

HAIRSTYLE AS AN ADAPTIVE MEANS OF DISPLAYING PHENOTYPIC QUALITY

Norbert Mesko and Tamas Bereczkei
University of Pécs

Although facial features that are considered beautiful have been investigated across cultures using the framework of sexual selection theory, the effects of head hair on esthetic evaluations have rarely been examined from an evolutionary perspective. In the present study the effects of six hairstyles (short, medium-length, long, disheveled, knot [hair bun], unkempt) on female facial attractiveness were examined in four dimensions (femininity, youth, health, sexiness) relative to faces without visible head hair ("basic face"). Three evolutionary hypotheses were tested (covering hypothesis, healthy mate theory, and good genes model); only the good genes model was supported by our data. According to this theory, individuals who can afford the high costs of long hair are those who have good phenotypic and genetic quality. In accordance with this hypothesis, we found that only long and medium-length hair had a significant positive effect on ratings of women's attractiveness; the other hairstyles did not influence the evaluation of their physical beauty. Furthermore, these two hairstyles caused a much larger change in the dimension of health than in the rest of the dimensions. Finally, male raters considered the longer-haired female subjects' health status better, especially if the subjects were less attractive women. The possible relationships between facial attractiveness and hair are discussed, and alternative explanations are presented.

KEY WORDS: Facial attractiveness; Good genes model; Hairstyles; Mate choice

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Address all correspondence to Tamas Bereczkei, Department of Psychology, Janus Pannonius University, 6 Ifjúság Street, Pécs, H-7624, Hungary. Email: btamas@btk.pte.hu

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FACIAL ATTRACTIVENESS AND HAIRDRESSING

The widespread view in the social sciences that physical beauty is arbitrary has been seriously questioned recently by evolutionary psychology (Gangestad and Simpson 2000). Human beings have been selected to be able to evaluate cues associated with the reproductive value of a potential mate (Buss and Schmitt 1993; Langlois et al. 2000; Symons 1979). For females, age has a relatively invariant association with fertility and thus with their mate value. Since their fecundity sharply declines with age, body traits indicating their youth are preferred by males (Bereczkei et al. 1997; Buunk et al. 2001; Kenrick and Keefe 1992). A youthful or neotenus face is characterized by certain facial proportions, especially a thinner jaw, small nose, large eyes, and large, full lips. Raters found feminized female faces the most attractive, whereas masculinization—enlarged jaw, lateral growth of cheekbones, and lengthening of lower facial bones—decreased attractiveness (Johnston et al. 2001; Perrett et al. 1994, 1998). Several studies of various populations have revealed that male raters find faces that appear younger than their actual age to be more attractive (Cunningham et al. 1995; Jones 1995). According to the sensory bias theory of sexual selection, neoteny is a supernormal cue of youth. During evolution individual females whose faces exhibit exaggerated cues of youth have an advantage in female-female competition for desirable mates (Jones 1996). Men's preference for facial markers of high, age-related fecundity was a sensory bias that selected for neoteny in female faces (Miller 1998).

Other researchers suggest that attractive facial traits are not so much exaggerated cues of age as indicators of actual phenotypic and genetic quality (Fink and Penton-Voak 2002; Thornhill and Gangestad 1993, 1999). These features—high cheekbones, full lips, small chin—are considered to be hormone markers that show a relatively high ratio of estrogen to testosterone. Although a high level of estrogen is associated with fertility, it could also imply harmful effects given that estrogen can draw resources away from other bodily functions (e.g., immune system, repair mechanisms), and its byproducts are toxic. Therefore, estrogen markers on the face may reliably signal that a female's immune system is so high-quality that it can deal with the detrimental effects of high estrogen levels (Gangestad 2000; Grammer and Thornhill 1994; Thornhill and Grammer 1999). According to the Zahavi principle, only people with good genes are able to pay the costs of displaying such traits. Female facial attractiveness thus advertises the high immunocompetence of the bearer, and it evolved because of male preference for healthy and fertile mates. Indeed, several recent studies have revealed that the most attractive female faces

have extreme secondary sex traits, and their bearers' health condition is above average (Hume and Montgomerie 2001; Kalick et al. 1998; Shackelford and Larsen 1999).

Although facial traits that are judged beautiful across cultures have been investigated using a framework of sexual selection theory, the effects of head hair on our esthetic evaluations have rarely been examined from an evolutionary perspective. Yet, hair plays a significant role in our mate choice (Kingsley 1995). One of the first characteristics we notice upon meeting another person is their hair. In an experiment in which the same women were portrayed either as blondes or as brunettes, blondes were rated as more attractive, feminine, emotional, and pleasure seeking, whereas brunettes were seen as more intelligent (Cunningham et al. 1997). The authors suggest that blondness serves as a cue to neoteny. Another study has revealed that younger women tend to wear their hair longer than older women, and that hair quality was correlated with women's health (Hinsz et al. 2001). Grammer and colleagues (2001) found that males prefer long hair in women and speculated that longer hair may provide a larger surface for the distribution of sexual pheromones produced in the apocrine glands. Several studies found that males with scalp hair were rated as more handsome, strong, active, and sharp than those who were balding. Baldness among males led to decreased perceptions of socially desirable traits, including attractiveness and assertiveness (Muscarella and Cunningham 1996). At the same time, a receding hairline may convey a message of maturity and social dominance, and baldness is consistently associated with an increased perception of age and intelligence.

