments of the FacA of unfamiliar men. Thus, people in a stable bond, and a happy bond particularly, have smaller need to find a partner, so they are more choosy. Women having a partner prefer more masculinized male faces than women without a partner [LITTLE *et al*. 2002]. This effect is more pronounced in the fertile phase of the menstrual cycle [PENTON-VOAK *et al*. 1999*a*], which suggests a female proclivity to seek a lover with good genes in the period when fertilization is possible. When a person has access to a smaller number of opposite-sex partners, they perceive them as more attractive than in the case of access to a larger number of them [BUSS 1999]. In a harsh or uncertain living situation, the most attractive are faces signaling maturity, power and independence, i.e., having small eyes and a large chin [PETTIJOHN and TESSER 1999, PETTIJOHN and JUNGEBERG 2004, LITTLE *et al*. 2007*b*]. Finally, men and

women who had better relationships with opposite-sex parent in their childhood prefer, in adulthood, faces similar to the face of the parent [BERECZKEI *et al*. 2002, 2004; WISZEWSKA *et al*. 2007]. The specific features of faces of "good" parents are probably regarded as a cue to a good personality of a potential partner.

Physical similarity

Physical similarity suggests kinship, and mating with a relative entails genetic impairment of the offspring. One can thus predict that faces similar to one's own face will be perceived as unattractive. On the other hand, shaping own sexual preferences on the basis of the appearance of the opposite-sex parent prevents sex (and species) confusion. In turn, social propulsion toward a person with a similar face should be advantageous as long as the person is a relative (kin altruism may ensue).

Faces of partners are similar in regard to the majority of facial features [SPUHLER 1968, GRIFFITHS and KUNZ 1973, SUSANNE 1977, ZAJONC *et al*. 1987, HINSZ 1989, BERECZKEI *et al*. 2008]. It suggests a preference for faces similar to one's own. Faces made similar digitally to the face of the observer are perceived as more attractive socially (trustworthy) and physically, but less attractive sexually [PENTON-VOAK *et al*. 1999*b*, DEBRUINE 2002, 2004*a*, 2005*a*,*b*, BAILENSON *et al*. 2006]. ROBERTS *et al*. [2005*a*] found that women preferred faces of those men to whom they were similar in MHC genes. The phenomenon is stronger in the context of a long- than a short-term bond, which suggests seeking protection from relatives (MHC similarity as a cue to kinship).

Both men and women prefer children with faces that really are [PLATEK *et al*. 2002, 2003, 2004; DEBRUINE 2004*b*; BRESSAN *et al*. 2008] or seem to be [VOLK and QUINSEY 2002, 2007] similar to they own faces. Men are frequently uncertain of their paternity, so they "evolved" a mechanism of estimation of paternity probability on the basis of physical similarity, and of acting in accordance with that probability. While women are sure of their maternity, reacting to physical similarity is useful for them in the context of looking after a brother's children.

Many studies suggest that the preference for faces similar to one's own face is actually a preference for faces similar to the face of the opposite-sex parent: (1) A man's wife's face is more similar to his mother's face than to his own face [BERECZKEI *et al*. 2002]. (2) A person's partner's face is similar (both objectively and subjectively) to the person's opposite-sex parent, and not to the own-sex parent [BERECZKEI *et al*. 2008]. (3) In adopted women, the face of the partner is similar to the face of the adoptive father, but not to their own face or the face of the adoptive mother [BERECZKEI *et al*. 2004]. (4) Women prefer faces similar to their fathers' faces [WISZEWSKA *et al*. 2007]. (5) Children of mix-race parents usually have a partner of the race of the opposite-sex parent [JEDLICKA 1980]. (6) People prefer the color of hair or eyes of the opposite-sex parent [LITTLE *et al*. 2003].

The preference for faces similar only to the opposite-sex parent, and not the own-sex parent, refutes the hypothesis that the preference for similar faces is a form of kin altruism or that it is a plain preference for familiar-looking faces. Instead, the image of the desirable face is shaped selectively on the basis of the face of the opposite-sex parent, and only when rela-

tions with the parent are good (otherwise, the parental features in the face of a potential partner may be taken as a bad signal for the relationship with the candidate).

Previously seen faces

Several mechanisms underpin the influence of previously seen faces on later assessment of the attractiveness of those or other faces: the contrast effect, the exposure effect, and conditioning.

In the contrast effect, viewing attractive faces make subsequent faces seem less attractive [KENRICK and GUTIERRES 1980]. In the exposure effect: (1) repeated viewing a face makes the face seem more attractive and likeable [RHODES *et al*. 2005*a*], (2) viewing a group of faces sharing a feature (e.g., the level of masculinity, height-to-width facial proportion, the size of some parts) makes subsequently seen faces with this feature seem more attractive, more normal and typical [RHODES *et al*. 2003, LITTLE *et al*. 2005, BUCKINGHAM *et al*. 2006].

An experimentally induced exposure effect fades out in less than an hour. However, long and intensive exposure to particular faces, especially in childhood, may permanently affect a person's preferences. This mechanism may underpin the preference for faces typical of the population (the preference for average proportions) as well as the preference for similar faces. COOPER *et al*. [2006] found that 3-year-old children who had intensive contact with the faces of their peers (e.g., they attended a day-care center) preferred more childlike faces (i.e., with a small lower part) than the remaining peers.

When face viewing is accompanied by a valenced factor, the factor can give rise to classical conditioning – initially neutral faces become conditioned stimuli with the valence congruent with that of the accompanying factors. An association of some faces with a pleasant (or unpleasant) olfactory [TODRANK *et al*. 1995] or auditory [JONES *et al*. 2007*b*] stimulus makes the faces, or a composite face manufactured from those faces, more (or less) attractive than they were initially. It is possible that long-term natural conditioning produces an aversion to pale faces (due to their association with illness) and masculinized male faces (due to their association with harsh personality), and a preference for parental faces' features (or aversion to such features in the case of bad relations with parents).

