ANTHROPOLOGICAL REVIEW • Vol. 73, 3–19 (2010)
Available online at: https://doi.org/10.2478/v10044-008-0018-0

The pattern of facial preferences in boys at early adolescence

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ABSTRACT Despite numerous studies on perception of facial attractiveness in adults, preferences in adolescents remain poorly characterized. The aim of present study was to explore facial preferences in boys at early adolescence (11-13 years old) and compare them with preferences of men. All males evaluated the same 30 female faces, which were also assessed by independent judges for several perceived features. Regardless of age, boys assessed attractiveness much the same as men, and the strengths of their preferences for specific facial features were similar to those of men. The pubertal maturity (calculated on the basis of the presence of pubic hair at two sessions spaced ten months apart) correlated positively with strength of preference for several facial features (specifically: maturity, sexiness, marital appearance and friendly appearance). This remained true even after controlling for age and psychosexual development, suggesting that sex hormones are involved in the development of facial preferences in pubescent boys.

KEY WORDS: facial attractiveness, preference, development, puberty, sex hormones

Research on facial attractiveness has become very popular in past few decades and the psychoevolutionary perspective has recently gained a good measure of scientific currency. This perspective assumes that many of the criteria for facial preferences have been molded by natural selection so that the pursuit of and contact with individuals perceived as attractive is beneficial for one's reproductive success [Symons 1995, Gangestad & Scheyd 2005, Rhodes 2006]. It is no wonder then that facial preferences are, to a great extent, universal [Langlois *et al*. 2000]. Facial attractiveness is a reliable signal of possession of good genes, good health and desirable personality, and physically attractive people enjoy, on average, more popularity, and have better reproductive success than less attractive ones (see review by Kościński [2008]). Although attractiveness perception in adults has been extensively studied, the development of facial preferences in childhood and adolescence remains poorly represented.

Received 12 July 2010; accepted 1 December 2010
DOI: 10.2478/v10044-008-0018-0

Facial preferences already exist in newborns [Slater *et al*. 1998] and older infants [Langlois *et al*. 1987], who gaze longer at those faces deemed attractive by adults. The exact criteria used by infants for selective gazing are unknown, although large eyes [Geldart *et al*. 1999] and typicality (averageness) of facial proportions [Walton & Bower 1993, Rubenstein *et al*. 1999] have been reported to attract an infant's attention. Children at ages 7 to 17 evaluate facial attractiveness similar to adults [Kissler & Bauml 2000, Saxton *et al*. 2006]. Intragroup consistency in attractiveness evaluations is lower in children than in adults [Langlois *et al*. 2000, Saxton *et al*. 2006] but this increases with the increasing age of children [Saxton *et al*. 2006].

Saxton *et al*. [2009*a*] presented 11- and 13-year-old girls and boys with digitally manipulated faces of their respective peers. All groups displayed a preference for the male and female faces that were feminine, symmetrical and of typical proportions; this preference pattern was the same as that characteristic of adults. These preferences were also more pronounced in the older group of children than in the younger group. No correlation, however, was found between pubertal development of girls and boys and their evaluations of opposite-sex faces. In a similar study, Saxton *et al*. [2010] found that in 12-14 year-old boys and girls (analyzed together) pubertal maturity was positively related to preference for facial symmetry. Cooper *et al*. [2006] found that four- and nine-year-old children preferred female faces with more child-like proportions than did twelve-year-old children and adults. This change at puberty may result from concurrent hormonal changes or from frequent visual contact with faces of one's peers or one's own face. Peers of twelve-year-old children possess more mature faces than the peers of four- or nine-year-old children, and thus exposure to their faces may result in development of preferences for facial maturity. Some of the results obtained support the latter supposition: In the same study, Cooper *et al*. [2006] revealed that preference for faces with child-like proportions was stronger in those three-year-old children who had more contact with their peers, e.g., attending a day care center. In turn, Saxton *et al*. [2009*b*] observed that early adolescent girls (boys) attending single-sex schools (thus mainly exposed to own-sex faces) preferred more feminine (masculine) faces compared with counterparts attending mixed-sex schools.

Little *et al*. [2010] argue that sex hormones influence the development of adult-like facial preferences during puberty. This thesis has been strongly supported by Kościński [in press] who found that the time elapsed since the menarche and the breast development in 12-13 year-old girls positively correlated with preference for sexy-, friendly-, and healthy-looking male faces (as assessed by adult women) and with the similarity of the girl's attractiveness evaluations to those of adult women. Furthermore, these effects remained true even after controlling for age and psychosexual development, suggesting that sex hormones are involved in the development of facial preferences in pubescent girls.