This study focuses on the effect of female hairstyle on attractiveness. Unlike the morphological features on the human face, head hair can be easily, even profoundly, modified. Females as well as males frequently use various hairstyles to alter their appearance and increase their physical attractiveness in the eyes of potential partners. Although a wide range of diversity exists, certain universal characteristics of hair styling are more likely to correspond with a high mate value than others. In accordance with sexual selection theory, it is probable that a particular bulk, length, and structure of head hair signals the bearer's good health. It is also likely that hair has an indirect effect on attractiveness by ensuring an advantageous framework or background for the expression of facial traits.

To investigate the above assumptions, we set up three hypotheses from which several particular predictions could be inferred.

THEORIES AND PREDICTIONS

The Covering Hypothesis

Head hair may function to accentuate and/or hide certain facial features. Since exaggerated sex-typical traits are generally attractive in female faces, women are expected to use any accessible means to increase their "natural" attractiveness. In particular, we expect that short hair reveals desirable neotenous features by disclosing the face's advantageous features and ensuring that hormonal markers are exposed. On the other hand, long hair can conceal unattractive features. In addition, a bun on the top of the head (a knot of hair) may enhance the size of the forehead relative to face height, which can also stress the neotenous features of a female face. The image of high brow/face rate, peculiar to juvenile face composition, may indicate the girls' young age. Using these hairstyles women will be able to shift their facial attractiveness into a more desirable category for a potential partner.

Prediction 1. Short hairstyle will increase the attractiveness of women whose facial traits are judged highly feminine and sexy by men.

Prediction 2. Long hairstyles are expected to increase the attractiveness of women who possess less feminine and more masculine (testosterone-dependent) traits, such as a larger jaw and more prominent cheekbones.

Prediction 3. A bun on the top of the head may enhance female attractiveness by accentuating neotenous facial traits.

Healthy Mate Theory

The healthy mate theory states that certain traits inform others of an individual's actual pathogen load. Potential mates use that information to choose an individual to court who is less likely to transmit external parasites (lice, mites, fleas, etc.) which could harm them or their future offspring (Alcock 1998). Individuals free of infections can develop extreme ornaments and an elaborate display. In male turkeys, for example, the larger the beak ornament (called the snood), the lower the actual load of a certain protozoan parasite. As a consequence, females prefer males with larger snoods. Anthropologists report that among all peoples good complexion, cleanliness, sound teeth, firm muscle tone, and luxurious hair are considered attractive (Cunningham et al. 1995; Ford and Beach 1951). These cues are likely to signal an absence of pathogens. Given that human head hair is susceptible to various external parasites, individuals are very sensitive to abnormally appearing hair, which can signal the immediate risk of being infected.

Prediction 4. Unkempt, disordered, or disheveled hair will decrease female facial attractiveness because it signals the *actual* load of pathogens.

Good Genes Model

Good genes theory states that attractiveness is meaningful in human interactions because it advertises health and genetic quality, such as heterozygosity and immunocompetence. The benefit from mating with a healthy partner lies in the acquisition of viability-promoting genes that advance the survival chances of their offspring, usually by conferring hereditary resistance to parasite infections, toxins, or diseases. A number of recent studies (Grammer et al. 2003; Johnston et al. 2001; Thornhill and Grammer 1999) have revealed that attractive facial features, such as symmetry, averageness, prominent sex-hormone markers are costly display traits that honestly signal good physical condition.

In accordance with the handicap principle, in order to signal physical condition, scalp hair must be costly in terms of metabolism and time allocated for its care. Several studies have investigated the possible energetic costs of head hair (Dawber et al. 1998; Ebling et al. 1986). In its ontogenetic development hair may be very expensive in terms of metabolic expenditure. There are about 100,000 follicles in the scalp, and their life span is about 1,000 days. Consequently, about 100 hairs are lost every day, and the average recovery of shed hair is similarly high (although usually less than 100). The relevant studies suggest that scalp hair grows the quickest relative to the hair on other parts of the body. The rate of hair growth on the scalp is about 0.5 mm per 24h, whereas the rate of growth is 0.03 mm/h for vellus on the male forehead and 0.21 mm/h on the female thigh (Pelfini et al. 1969). Studies with ¹⁴C-labeled glucose indicate that hair follicles utilize a similar metabolic system as many other tissues and organs. They have a faster glycolytic rate, a slower respiration rate, and considerably higher pentose cycle activity than muscle tissues. Furthermore, the energy consumption of the active and resting follicles is very different. In active hair follicles, glucose utilization is increased by 200%, glycolysis by 200%, activity of pentose cycle by 800%, etc. In fact, the active (anagen) phase in the human scalp takes 3 years or more, whereas resting (telogen) phase lasts only a few weeks (Adachi and Uno 1969). In comparison, the activity phase of human hair follicles on other parts of the body is considerably shorter: it ranges from about 40 to 80 days.