Acquaintance with and knowledge of the face owner

In accordance with the exposure effect, the very acquaintance with a person is enough to judge their face higher [HUME and MONTGOMERIE 2001]. Yet, we like some of our acquaintances more than others, and some we do not like at all. KNIFFIN and WILSON [2004] noted that the level of liking of someone influenced the assessment of his face. People who declare good bonds and highly appreciate their partners, perceive their partners as more attractive than they really are. The opposite is true of people who are dissatisfied with their bonds or partners [PENTON-VOAK *et al*. 2007*b*].

A man seen in the company of a pretty woman is perceived as more attractive and endowed with many positive attributes [SIGALL and LANDY 1973, WAYNFORTH 2007]. Women assess the FacA of a man higher when other women smile at him [JONES *et al*. 2007*a*] or when they think that other women like his face [GRAZIANO *et al*. 1993]. The conviction

that a person is honest also makes their face appear more attractive [PAUNONEN 2006].

Universality of facial preferences

Between-population similarity of preferences

UDRY [1965] found a strong similarity in tastes between Americans and Britons. Since then many studies have proved the unanimity of facial preferences in Westernized populations, regardless of the ethnic affiliation of the judges (see the meta-analysis by LANGLOIS *et al*. [2000]).

The reason of the inter-populational agreement in the assessment of FacA may be that various populations share the same genetically determined preferences. In each population, it is adaptive to seek a partner who is young (especially women) and healthy. FORD and BEACH [1951] found that the preference for youthfulness and healthy-looking skin is universal, and in each culture facial attractiveness is more important for men than women. Symmetry is a cue to developmental stability, and the preference for symmetric faces was found in several non-Western cultures: in Russians [JONES 1996], the Japanese [RHODES *et al*. 2001], and Tanzanian Hadza [LITTLE *et al*. 2007*a*]. The way child faces differ from adult ones is universal and it is no wonder then that the male preference for such childlike traits such as large eyes and small chin in female faces is universal [CUNNINGHAM 1986, CUNNINGHAM *et al*. 1995, PERRETT *et al*. 1998].

An explanation of inter-populational similarity in facial preferences other than genetic is cultural, especially the propagation of Western attributes of beauty (mainly through the media). A method of testing this presumption is to compare the preferences of people from a population strongly exposed to Western culture with those of people from the same population relatively isolated from it. The dependence of the level of agreement with Western beauty attributes on the level of exposure to Western culture was found in Africans [MARTIN 1964], Koreans [LIM and GIDDON 1991] and Mexicans [MEJIA-MAIDL *et al*. 2005]. Africans [MARTIN 1964, NGUYEN *et al*. 1998] and Asians [MAGANZINI *et al*. 2000, CHOE *et al*. 2004, SOH *et al*. 2005] prefer those faces of their own group whose proportions are typical of Whites. Faces of black female models depart from typical black female proportions towards those of typical white females [SUTTER and TURLEY 1998]. Surprisingly, the most thorough and comprehensive study of this sort [CUNNINGHAM *et al*. 1995] found no influence of the level of exposure of Asians and Hispanics to Western culture on assessments of FacA of Whites, Blacks, Asians and Hispanics.

JONES [1996] examined Paraguayan Ache and Venezuelan Hiwi who had very limited contact with Whites and no contact with Western media. Their assessments of FacA correlated poorly with those by Americans, Russians and Brazilians (r = 0.14) and moderately with each other (r = 0.43), while the correlations among Americans, Russians and Brazilians were strong (r = 0.66). These results suggest that populations independent of Western culture perceive FacA quite differently from Europeans and Americans.

Inter-populational variation of preferences

If two populations live in different environments, natural selection may evolve a different face in each of them. Therefore, each population may have evolved preferences for a somewhat different face – the most ecologically optimal one for the given environment. Genetic determination of preferences may be: (1) rigid, e.g., in population *A*, the genes "say": "prefer faces of type *X*", and in population *B*, the genes "say": "prefer faces of type *Y*", and the populations have different genes; (2) conditional: both populations share the same genes, which "say": "in conditions *A*, prefer faces of type *X*, and in conditions *B*, prefer faces of type *Y*".

The preference for faces having proportions typical of one's own ethnic group was found in the Chinese, the Japanese [RHODES *et al*. 2001] and Blacks [MCKOY-WHITE *et al*. 2006, APICELLA *et al*. 2007]. This preference for average facial proportions is probably determined by genes that "say": "prefer faces with typical proportions"; this is thus an example of conditional preferences. In populations with high parasitic infestation, both sexes highly appreciate physical attractiveness and strongly prefer facial cues to health (sexual features, symmetry) [GANGESTAD and BUSS 1993, PENTON-VOAK *et al*. 2004, LITTLE *et al*. 2007*a*]. The phenomenon may be underpinned by either rigid or conditional genetic determination.

Changes of preferences in a population with time may have a definite and adaptive underpinning, and is not always a fashion for fashion's sake. Pettijohn and coworkers [PETTIJOHN and TESSER 1999, PETTIJOHN and JUNGEBERG 2004] proved that changes in the preference for size of eyes and chin were adaptively associated with the national socio-economic situation. BARBER [2001] found that in England in 1842-1971, the fashion for facial hair in men was determined by two factors: (1) a high percentage of single men at reproductive age (facial hair is a form of competition among men), (2) a low rate of illegitimacy (facial hair decreases perceived fidelity of a man, so in times of a high rate of infidelity, women prefer faithful-looking men, that is – clean shaven).

Are facial preferences innate?

It is difficult to comprehend but, as far as I know, there has not yet been a single study on the inheritance of facial (or bodily) preferences. Still, the results of several studies indirectly suggest a genetic contribution to facial preferences: (1) Some evidence for the inheritance of bodily preferences was presented for animals [JENNIONS and PETRIE 1997]. (2) Human facial preferences partly depend on openness to casual sex which is highly heritable [BAILEY *et al*. 2000]. (3) BRONSTAD and RUSSELL [2007] found that siblings had more similar facial preferences than unrelated individuals. (4) The study of LIPPA [2007] suggests that the importance of physical attractiveness is strongly determined genetically (whereas the importance of mental virtues depends mainly on cultural factors).