The present study was aimed at a comparison of facial preferences by early pubescent (11-13 years old) boys and young men, and whether a relationship existed between the boys' pubertal maturity (as measured by pubic hair development) and their facial preferences. All boys and men rated the same 30 female faces according to the same methodology, thus rendering the answers provided by these groups comparable. Separate groups of men assessed

all 30 female faces for perceived age, skin healthiness, mouth positivity and suitability for short-term, long-term and friendly relationships. This enabled comparison of the boys with men in respect of preference for each of the assessed facial features. The boys also filled in a questionnaire regarding their pubertal and psychosexual development. Their psychosexual development and chronological age were then statistically controlled in analyses aimed at revealing the effects of pubertal maturity on facial preferences.

If facial preferences are biological adaptations, then they should change with age, because the adaptive interests of an individual change with his/her age [Buss 1999]. For example, many studies have shown that adult men prefer cues to reproductive fitness in female faces, such as feminine proportions and healthy-looking skin [Symons 1995, Kościński 2007]. Female reproductive fitness is most important for men in the context of a short-term relationship [Buss & Schmitt 1993] and female faces with cues to reproductive fitness are appreciated more in the context of a short-term than a long-term relationship [Burt *et al*. 2007]. Prepubescent boys are still sterile, so may be expected not to prefer facial cues to reproductive fitness (i.e., "sexy" faces) as strongly as men. On the other hand, prepubescent children are dependent on physical and economic support from older individuals, and the extent of this dependency is related to their exact age. They may thus be expected to prefer facial cues to good character (e.g., supportiveness, generosity and altruism) more strongly than adults. Examples of such cues may be a smile and appearance suggesting good character [Roney *et al*. 2006, Mehu *et al*. 2007]. Adolescence is a transient period between childhood and adulthood, so the facial preferences of adolescents may be expected to be intermediate between child-like and adult-like. We therefore predicted that the adolescent boys under study would prefer sexy looking female faces to a lesser degree than the adult men and that they will prefer mouth positivity and friendly appearance to a greater degree than the men.

During puberty, levels of sex hormones (estrogens, progesterone and testosterone) increase substantially in both sexes [Winter 1978]. These hormones are related to sexual drive [Regan 1999] and facial preferences [Scarbrough & Johnston 2005, Welling *et al*. 2007, Jones *et al*. 2008, Roney & Simmons 2008]. The pubertal increase of androgens was proven to stimulate sexual drive and activity in boys [Halpern *et al*. 1994, 1998]. It is thus probable that the growth of sex hormones at puberty sensitizes boys to female-typical facial features and shapes an adult-like neural apparatus of attractiveness perception. Specifically, we predicted that boys more advanced in their pubertal development would have facial preferences more similar to adult men than their less biologically developed peers, and display a relatively strong preference for facial cues to good reproductive fitness such as skin healthiness and a sexy look.

Methods

Participants

A group of 53 boys was gathered for purposes of the present study. They were examined twice; first, in 2008 from February to April, at which they then aged 11.2-12.7 (M = 11.7). About ten months later the second session took place (from Dec-2008 to Jan-2009), at which they were aged 12.0-13.4 (M = 12.5). The boys were pupils of three elementary schools in Poznań and

Leszno, both relatively large Polish cities. The boys underwent exactly the same procedure in both examinations. Attractiveness assessments by 100 men (aged 18-26 years, $M = 21.2$) served as the reference point for the boys' judgements. The men were college students in Poznań and were recruited in student hostels and lecture buildings. Informed consent was provided by all participants and, in the case of boys, also by their parents, class tutors and school headmasters. The data on boys gathered at the first and second examination will henceforth be referred to as BOYS-11 and BOYS-12, respectively.

Procedure

All participants viewed the same full-face color photographs of 30 Polish women – students of Adam Mickiewicz University in Poznan – aged 19-25 years. The female posers displayed a neutral expression with a direct gaze, their glasses removed and hair swept off their faces. A white mask was applied to each photograph so as to hide all elements around the face. The facial photographs were then printed in color on glossy paper (330 DPI, 7x7 cm). Preliminarily, all 30 faces were ranked by four other young men, which gave an approximate estimate of their attractiveness. The set of 30 faces was divided into three 10-face series of similar distribution of attractiveness, i.e., each series contained some attractive, moderately attractive, and unattractive faces. Three different divisions of this sort were conducted, producing three sets of faces, each comprising three 10-face series. By use of this method, the series were standardized in regard to attractiveness, and distribution of extraneous facial features was balanced across the sets of faces.