Besides requiring substantial metabolic costs, long hair may be expensive in that it requires more time and more care than short hair (Baktay-

Korsós 1999). It is more difficult to comb, it dries more slowly, hangs in the eyes, may turn shaggy sooner, and it becomes greasy or split more quickly. Several authors argue that the care of long hair involves a considerable amount of investment either by the subject or by a hairdresser. For that reason, certain women—for example, the poor, or those active in sports—are not interested in spending time beautifying themselves or are not able or willing to pay these costs and instead decide to wear short hair.

These studies suggest that scalp hair is costly in terms of metabolism and care, which explains the individual variance in hair quality. In accordance with the handicap principle, only a fraction of people—e.g., high-quality individuals—can afford to develop and maintain healthy, long, and thick hair. Since the growth of long hair extracts more resources from the organism than short hair, it may be a marker of high phenotypic and genetic quality of the bearer.

Prediction 5. Long hair of females, irrespective of the attractiveness of the facial features, is highly valued by mates because it signals better health.

Prediction 6. An individual's length of head hair is associated with his/her health state perceived by potential mates; women with long hairstyles are regarded as more healthy than those with short hair.

Note that good genes theory and healthy mate theory are not mutually exclusive and may overlap at certain points. Mates with hereditary resistance to certain ectoparasites (good genes benefit) will also be less likely to infect their partners with these parasites (healthy mate benefits). The distinction between the two theories may be that good genes theory predicts that individuals with costly and elaborate signals are less likely to have diseases during their life. In this view, what long hair advertises is not the bearer's actual health but his/her good immunocompetence: the ability to resist infection and maintain the homeostasis of the body.

METHODS

Stimulus Material

We took photo portraits of 77 female subjects recruited from the undergraduate student population at the University of Pécs. Their mean age was 21.98 (with a range between 18 and 29). Before taking the photographs, the subjects were asked to pull their hair back from their face and fix it with clips so that the length and style of their hair could not be seen. Our aim was to reduce the visible amount of cranial hair as much as

possible. This image was called the “basic” face. They were also instructed to remove glasses, makeup, and jewelry, and maintain a neutral facial expression.

The photographs were scanned into a computer, and with the help of an altering procedure different hairstyles were adjusted on the basic faces: short, medium-length, long, disheveled, knot (bun), and unkempt (Figure 1). They were selected from a large set of hairstyles provided by a computer program (Cosmopolitan My Style 2), which is widely used in hairdressing salons. Hair color was not included as a variable. Therefore the hair color was adjusted by the computer program to approximate the woman’s natural (original) hair color. As a result, we produced 538 photographs: each woman was shown with “hairless” head, and with the same six coiffures.