Some information about the innate character of facial preferences comes from studies of newborns and infants. Newborns prefer to gaze attractive (in the opinion of adults) faces as soon as two days after birth [SLATER *et al*. 1998, 2000*a*,*b*] and so facial preferences seem to be at least partly innate. Such prefer-

ential gazing was found in infants at various ages [LANGLOIS *et al*. 1987, 1991, VAN DUUREN *et al*. 2003]. It is not known what criteria are used by newborns and infants for selective gazing. Research suggests that infants produce a mental facial model (a so-called prototype) as a geometrical average from previously seen faces, and prefer faces similar to the model [WALTON and BOWER 1993, RUBENSTEIN *et al*. 1999, KELLY *et al*. 2005].

It is believed that the existence of facial preferences at such a young age is associated with the expectance of benefits (care) from other persons [LANGLOIS *et al*. 1987]. If facial attractiveness is a cue to health and social status, then attractive people can give more care to a child than unattractive people. Gazing at a person may stimulate them to provide care.

Facial attractiveness and mate value

Theoretical remarks

The above-mentioned results suggest the adaptive character of many patterns of facial preferences. The question that arises is whether facially attractive people are really distinguished by a high biological quality and a high mate value to an observer. It should be emphasized that a possible lack of association between FacA and biological quality does not mean nonadaptiveness of facial preferences. Ecological conditions in contemporary Western populations (in which almost all studies on FacA have been conducted) are completely different from those in which the preferences evolved (with a hunter-gatherer economy, low level of medicine and hygiene, short lifespan, the necessity of giving birth to many children *etc*.). The change of living conditions might upset the association between FacA and the mate value. That is why studies of contemporary hunter-gatherers are much required.

Many mechanisms could possibly produce a correlation of FacA with biological quality. Here they are listed for intelligence, which contributes to both the general quality of an individual and his mate value [see ZEBROWITZ *et al*. 2002, KANAZAWA and KOVAR 2004]. (1) Genetic pleiotropy: some genes affect biological quality and, consequently, facial symmetry and proportionality (thereby FacA) as well as brain development (thereby intelligence). (2) Mating selection: if men seek beautiful women and women seek intelligent men then the bilateral selection will produce a correlation between the wife's FacA and the husband's intelligence. Then, by the rules of heritability, a correlation between an individual's FacA and his intelligence will manifest in the next generation. (3) Environmental factors: good living conditions (due to e.g., high economic status of parents) facilitate proper development of both the face and intelligence. (4) Intelligence influences FacA: intelligent people, in comparison with less intelligent ones, may be more aware of the role of their health and attractiveness, take better care of themselves and have more money to do this. (5) FacA influences intelligence: attractive people are socially favored (see below) – among others, they are employed to better and possibly also to intelligence enhancing jobs. Note that regardless of the mechanism, the preference for facial attractiveness enhances the chances of finding an intelligent partner, but only the first two mechanisms (genetic) result in the preference leading to a partner with good genes for intelligence.

Different components of FacA may correlate with different components of mate value. One may expect that facial proportionality, symmetry and dimorphism correlate with an individual's genetic quality, skin appearance correlates with actual health, and facial expression correlates with personality. For these reasons, searching for relationships between components of the mate value and appropriate components of FacA may be more successful than between the general mate value and frank FacA.

Genetic and somatic aspects

Many somatic and mental genetic impairments are associated with decreased facial symmetry and proportionality [JONES 1996, THORNHILL and MØLLER 1997, RHODES 2006]. Heterozygosity for MHC genes improves resistance to parasites, and people heterozygous for MHC have more attractive and healthy-looking faces [ROBERTS *et al*. 2005*b*, LIE *et al*. 2008]. Women prefer faces of men similar to their own in MHC [ROBERTS *et al*. 2005*a*,*b*]. Genetic similarity indicates kinship, so the propulsion toward kin and an expectation of help from them may be involved here.

JEFFERSON [1996] lists the health problems ensuing from having a disproportional, thus unattractive, face. (1) Persons with a narrow face have the nasal airway obstructed and have to breathe through the mouth. (2) Persons with a short face have an improper distribution of tensions in temporomandibular joints, which impinge a nerve or a vessel and leads to migraine. (3) Persons with retrognathic mandibles tend to have a head-forward posture in order to restore patency of the trachea. It strains the spine and muscles and causes neck, shoulder and back pains. (4) A mandibular asymmetry decreases chewing efficiency, causes head bending, and consequently scoliosis.

Facial attractiveness is a reliable cue to longevity of men and women [HENDERSON and ANGLIN 2003], male physical strength [FINK *et al*. 2007, SHOUP and GALLUP 2008], female physical fitness [HÖNEKOPP *et al*. 2004] (but not necessarily male [HÖNEKOPP *et al*. 2007]), and male reproductive fitness (sperm motility and morphology) [SOLER *et al*. 2003, but see PETERS *et al*. 2008].

SHACKELFORD and LARSEN [1997, 1999] found that facial attractiveness and symmetry were associated with better cardiovascular health, less sleeping problems, rarer catarrh and migraine. The relationship between FacA and infections was studied repeatedly, but the correlations obtained were weak [HUME and MONTGOMERIE 2001, HÖNEKOPP *et al*. 2004, THORNHILL and GANGESTAD 2006, a meta-analysis: LANGLOIS *et al*. 2000] or none [KALICK *et al*. 1998]. Some research suggests that only a substantial departure of appearance from typicality indicates inferior biological quality, and the relatively low attractiveness of slightly atypical faces is a result of overgeneralization of aversion to very atypical faces [ZEBROWITZ *et al*. 2003, ZEBROWITZ and RHODES 2004].

Women who have a high level of estrogen in the fertile phase of the menstrual cycle or a high level of progesterone in the luteal (infertile) phase, have more attractive, feminine and healthy-looking faces [LAW SMITH *et al*. 2006]. High levels of estrogen and progesterone in specific phases of the cycle are associated with reproductive fitness [see LAW SMITH *et al*. 2006] and thus both are cues to biological quality.