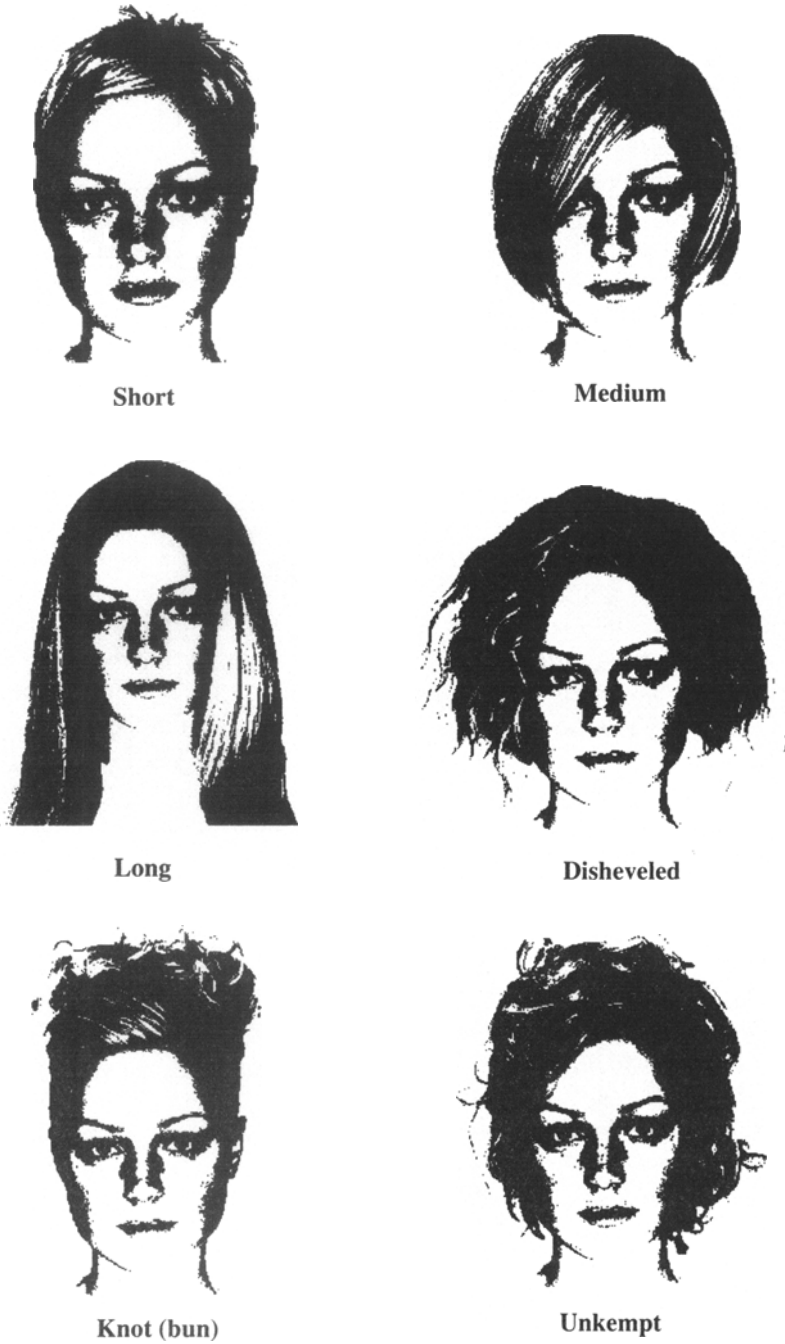
Procedure

First, 30 young men recruited as raters were presented with the photos of 77 women without visible head hair. They were provided ample time to examine each picture. They were asked to rate the attractiveness of the presented faces on a scale from 1 to 6, where 6 was the most attractive and 1 was the least attractive. Based on their judgments, we selected 20 individual photographs from the original group of the 77 females: the 10 most attractive and the 10 least attractive. This was an indispensable step because the subsequent ratings of faces with different coiffures could not have been achieved if each photograph (77 women \times 7 hairstyles [“basic” + 6 coiffures]) had been presented. In this case each rater would have had to compare 538 faces, which is a highly unrealistic task.

In the second step, another group of 52 male raters was asked to judge the attractiveness of the selected 20 females. First they were shown the “basic faces.” Next, the remaining 120 photographs were *randomly* presented on the computer screen. Each rater saw a different sequence of pictures, which eliminated the possibility of the sequential position effect. The raters were asked to rate each face using four scales referring to different dimensions of feminine attractiveness: (1) femininity, (2) youth, (3) health, and (4) sexiness. These dimensions correspond to those used in several previous studies which have found that opposite sex-attractiveness ratings of facial photographs are positively related to various—e.g., romantic and sexual, feminine and masculine, etc.—interests in the person depicted (Johnston et al. 2001; Penton-Voak and Perrett 2000; Perrett et al. 1998).

In order to calculate the effect of hairstyle on attractiveness, we subtracted the values given to the “basic face” pictures from the coiffured

Figure 1. Hairstyles used in the study.



ones. Then means were calculated for each dimension and group. For example, the variable "lafem1" indicated the mean value of the less attractive faces with hairstyle 1 (short hair) on the dimension of femininity, relative to the value for the basic picture of the same women. Consequently, we were able to measure the shifts in attractiveness judgments from the "basic face" to the faces with various hairstyles. Differences in esthetic evaluations between female groups (less vs. more attractive), among hairstyles (1–6), and among dimensions (youth, health, sexiness, femininity) could also be calculated.

RESULTS

"Basic Faces" (Without Head Hair)

As Table 1 shows, when basic faces were compared, women who were judged more attractive received higher values in all four dimensions (youth, femininity, health, sexiness) than those who were considered less attractive.

Significant differences between the most and the least attractive girls were found in the three measured facial traits. The former proved to have higher foreheads, larger eyes, and smaller chins than the latter (forehead: $t = -18,703$, $p < 0,001$; eyes: $-4,029$, $p < 0,05$, chin: $t = 10,330$, $p < 0,001$).

Hairstyles and Attractiveness

The results of one-way repeated measures ANOVA revealed that the seven hairstyles (including basic face) significantly differ in their effect on facial attractiveness ($F_{6, 282} = 33.62$, $p < 0.001$). The six hairdos enhanced the attractiveness values relative to faces without head hair ($F_{1,47} =$

Table 1. Differences in Attractiveness of Faces without Visible Head Hair between Two Groups of Women

<i>Dimensions</i>	<i>Groups of Women</i>		<i>F</i>	<i>p</i>
	<i>More Attractive</i>	<i>Less Attractive</i>		
Femininity	3.72	1.2	479.055	< 0.001
Youth	3.97	2.39	114.749	< 0.001
Health	4.32	2.49	69.412	< 0.001
Sexiness	3.28	1.13	343.49	< 0.001

Table 2. The Effect of Medium-length and Long Hair on Physical Attractiveness, Relative to That of Basic Faces (without Visible Head Hair)

	Less Attractive Women				
	Basic	Medium	F	Long	F
Femininity	1.2	1.9***	53.8	2.22***	98.2
Youth	2.39	245	0.226	2.66*	5.55
Health	2.49	3.06***	23.62	3.44***	49.2
Sexiness	1.13	1.46***	30.62	1.59***	59.51
	More Attractive Woman				
	Basic	Medium	F	Long	F
Femininity	3.71	4.05*	6.29	4.36***	14.87
Youth	3.97	4.49***	23.79	4.33**	11
Health	4.32	4.62*	6.57	4.56*	6.26
Sexiness	3.28	3.88***	18.35	3.83***	14.67

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

14.32, $p < 0.001$). According to the Bonferoni pairwise comparison test, only long hair and medium-length hair improved the female subjects' physical appearance significantly ($p < 0.001$ for both). The others (bun, short hair, disheveled, and unkempt) did not have a significant effect on attractiveness judgments ($F = 2.69$, $p > 0.05$) (Figure 2).