In men, testosterone causes costly development of bones and muscles, forces permanent maintainance of their metabolism, inhibits the immune system [FOLSTAD and KARTER 1992, SELI and ARICI 2002, ROBERTS *et al*. 2004] and induces competitive behavior from other men [GANGESTAD and SCHEYD 2005]. For these reasons, only high-quality men can afford to keep a high level of testosterone. Men with a high testosterone level have more masculinized faces and are perceived as more manly [PENTON-VOAK and CHEN 2004, RONEY *et al*. 2006]. Women prefer faces of high-testosterone level men only in the context of short-term bond, that is when male biological quality is particularly important [RONEY *et al*. 2006].

Psychological aspect

The correlation between FacA and intelligence is positive though weak [meta-analyses: FEINGOLD 1992, JACKSON *et al*. 1995, LANGLOIS *et al*. 2000]. ZEBROWITZ and RHODES [2004] claim that the relationship exists only in the lower half of the FacA distribution. Mentally impaired persons appear relatively unattractive, and the more serious the diagnosis, the lower is their FacA [FARINA *et al*. 1977].

An ability to detect a pro-family personality in a potential partner is especially important for women. People can, with moderate accuracy, read from a face such traits as emotional warmth, honesty, aggressiveness [see BERRY and WERO 1993]. Male FacA is related to actual physical and social power, assertiveness, but not to aggressiveness [BERRY 1991]. Women can accurately judge the attitude of a man to children from his face, and the estimation affects the attractiveness of the male in the context of a long-, but not short-term, bond [RONEY *et al*. 2006, PENTON-VOAK *et al*. 2007*a*].

The chief personality dimensions (openness, conscientiousness, extroversion, agreeableness and emotional stability) can also be accurately perceived in faces (the highest accuracy is for extroversion) [BORKENAU and LIEBLER 1992, PENTON-VOAK *et al*. 2006, LITTLE and PERRETT 2007]. The faces of individuals with high (i.e., desirable) values of these traits are regarded as more attractive [PENTON-VOAK *et al*. 2006]. Of course, it is not true that each person desires the same personality in an ideal partner. For example, introverts may seek introverts rather than extroverts. Facial attractiveness is perceived according to the presence of reliable cues to traits that an observer desires [LITTLE *et al*. 2006*b*], which facilitates assortative mating with respect to personality.

Neurophysiological and behavioral reactions to facial attractiveness

The brain possesses areas specialized in face analysis. Face recognition occurs in the occipito-temporal cortex, mainly in the right hemisphere [TOVEE 1998]. The right hemisphere is also dominant in the perception of facial attractiveness [BURT and PERRETT 1997]. Many patients with prosopagnosia (i.e., an inability to recognize familiar or famous faces) perceive FacA as do healthy people, preferring facial symmetry, geometrical typicality and feminized female faces [SADR *et al*. 2004, LE GRAND *et al*. 2006].

Watching an attractive face, especially one from the opposite sex, activates neural structures associated with the reward system, making of evaluative statements,

emotional memory, and with attention [AHARON *et al*. 2001, O'DOHERTY *et al*. 2003, JACOBSEN *et al*. 2006, KRANZ and ISHAI 2006, WINSTON *et al*. 2007]. Watching attractive faces also alters brainwaves [JOHNSTON and OLIVER-RODRIGUEZ 1997, WERHEID *et al*. 2007]. The brain also reacts to unattractive faces, but in a way different to attractive ones.

The presentation of a face for a mere 13ms is enough for judges to differentiate attractive faces from unattractive ones (note that a stimulus of 13ms duration is subliminal) [OLSON and MARSHUETZ 2005]. The assessments of faces presented for 0.1sec are highly consistent with those made without any time limit [WILLIS and TODOROV 2006].

The image of an attractive face of the opposite sex triggers pleasure, arousal and submissiveness, and an attractive face of one's own sex worsens the mood [KENRICK *et al*. 1993, MEHRABIAN and BLUM 1997]. A subject displays a greater skin conductance response when presented (sub- or supraliminally) with an attractive rather than an unattractive face [MCDONALD *et al*. 2008]. When a woman watches an attractive male face, she unintentionally and invisibly to the naked eye tenses her zygomatic muscle (an initiation of a smile), and when she watches an attractive female face, her corrugator tenses (an initiation of the expression of a dissatisfaction) [HAZLETT and HOEHN-SARIC 2000].

Since watching attractive faces activates the neural reward system, it is no wonder people want to view such faces. Men, and to a lesser degree women, chase after the image of an attractive opposite-sex face (e.g., repeatedly press a keyboard key to keep it on the screen) [AHARON *et al*. 2001, LEVY *et al*. 2008]. Both men and women, when asked for evaluations of FacA, view an attractive face for much longer than an unattractive one [SHIMOJO *et al*. 2003, HÖNEKOPP 2006], and also a female face for longer than a male face [FISHER 2004] before they make a judgment.

After a short look at a photo of a group of faces, both men and women overestimate the percentage of female (but not male) attractive faces present in it [MANER *et al*. 2003]. This means that, for the first few seconds, an observer looks mainly at attractive faces. Even though women watch attractive male faces more than unattractive ones, they do not retain them better, and so they do not recognize them better and do not overestimate the percentage of male attractive faces in the photo. Men remember and recognize female attractive faces better than unattractive ones [MANER *et al*. 2003]. Female (but not male) attractive faces capture attention of men and women, that is, they find it difficult to gaze away from them to another object [MANER *et al*. 2007]. In both studies of Maner and coworkers, the obtained effects were more pronounced in individuals open to casual sex.

Consequences of being (un)attractive

Reproductive success

If attractive people are desired by individuals of the opposite sex, in the dating, sexual or marital contexts, and the desire translates into a successful bond (in erotic and psychological terms), then they will have higher reproductive success. Indeed, both male and female FacA strongly correlates with being desired for a date, sex, and marriage [CUNNINGHAM

1986, CUNNINGHAM *et al*. 1990]. After a blind-date, readiness for a next one depends solely on the interlocutor's physical attractiveness [WALSTER *et al*. 1966].