We did, however, find large differences between the two groups of female subjects with different levels of attractiveness ($F_{1,47} = 63.28$, $p < 0.001$). A significant effect for interaction between groups (less attractive – more attractive) and hairstyles was found ($F_{6, 282} = 3.91$, $p < 0.01$), showing that various hairstyles imply different changes in facial attractiveness for less attractive and more attractive women (Figure 3). According to the one-way repeated measures ANOVA, hairdressing caused a significant improvement in physical appearance among less attractive women ($F_{96, 282} = 38.96$, $p < 0.001$). The Bonferoni test shows a significant effect for long ($p < 0.001$) and medium-length ($p < 0.001$) hair. A strong tendency was found in the case of the bun and disheveled hairstyles but did not reach the level of significance (0.062 and 0.065, respectively). Short hair and unkempt hair did not change the physical attractiveness values significantly.

Hairdressing had a similarly significant but weaker impact on attractiveness judgments in the group of women who were judged as more

Figure 2. The effect of six hairstyles on physical attractiveness (Basic = face without visible head hair).

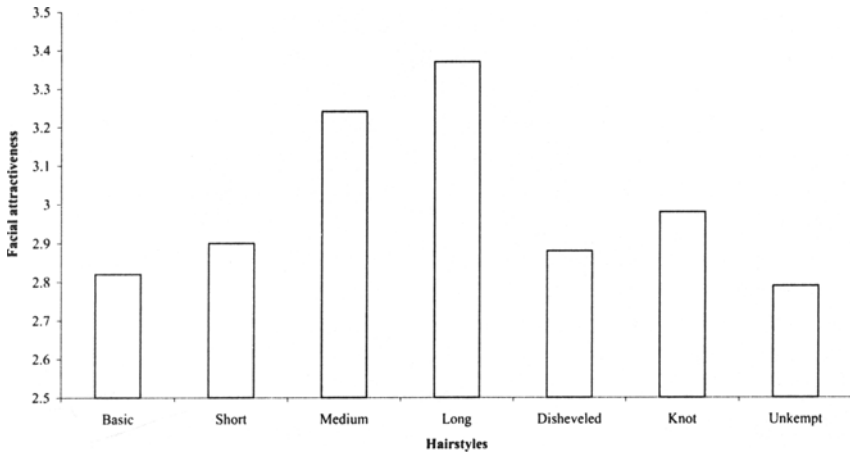
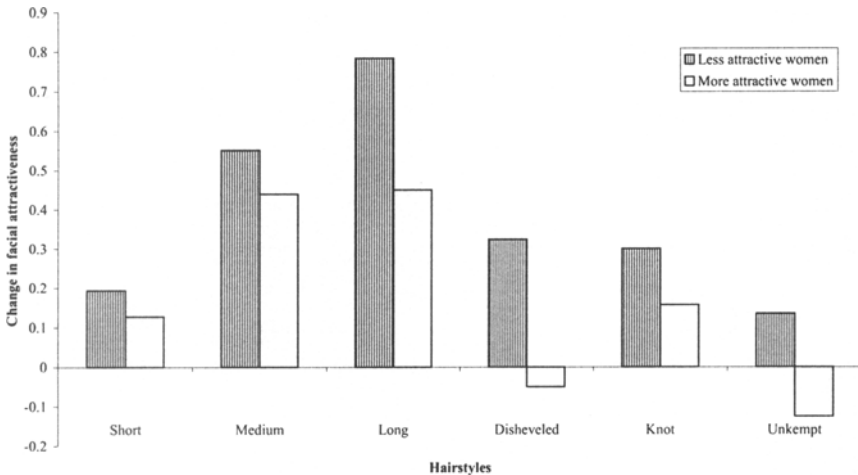


Figure 3. The effect of various hairstyles on facial attractiveness in the groups of young women with different levels of “basic” attractiveness (attractiveness of face without visible head hair)



attractive by the male raters in the “basic face” study ($F_{6, 282} = 14.28, p < 0.01$). The Bonferoni test revealed that long and medium-length hair caused significant rises in physical beauty ratings relative to faces without head hair ($p < 0.01$ for both), but the other styles did not significantly alter the previous values of physical appearance.

Although long hair had a considerable effect on physical appearance in both groups, large differences were found between the two groups (Fig-

ures 3 and 4); with the long hairstyles, the attractiveness scores for female subjects perceived formerly as less attractive increased nearly twice as much as did those for more attractive women ($F_{1,47} = 38.02, p < 0.001$). However, hairdressing in and of itself did not reverse the original differences in esthetic evaluations based solely on facial features. As Figure 4 shows, the absolute differences in attractiveness judgments between the two groups remained; women who had been classified as more attractive in the former (“basic face”) study were also more highly valued in the subsequent study with long hair.