RHODES *et al*. [2005*b*] found that facially attractive men had had more short-term, but not long-term, bonds, and facially attractive women, conversely, had had more long-, but not short-term, bonds. From an evolutionary point of view, women's interest consists, generally, in building a stable bond, but for men it is better to gain as many short-term bonds as possible. Thus, an attractive face allows both men and women to achieve their respective aims. Female reproductive fitness, and consequently her FacA, decreases with age quite quickly, so it is important for women to marry and bear the first child at a young age. Again, the aim is easier to realize for attractive women – they have lower sexual initiation age [RHODES *et al*. 2005*b*], marry at a younger age and less frequently remain old maids [UDRY and ECKLAND 1984, KALICK *et al*. 1998].

Facially attractive men have good chances to get erotic access to a woman, and thereby to increase their reproductive success. Thus, they devote relatively more time to mating effort and less time to nepotistic effort than less attractive men do [WAYNFORTH 1999].

THORNHILL *et al*. [1995] found that women had more orgasms, and more simultaneous orgasms, when the partner was facially attractive. A female orgasm, and especially the simultaneous one, increases the probability of conception, so the above relation enhances the probability that a woman will be fertilized by a man with good genes (assuming that FacA signals genetic fitness). The effect also increases the reproductive success of an attractive man.

Facially unattractive young men and women are at a higher risk of remaining childless than attractive ones, but the number of offspring of married men and women is unrelated to their FacA [KALICK *et al*. 1998]. This suggests that the relationship between FacA and reproductive success is underpinned by sexual selection (attractive people are selected for a spouse or a lover), but not by natural selection (attractive people are not necessarily more fecund than unattractive ones). Men with more dominant-looking (thus masculinized) faces are promoted in the army more quickly, and the higher their rank, the greater number of their offspring (probably due to higher salaries) [MUELLER and MAZUR 1997]. Thus, the relationship of FacA with reproductive success is also underpinned by intra-sexual selection (the competition of same-sex individuals for access to other-sex individuals).

If facially attractive people are reproductively more successful, then their genes (including those influencing FacA) will spread over the population from generation to generation. In this way, over a long period, all genes lowering FacA would be eliminated from the population, and inter-individual variation of FacA would be of only environmental (not genetic) origin. Such a scenario, however, is fictional for two reasons: (1) Mutations originate repeatedly in each population and they usually have negative impact on FacA. (2) Some genes (e.g., MHC genes) are under a frequency-dependent selection. Parasites are not adjusted to biochemically atypical hosts, thus a rare allele in MHC locus would increase the host's resistance to parasites,

and consequently his attractiveness. But, when the allele has spread throughout the population, parasites will adjust to it, and it will cease to be profitable for hosts. For this reason, no MHC allele can be advantageous for ever [JONES 1996]. Therefore, sexual selection for an attractive face supports natural selection in the elimination of harmful mutations and in the battle against parasites.

FacA-related selection also occurs in children. Unattractive children are maltreated by their parents more frequently than attractive ones [MCCABE 1984]. HARRIS [2006] claims that the attractiveness-related killing of newborns is, or was until recently, common in all primitive populations, and suggests that this has contributed to the evolution of newborn faces, and indirectly also adult faces.

Assortative mating

It has been shown repeatedly that the correlation of FacAs between spouses is quite strong ($r \approx 0.5$) [LITTLE *et al*. 2006*a*, a meta-analysis: FEINGOLD 1988]. If both sexes are choosy, then such a correlation is predicted by mathematical models [JOHNSTONE 1997] and is intuitive: pairs composed of an attractive and an unattractive individual are formed only rarely because an attractive person is usually unwilling to bind with an unattractive one.

Between-partner similarity in FacA could easily arise if people were able to assess reliably not only the FacA of potential partners, but also their own FacA. However, as mentioned above, self- and other-assessments of FacA are weakly correlated ($r \approx 0.3$). Self-assessments of physical attractiveness by two partners in a bond also correlates poorly ($r = 0.29$) [BARELDS-DIJKSTRA and BARELDS 2008]. Nevertheless, a correlation between partners in FacA can arise on other grounds: attractive people are more popular so they can afford to be more choosy, and finally choose a relatively attractive partner.

FacA-related mate selection may have the following biological consequences:

1. It produces inter-partner similarity in some facial morphological features, e.g., those which are linearly associated with FacA in both sexes. For example, both sexes prefer large eyes in opposite-sex faces [CUNNINGHAM 1986, CUNNINGHAM *et al*. 1990] and, hence, both attractive persons in a pair will have, in general, large eyes, and both unattractive persons in a pair will have smaller eyes.

2. If FacA is a reliable cue to biological quality, then FacA-related mate selection will increase inter-marriage variation of the biological quality. This may increase inter-family variance of the number and quality of offspring. This, in turn, accelerates the evolution of FacA-determining traits (according to Fisher's fundamental theorem).

Social consequences

Because facial attractiveness is a cue to the general quality of an individual, one can predict that people would perceive facially attractive persons more favorably and treat them better than less attractive ones. Such a proclivity could be innate (evolutionarily shaped) or acquired (learnt). The mechanism of overgeneralization can produce a relationship between FacA and perceived virtues that is much stronger than the relationship between FacA and real virtues [ZEBROWITZ and RHODES 2004].

In accordance with predictions, observers attribute to attractive people such

desirable features as physical and mental health, intelligence, competence, sociability, assertiveness, erotic efficiency, occupational fulfillment, and happiness [DION *et al*. 1972, ETCOFF 1999, LANGLOIS *et al*. 2000]. Attractive newborns and infants are also perceived as cleverer and easier to rear [STEPHAN and LANGLOIS 1984, CASEY and RITTER 1996]. After DION *et al*. [1972], this phenomenon is called the "halo effect" and is believed to be underpinned by the stereotype "what is beautiful is good", but this is a simplification. More attractive people are more popular for the opposite-sex persons so they can afford to be more choosy. Hence, people with attractive faces are attributed some faults, such as egotism, vanity and conceit [EAGLY *et al*. 1991, FEINGOLD 1992].