The effects of long and medium-length hairstyles on the judgment of attractiveness proved to be different in the various dimensions. Three-way repeated measures ANOVA revealed a strong interaction for groups (less attractive – more attractive) and dimensions ($F_{3, 141} = 42.61, p < 0.001$), between hairstyles and dimensions ($F_{6, 282} = 6.79, p < 0.001$), and among groups, hairstyles, and dimensions ($F_{6, 282} = 10.45, p < 0.001$). Figure 5a shows that long and medium-length hair caused especially favorable changes in male raters’ evaluations of the less attractive female subjects’ health and femininity. For more attractive women the greatest improvement in attractiveness judgments occurred in the dimensions of femininity and sexiness (Figure 5b), although these effects are much weaker than those measured in the group of less attractive women.

The question arose whether our result that males perceive longer hair as more healthy could be an effect of an overall correlation between attractiveness and health. In other words, could the correlation between

Figure 4. Differences in attractiveness judgments between the two groups of more and less attractive women for the effects of various hairstyles in the dimension of health (Basic = face without visible head hair).

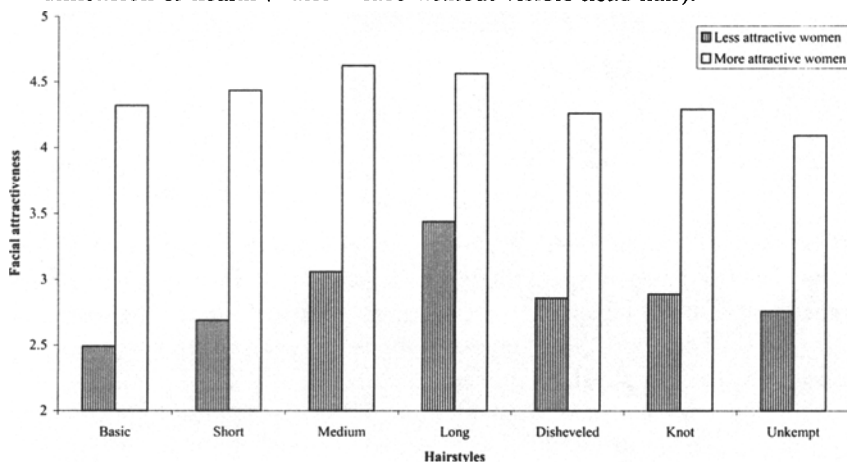
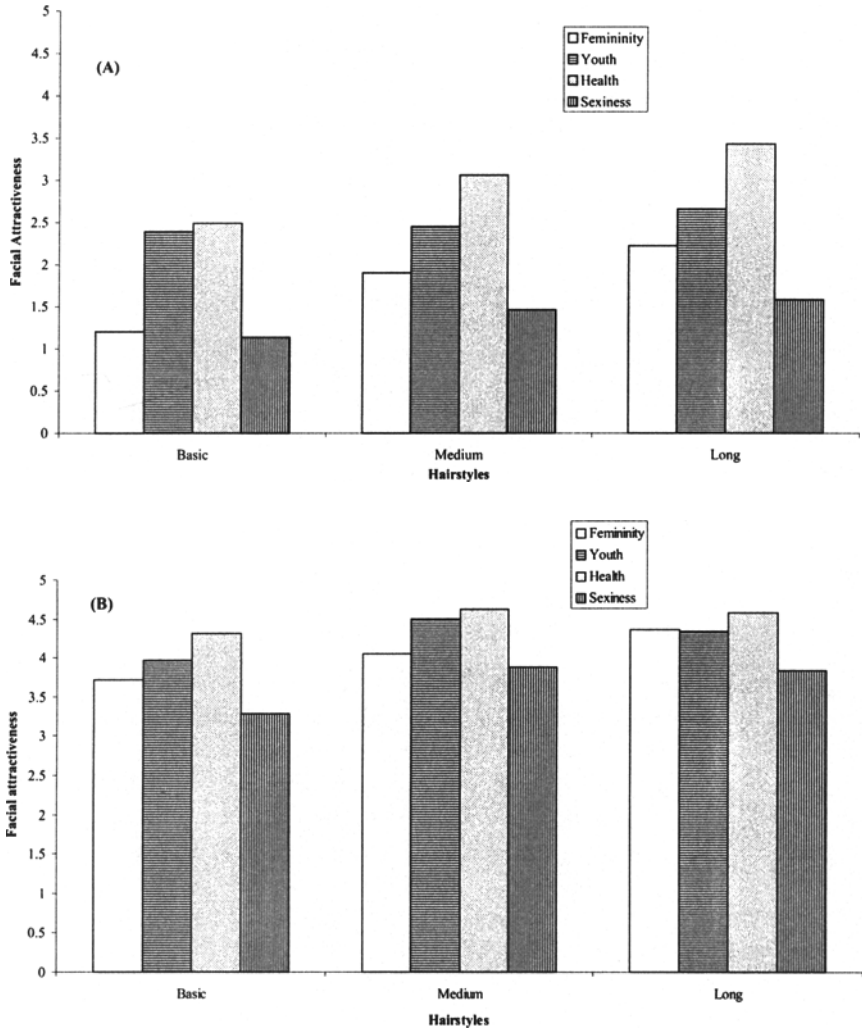


Figure 5. The effect of long and medium-length hairstyles on facial attractiveness for (A) less-attractive and (B) more-attractive women.



hair length and health be attributed to the general relationship between physical attractiveness and good physical condition. We found that hair length has an independent contribution to the evaluation of female health. Long hair increased the scores of female subjects' perceived health to a significantly greater extent than it did the scores of "global" attractiveness involving femininity, youth, and sexiness ($F_{1,47} = 115.96, p < 0.001$).