A favorable perception of facially attractive people translates into their better treatment. People declare more willingness to help an attractive than an unattractive person in a photo [CUNNINGHAM 1986], and the declaration agrees with their behavior: many studies have proved that attractive people, in comparison with unattractive ones, get help and are asked for help more often, are treated honestly and trusted more, are punished more leniently, and are adulated. In real life they have more prestige, are more persuasive (in discussions, marketing and court trials), are employed to highly-paid jobs more readily, and promoted sooner [ARONSON 1999, ETCOFF 1999, HOSODA *et al*. 2003]. Infants prefer to play with a facially attractive person or with a doll with an attractive face [LANGLOIS *et al*. 1990]. On the other hand, adults treat attractive infants better than unattractive ones [LANGLOIS and DOWNS 1979, MCCABE 1984, LANGLOIS *et al*. 1995, VOLK and QUINSEY 2002].

LUXEN and VAN DE VIJVER [2006] found that the influence of a candidate's attractiveness on the employment decision depended on the expected intensity of occupational contacts between the recruiter and the candidate. When the expected contact is intense (e.g., work on the same project), men strongly prefer attractive women, and women discriminate against attractive female candidates. As is known, physical attractiveness is more important in women than in men and thus the results prove that some occupational behaviors derive from intersexual selection (the male preference for female physical attractiveness) and intrasexual competition (women compete with one another by means of their physical attractiveness).

Differential perception and treatment of people varying in FacA may start a self-fulfilling prophecy, which will make people change according to viewers' stereotypes. Specifically, differential treatment make attractive people become more self-assured and assertive [SNYDER *et al*. 1977] as well as socially more skilled [FEINGOLD 1992]. Differential treatment may be also at least partly responsible for the low self-esteem, unhappiness and low life satisfaction of unattractive people [MATHES and KAHN 1975, UMBERSON and HUGHES 1987, DIENER *et al*. 1995].

Sometimes undesirable stereotypes induce counteracting behaviors which lead to development of traits opposite to the expected ones. For example, babyfaced people are attributed a "babyish" personality, that is submissiveness, dependence, naivety, honesty and warmth. However, among adolescent boys, those who are

babyfaced are more assertive and hostile, and commit more offences [ZEBROWITZ *et al*. 1998*a*,*b*].

A common reaction to evaluating and treating people according to their physical attractiveness is taking care of one's own appearance. Physical attractiveness is more important in women than in men, so women take care of their appearance much more than men do. Women try hard to display femininity and youthfulness in their faces. Research has proved that women's efforts are indeed effective: makeup increases FacA, as well as perceived health and femininity, in the opinion of both men and women [CASH *et al*. 1989, MULHERN *et al*. 2003, LAW SMITH *et al*. 2006]. The most helpful for FacA is eye makeup, the next foundation, and then lipstick [MULHERN *et al*. 2003]. Invasive operations are governed by similar criteria as noninvasive ones (smoothing the skin, stressing sexual features *etc.*), but their possibilities are greater. Facial surgery improves FacA in about 80% of cases [BAKER and WOODS 2001], and the improvement is more apparent in people whose FacA before the operation was low [EDLER *et al*. 2006].

Adaptiveness and phylogeny of facial preferences

Adaptiveness of facial preferences

At present, facial preferences are commonly regarded as adaptations which have evolved in the course of biological evolution. This view is theoretically consistent and concordant with the theory of biological evolution, yet its empirical support is not fully satisfactory. Many predictions of the adaptive view of attractiveness have been corroborated empirically, but empirical tests of some other predictions are equivocal.

An example of strong evidence for the adaptive character of facial preferences is the condition-dependent female preference for the masculinization of male faces. The preference depends, among others, on the menstrual cycle phase, the type of a prospective bond (long- vs. short-term), being in a stable bond, and the character of these dependencies is, from an adaptive point of view, profitable for women. Besides, it is difficult to explain these relationships other than by the adaptive effects of natural selection. For example, is seems unlikely that oscillations of the preference with the cycle phase might result from a form of learning, since the oscillations are absent in women taking pills.

Other evidence for an adaptive character of facial preferences is: (1) intra-individual variation of preferences: e.g., in the fertile phase of the menstrual cycle, women prefer symmetric male faces, (2) inter-individual variation of preferences: e.g., physically attractive women prefer masculinized male faces more than less attractive women do, (3) inter-populational variation: e.g., physical attractiveness is more valued in heavy parasite-infested populations, (4) changes of preferences with time: e.g., the preference for signs of maturity in a face strengthens in harsher times, (5) the innateness of facial preference: the preferences for attractive faces exists already in two-day-old newborns.

The adaptive view of facial preferences is also supported by cross-region and cross-modality correlations of attractiveness and preferences. Specifically, men who have attractive faces, have also attractive body shapes [GANGESTAD *et al*.

1994, THORNHILL and GANGESTAD 1994, HÖNEKOPP *et al*. 2007, SHOUP and GALLUP 2008, but see PETERS *et al*. 2007], and voices [SAXTON *et al*. 2006, LANDER 2008]. Similarly, women who have attractive faces, have also attractive body shapes [THORNHILL and GRAMMER 1999, PENTON-VOAK *et al*. 2003, WEEDEN and SABINI 2005, BREWER *et al*. 2007, PETERS *et al*. 2007], and voices [ZUCKERMAN *et al*. 1995, COLLINS and MISSING 2003, FEINBERG *et al*. 2005, LANDER 2008]. Facially attractive men and women have a nicer and sexier smell [RIKOWSKI and GRAMMER 1999, THORNHILL and GANGESTAD 1999*b*, THORNHILL *et al*. 2003]. These correlations among attractiveness of face, body, voice and smell are presumably underpinned by sex hormones (estrogen in women and testosterone in men). In regards to correlated preferences, those people who prefer opposite-sex faces with strongly pronounced sexual features, also prefer the smell of opposite-sex pheromones [CORNWELL *et al*. 2004] and, in the case of women, low, masculine voices of men [FEINBERG *et al*. 2008].

On the other hand, the thesis that the preference for facial averageness is adaptive is supported only weakly. Two facts are militate against it: (1) The preference for averageness exists not only for faces, but also for many other categories, and even of the same strength as for faces. (2) The relationship between an individual's facial averageness and biological quality exists only for clearly disproportional faces, but not for faces slightly deviant from typicality.

Some facial preferences may possibly be underpinned by a perceptual bias. However, theoretical considerations show that a preference which is a perceptual bias exerts selective pressure on the preferred feature, and consequently produces a correlation between an individual's quality and the size of the feature. In this way perceptual biases become adaptations.

The role of culture in the development of facial preferences, in turn, seems to be smaller than scientists believed half a century ago, and than laymen believe presently. That is, inter-individual consistency in FacA assessments is substantial, and inter-individual variation can be partly explained in an adaptive fashion – by differences in their personalities and living conditions.

Note that the evolutionary origin of preferences and their development through individual experience (learning) are not necessarily contradictory, because the way experience affects preferences may be genetically determined and evolutionarily shaped. For example, the optimal pattern of preferences depends on ecological conditions, so a correct recognition of one's own ecological situation is helpful in the choice of a suitable partner. More generally speaking, evolutionary explanations (referring to the development of adaptations or perceptual biases through generations) should not be confused with ontogenetic ones (referring to physiological or cognitive processes occurring at the specimen level).

Remarks on the phylogeny of facial preferences

Female rhesus monkeys pay attention to the reddish faces of conspecific females (a signal of mating readiness) [GERALD *et al*. 2007] and to the reddish faces of conspecific males (a probable cue to their biological quality) [WAITT

et al. 2003]. In the fertile phase of their menstrual cycle, they are more interested in male faces than in the infertile phase [LACREUSE *et al*. 2007]. Both male and female rhesuses prefer symmetric faces of opposite-sex conspecifics [WAITT and LITTLE 2006]. It is known that goats, sheep and macaques use previously seen faces to produce separate mental prototypes of the conspecific female and male face [KENDRICK *et al*. 1998]. Their sex drive is directed to individuals with faces similar to the opposite-sex prototype, so this is a preference for facial averageness. Many primates groom, so one can believe that they are able to assess skin health in a potential partner. The loss of facial hair (already well advanced in monkeys) has made a skin-based assessment of biological quality easier and feasible from a distance. All these facts prove that the perception of a face in the mating context and some human criteria of facial attractiveness originated well before the appearance of the genus *Homo*.

Some other criteria developed only much later, in *Homo* or slightly earlier. Men prefer young and young-looking women because of a steep decrease in women's fecundity with age. Male chimpanzees, however, prefer older females to young ones [MULLER *et al*. 2006] for several reasons: (1) older females have a higher social status and more parental experience, (2) the fecundity of a female chimpanzee does not decrease with age, and they have no menopause, (3) chimpanzees do not form long-standing bonds, so a male is not interested in female life expectancy. The preference for young-looking females surely evolved after the development of two features: long-term bonds and menopause (probably 1-2m years ago, that is after the appearance of the genus *Homo*; PECCEI [2001]).

Presumably, male preference for young-looking females made the adult female face relatively similar to a child's face (neotenization). Note that facial differences between modern man and his Pleistocene ancestors correspond to differences between a woman and a man and between a child and an adult [MEYER and QUONG 1999]. The evolution of long-term bonds and monogamy has weakened the competition between men and, consequently, decreased facial and bodily sexual dimorphism. Canine dimorphism is pronounced in species characterized by a strong male-male rivalry (e.g., in the chimpanzee) [KREBS and DAVIES 1993] while in humans it disappeared. Nonetheless, there is still some facial dimorphism in humans in terms of both size and proportions. This is because male-male competition has by no means disappeared altogether and because the face should be a cue to the sex [see WESTON *et al*. 2004]. Another factor decreasing facial dimorphism could be female facial preferences – as parental care from the father became more and more important, in the course of evolution, women started to show ever stronger preference for men with a family-oriented personality, that is, men with less and less masculinized faces.

Facial hair is normally present only in men, only in the lower part of the face, and, most probably, is not an adaptation to the natural environment. Thus, the beard has surely evolved under sexual selection owing to the fact that it enhanced perceived maleness.

Conclusions

The review of the relevant literature leads to the following conclusions:

1. Inter-individual variation of facial attractiveness judgments is as great as the degree of inter-individual consistency. Moreover, two attractiveness assessments made by one individual at some interval differ substantially.

2. Many factors influence an individual's preference, e.g., the age, sex, biological quality, physiological state, personality, and living situation of the judge, as well as previously seen faces, physical similarity of the focal face to the judge's face, and the acquaintance with and knowledge of the face owner.

3. Inter-populational consistency in the perception of facial attractiveness is substantial and possesses both a biological and a cultural basis. Biological, because in each population smooth skin signals youthfulness, symmetry signals good genes, pronounced female lips signal a high level of estrogen, and thereby fecundity, *etc*. Cultural, because non-Western populations exposed to Western culture assimilate its beauty attributes.

4. Facial preferences are partly inborn because infants at various ages (even two days after their births) tend to look at faces regarded by adults as attractive. Heritability of facial preferences, however, is not known.

5. Facial attractiveness is a reliable cue to the owner's biological quality. Attractive people have, on average, better parasite resistance, physical fitness, reproductive fitness, longevity, less mutational load, higher intelligence and better mental health. Therefore their mate value is higher.

6. Neurological, physiological and behavioral reactions to faces suggest that the view of an attractive face of the opposite sex has a rewarding value, but the view of an attractive face of the same sex is rather unpleasant.

7. Facially attractive people are more popular for opposite-sex persons, have more sexual partners, marry at a younger age, and less frequently remain single. Thereby, they have higher reproductive success than unattractive ones.

8. Because facial attractiveness is a cue to the general quality of an individual, people favor facially attractive persons not only in contexts related to reproduction but also in many social contexts. Specifically, attractive persons are attributed many virtues (e.g., good health, intelligence, social competence) and are treated better than less attractive ones.

9. On the whole, research supports the thesis that facial preferences are adaptive, that is, they evolved during the course of biological evolution because they helped an individual to choose a mate with good genes or a good personality. However, perceptual bias and lifelong experience also contribute to an individual's preferences.

10. Preferences for symmetrical, geometrically average, and sex-typical faces with healthy-looking skin are probably inherited from primate ancestors. On the other hand, male preference for youthful-looking women, and a female reserve toward strongly masculinized male faces evolved presumably only in the genus *Homo*.