DISCUSSION

Our study suggests that hairstyles have a large impact on female facial attractiveness, which can be explained from an evolutionary perspective. We found that

1. More attractive females have higher brows, larger eyes, and smaller chins than less attractive ones. These facial characteristics are considered to be estrogen markers and neotenous.
2. Hairdressing has a large impact on facial attractiveness. The long and medium-length hairstyles proved to be the most influential on the male raters' evaluations about female physical appearance. These hairdos increased attractiveness in all dimensions, and in both female groups, irrespective of the "original" attractiveness of female faces without head hair.
3. Changes in hairstyle—that is, adjusting various hairdos on the bare scalp—caused a much larger increase in the perceived attractiveness of the women who were judged as less attractive in the primary ("basic face") study.
4. Long and medium-length hairstyles had a different impact on the various dimensions of facial attractiveness; the degree of the female subjects' health and femininity, estimated by the male raters, increased in the group of the less attractive girls, whereas an improvement of the perceived physical appearance was revealed in the dimensions of sexiness and femininity in the group of more attractive women.

In light of the covering hypothesis, long hairstyles are expected to improve the physical appearance of less attractive women because these hairstyles tend to hide their disadvantageous facial traits (Prediction 2). Long hair frames the face in a way that cuts the margins of the large, masculine mandible and thus may reduce the appearance of jaw size. Similarly, long and medium-length hair may hide the low, less-pronounced cheeks that are also unfavorable in ratings of feminine attractiveness. In accordance with that assumption, long hair was found to enhance the female subjects' perceived femininity significantly, which may derive from hiding disadvantageous (masculine) facial traits.

Contravening these expectations, however, is the finding that the long hairstyle enhanced the attractiveness of less-attractive as well as more-attractive women who display pronounced estrogen markers and neotenous facial traits. Furthermore, in opposition to our expectation, short hair did not improve attractiveness ratings significantly (Prediction 1). The effect of a hair bun is also contradictory: it enhances the femininity of less attractive women but decreases their youthfulness (Prediction 3). We had assumed that as more of the forehead is exposed, the female subject would

be considered younger, inducing the image of neoteny. However, contrary to our hypothesis, a hair bun was associated with an older appearance. These results suggest that hairstyles are unlikely to modify attractiveness ratings considerably, whether by hiding testosterone-dependent features or revealing estrogen-dependent facial traits.

Our data do not support the healthy mate hypothesis, either. The disheveled and the unkempt hairstyles did not decrease the women's facial attractiveness as judged by male raters in the "basic face" study (Prediction 4). They did not even decrease the image of the female subject's health relative to faces without visible head hair. However, it is possible that we did not select the appropriate pictures for displaying head hair of ill or infected people. The photographs may merely depict extravagant hairstyles. Dermatological textbooks show that seriously infected scalps show a dramatically high rate of shedding and other, even more spectacular damage and hair loss (Dawber et al. 1998). Several cross-cultural observations revealed that people show aversion to persons whose skin condition visibly and obviously signals infection (Eibl-Eibesfeldt 1989). In order to test healthy mate theory appropriately, future studies should be based on more realistic stimulus material.

At the same time, our results are highly compatible with the good genes selection model. According to this theory, those individuals who have good phenotypic and genetic quality can afford the high costs of long hair. Two of our results support this hypothesis. First, our data show that only long and medium-length hair had a significant, positive effect on women's attractiveness, the other hairstyles did not influence the values of physical beauty perceived in the "basic face" study (Prediction 5). Second, in accordance with this theoretical model, long (and medium-length) hair caused the largest change in the dimension of health; these hairstyles improved the male raters' evaluations of the female subjects' health status (Prediction 6). This relationship cannot be attributed to a more general relationship between attractiveness and health; long hair increased the females' perceived health more than it did their "global" attractiveness involving femininity, youth, sexiness.

Furthermore, our results show that long hair does not equally influence the physical appearance of women with different attractiveness values. We found that long and medium-length hair improved the perceived physical appearance of less attractive women more remarkably than they did that of more attractive women. This increase was primarily due to the fact that male raters gave a better evaluation of their health status. The hair bun also increased the perceived health status of less attractive women. The reason may be that for this hairstyle women need a suf-

ficient length of hair, and thus it represents a costly signal. These results suggest that women whose facial features were judged as less attractive may compensate for this handicap by displaying signals that advertise good health. Markers of a poorer quality of estrogen are thus counterbalanced by another cue of good physical condition. This effect is remarkable because in the "basic face" study (where no head hair was visible), the more-attractive women were immediately judged as more healthy than the others.

The highly attractive women's physical appearance is not changed by hairdressing to such a great extent. Their health, femininity, and sexiness is highly rated irrespective of the hairstyle they wear. In other words, their physical beauty is mediated by estrogen-dependent facial features and neotenus traits, and hairdressing seems to have only a secondary influence on their attractiveness.

This result raises a theoretical question: if long, healthy hair is a handicap signal, and if it improves the physical appearance of women with less attractive faces more than that of those whose faces are judged as more attractive, what relationship can be found between facial and hair attractiveness? According to the redundant signal hypothesis, the features of a woman's face and body collectively comprise a single ornament that honestly signals hormonal health and immunocompetence (Grammer et al. 2001; Thornhill and Grammer 1999). Another hypothesis, the multiple fitness model (multiple message hypothesis), claims that physical attractiveness has multiple dimensions. Each feature signals a specific, unique property of the condition of an individual, and together they specify a variety of trade-offs in the perception of the face and body (Cunningham et al. 1997). In order to clarify the independence of hair signals and facial signals, several questions should be asked. First, is there a relationship between various hairdos and the frequency of illnesses; in other words, does a particular hairstyle indicate an elevated incidence of diseases? Second, does the females' facial attractiveness correlate with the quality of head hair indicated by the level of greasiness, dandruff, etc.? Third, is female facial attractiveness predictive for the particular hairstyle they actually wear; is there a difference in hairstyles between the groups of females with attractive and non-attractive appearance? Our next study is aimed at answering these questions.

Similarly, further studies can clarify the effect of male hairstyle and hair quality on attractiveness. One of the reviewers of this paper suggested that hairdo and hair condition may be an even more powerful cue to developmental quality for males than for females, given the greater intensity of sexual selection on men relative to women.

Alternative explanations may also exist for the relationship between female hairstyle and attractiveness. Several studies have revealed that cultural and psychological factors may be responsible for the preference for long hair. Because long, full head hair needs a large amount of investment in terms of time, money, and daily care, it may signal high financial status, self-respect, and an increased concern about physical condition and health. Another study has shown that long-haired girls are more successful in primary school than short-haired ones (Baktay-Korsós 1999). They have more friends, are considered more attractive, and are regarded as more popular in the community. Interestingly, that study did not find correlation between the desired and the actual length of hair; all of the schoolgirls wanted to wear long hair but their parents frequently had several reasons for choosing a short haircut.

Our study has two principal limitations. Our investigation was primarily aimed at revealing the relationship between female attractiveness and hairstyles from an evolutionary perspective; thus it did not focus on the cultural and historical context. Obviously, people around the world have been treating their head hair very differently and for various reasons. Some practices occur in connection with enhancing sexual attractiveness while others do not. Cutting the hair short, for example, may serve the practical purpose of keeping parasites (e.g., lice) away, or it may indicate special status (e.g., in a religious order). Several studies suggest that hairstyle, as well as a number of other grooming features (clothing, jewelry, tattoos), convey the message of group membership and status (Cunningham et al. 1995). Different hairstyles can convey information about a woman's sociosexuality. An American study has revealed that young women tend to wear longer head hair than older women, using long hair as a sign of their youth (Hinsz et al. 2001). Certain hairdos signal a low level of sexual receptivity for women in various cultures. In the traditional peasant cultures in Hungary, women were expected to tie their hair into bun (and also cover it with a scarf) from their wedding day on, indicating that men were no longer free to flirt with them. Letting their hair down was an erotic signal and was only done in an intimate setting. Similar customs were widespread in historical Europe. In one of the oldest written documents, the Apostle Paul warned women that it was shameful for them to leave their head uncovered. Even in modern times certain religions require women to keep their hair covered; these examples indicate the importance of the sexual connotations of head hair. In almost every culture, changing the length or style of head hair is associated with a transition to a different stage in the life course: the onset of sexual maturity (puberty rite), marriage, entering a new community, and so on (Morris 1985). It is

thus far from surprising that many symbolic meanings of hairdos in different cultures—long hair as a sign of power, shaving of the head as a mark of castration or humiliation, using a curl of hair for black magic, etc.—are frequently associated with sexuality.

Another limitation of the present study is that, as one of the referees remarks, it examines only a narrow range of possible hairstyles. In other cultures different hairstyles are worn, and it is also possible that men living in other countries would judge the six hairstyles presented in our study in different ways. Unfortunately, almost all the investigations concerning hairdo and attractiveness have been carried out in Europe and North America, and we have very little information about the norms and traditions in Asian and African countries in this respect. In light of evolutionary theory, it is expected that hairstyles, expressed in any particular form and design, function to signal physical condition and health in the community. Naturally, further investigations are needed to clarify the possible links between evolved motives and cultural values in shaping the desirable hair length and hairstyle.

Norbert Mesko is a Ph.D. student in the Institute of Behavioral Sciences at the University of Pécs. His main research interests are in mate choice and physical attractiveness.

Tamas Bereczkei is a professor of psychology at the University of Pécs. His research interests span life history strategies, mate choice, parental biases, and reproductive behavior of Gypsies.

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