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Streszczenie

Takie kryteria atrakcyjności twarzy jak symetria, proporcjonalność, wyrazistość cech płciowych czy gładkość skóry opisują przeciętne preferencje w populacji, ale nie oznacza to, że wszyscy oceniają twarze tak samo i według tych samych kryteriów. Wewnątrzpopulacyjne zróżnicowanie gustu jest równie duże jak stopień zgodności sędziów w ocenie atrakcyjności twarzy. Co więcej, różnice pomiędzy dwoma ocenami atrakcyjności danej twarzy dokonanymi przez jedną osobę w jakimś odstępie czasu są również bardzo duże. Ocena atrakcyjności twarzy zależy od: 1) kontekstu, np. erotyczny, małżeński, społeczny; 2) właściwości biologicznych i psychicznych sędziego, np. wiek, płeć, jakość biologiczna, faza cyklu miesiączkowego, osobowość i stan psychiczny; 3) szeroko pojętych czynników ekologicznych, np. sytuacja życiowa, wygląd uprzednio oglądanych twarzy, podobieństwo ocenianej twarzy do twarzy sędziego, znajomość ocenianego.

Istnieje znaczna zgodność w ocenie atrakcyjności twarzy między sędziami z różnych populacji. Jej przyczynami są: (1) jednolity dla wszystkich populacji ludzkich związek cech twarzy z pożądanymi cechami, np. gładka skóra sygnalizuje młodość, symetria – dobre geny, a wydatne usta kobiet – wysoki poziom estrogenu, a zatem płodność; (2) nie-zachodnie populacje pod wpływem zachodnich mediów przejmują zachodni standard atrakcyjności. Niektóre międzypopulacyjne różnice w preferencjach dla twarzy mają biologiczne wyjaśnienie, np. w populacjach silnie zapasożyconych i ze słabą opieką medyczną przykłada się większą wagę do wyglądu partnera, a kobiety preferują silniej zmaskulinizowane twarze mężczyzn (oznaka dobrych genów) niż w populacjach o ogólnie lepszej kondycji zdrowotnej.

Przynajmniej niektóre kryteria oceny atrakcyjności twarzy są wrodzone, gdyż już kilkudniowe noworodki dłużej patrzą na te zdjęcia twarzy, które przez dorosłych są uważane za atrakcyjne. Odziedziczalność atrakcyjności twarzy jest wysoka, nie badano natomiast odziedziczalności preferencji dla twarzy. Atrakcyjność twarzy jest rzetelnym sygnałem jakości

osobnika, a zatem i jego wartości partnerskiej dla obserwatora. Niska atrakcyjność twarzy związana jest z występowaniem szkodliwych mutacji, niską heterozygotycznością (mniejszą stabilnością rozwoju i odpornością), niższą długością życia i sprawnością fizyczną, oraz z wyższym ryzykiem problemów związanych z reprodukcją). Widok atrakcyjnej twarzy jest dla mózgu bodźcem nagradzającym i powoduje aktywację układu nagrody. Wartość nagradzającą mają tylko atrakcyjne twarze płci przeciwnej. Prezentacja twarzy przez 100 ms wystarcza do rzetelnej oceny jej atrakcyjności, a odróżnienie twarzy atrakcyjnej od nieatrakcyjnej jest możliwe nawet przy prezentacji podprogowej (13ms).

Osobom o atrakcyjnych twarzach mimowolnie przypisuje się wiele pożądanych społecznie cech i niewiele cech negatywnych (próżność). Osoby te są generalnie lepiej traktowane niż osoby o mniej atrakcyjnych twarzach w rozmaitych sytuacjach prywatnych i zawodowych, przez znajomych i obcych. Jednak bycie atrakcyjnym ma też niepożądane następstwa (np. częstsze molestowanie seksualne, mniej przyjaciół swojej płci). To zróżnicowanie ocen i traktowania ma złożoną etiologię, na którą składają się mechanizmy biologiczne (np. nadmierna generalizacja) i społeczne (np. samospełniające się proroctwo). Konsekwencją tych faworyzujących i dyskryminujących postaw są zmiany osobowości ocenianych osób (uleganie stereotypom lub przeciwnie – ich kompensacja) oraz, głównie u kobiet, nieinwazyjne i inwazyjne modyfikacje twarzy podnoszące jej atrakcyjność.

Osoby o wysokiej atrakcyjności twarzy mają więcej partnerów seksualnych, w młodszym wieku biorą ślub i rzadziej pozostają samotne. Konsekwencją tych zależności jest wyższy sukces reprodukcyjny osób atrakcyjnych niż nieatrakcyjnych. Taka selekcja płciowa mogła odegrać pewną rolę w ewolucji ludzkiej twarzy. W przypadku niektórych kryteriów preferencji dla twarzy (np. stopień maskulinizacji) przekonująco wykazano ich adaptacyjny charakter, co oznacza, że kryteria te zostały ukształtowane w procesie ewolucji i są korzystne (z reprodukcyjnego punktu widzenia) dla osób stosujących je przy ocenie atrakcyjności twarzy. W odniesieniu do innych kryteriów postrzegania atrakcyjności twarzy (np. przeciętność proporcji) sprawą otwartą pozostaje czy mają one wartość przystosowawczą czy też są jedynie objawem tendencyjności percepcyjnej. Wydaje się, że czynniki kulturowe mają znacznie mniejszy wpływ na postrzeganie atrakcyjności twarzy niż się powszechnie uważa. Nawet to co wydaje się przypadkową modą często daje się wyjaśnić zmianą sytuacji ekologicznej danej populacji. Preferencje dla twarzy symetrycznych, o typowych proporcjach, widocznych cechach płciowych i zdrowo wyglądającej skórze rodzaj ludzki przypuszczalnie odziedziczył po swych małpich przodkach. Natomiast preferencja mężczyzn dla bardzo młodo wyglądających kobiet oraz rezerwa kobiet w stosunku do mężczyzn o silnie zmaskulinizowanych twarzach to najprawdopodobniej już ludzkie nabytki ewolucyjne.