All the groups of judges, boys and men, evaluated attractiveness in the following way: Each participant was provided with one of the three stimuli sets, with the series order within the set equivalent between the judges. Ten photos (i.e., one series) were taken from an envelope and laid out before the judge. The participant was asked to sort the photos according to perceived attractiveness. After completing the task, another series was laid out for evaluation, and the experimenter wrote down the sequence of photographs of each series (the photographs were numbered on their backs). In this way, the photographs in all three facial series were viewed; each participant thus assessing all 30 faces.

After completion of the attractiveness evaluations, the boys were asked to fill in a questionnaire which provided their date of birth and the answer to a question about their pubertal development: "Has your pubic hair already appeared?". Boys were informed beforehand that pubic hair is a relatively long and thick hair that appears in the genital area during sexual maturation. This question, therefore, enabled us to discern between the first and subsequent stages of pubic hair development according to Tanner [1962]. We decided to use this measure of pubertal maturity because the average age of appearance of pubic hair is about 12 [Tanner 1962, Marshall 1978], thus according with the age of the examined boys. Other signs of pubertal development, such as facial or axillary hair, occur only about two years afterwards [Tanner 1962].

The boys also answered the following questions concerning their psychosexual development:

(1) "Do you care about your appearance so as to appeal to girls?" (coded from 0–no, to 3–yes, a lot).

(2) "What is your attitude to girls?" (coded from 0 – "I don't like girls and avoid

them", to 3 – "I like them and associate with them willingly").

(3) "Do you pay attention to girls' appearance?" (coded from 0 – "I don't care how they look", to 3 – "Yes, I like to look at the most beautiful ones a lot!").

(4) "Have you ever gone out with a girl?" (coded as 0–no, and 1–yes).

(5) "Do you currently go out with a girl?" (coded as 0–no, and 1–yes).

(6) "Would you like to go out with a girl?" (coded from 0–no, to 3–yes, a lot).

Auxiliary facial evaluations

Several independent groups of young men (aged 19-24 years) evaluated the stimulus faces in respect of perceived age (N = 11), skin healthiness (N = 5), mouth positivity (N = 8), and suitability for short-term relationship (N = 20), long-term relationship (N = 20) and friendship (N = 20). The men who assessed facial youthfulness or suitability for short-term relationship, long-term relationship or friendship followed the same procedure as those who had assessed attractiveness, i.e., the sorted three 10-face series. Short- and long-term relationships were defined in a similar way to that used by Penton-Voak *et al*. [2003]. Skin healthiness and mouth positivity were assessed by using a computer monitor. Skin healthiness was rated on a 5-point scale on the basis of three cuttings from the forehead and cheek regions. Mouth positivity was rated on a scale from one ("distinct discontentment – sadness or anger") to five ("distinct contentment") on the basis of a cutting containing the lip region. Evaluations of these six features showed good reliability (all Cronbach's alphas $\geq$ 0.88, except that of perceived age which had a repeatability of 0.77), and were averaged across all raters, providing for each face an estimate of youthfulness, skin healthiness, mouth positivity, and suitability for short-term relationship, long-term relationship, and friendship. For purposes of brevity, the last three characteristics mentioned above will henceforth be referred to as sexy, marital and friendly appearance, respectively.

Initial calculations

Facial attractiveness may be regarded as normally distributed [Jones *et al*. 2001], while ranks are, by definition, uniformly distributed. Therefore, the rank values of facial attractiveness (from 1 to 10) collected from raters were transformed into standard normal values. The applied formula was $\Phi^{-1}[(rank - 3/8) / (10 + 1/4)]$, where Φ^{-1} is the inverse standard normal cumulative distribution function [Blom 1958]. Resultant values were multiplied by –1, so that the ranking number 1 (indicating the *most* attractive face) took the greatest normal value. All statistical analyses conducted were based on these values.

Thereafter, strengths of preference for youthfulness, skin healthiness, the mouth positivity, and sexy, marital and friendly appearance were determined for each judge. An individual's strength of preference for a facial feature was calculated as the correlation coefficient between values of the feature and attractiveness ratings by this individual. The obtained values were then Fisher-transformed so as to produce a normal distribution and, thereby, render parametric tests applicable [Silver & Dunlap 1987]. The strength of preference for each facial feature characteristic for each group of judges (i.e., boys or men) was calculated as the mean of the group members' strength of preference for the feature. In addition, Maturity of Preferences was calculated for each boy as the correlation of facial

assessments by the boy with average assessments by the men. Facial assessments by two boys were extremely lowly (even negatively) correlated with average assessments by the remaining boys, and between-session autocorrelations of assessments by these boys were negative. The Grubbs' test showed these correlations to be outliers, so we omitted the two boys in further analyses, thus reducing the sample size to 51.

Pubic hair was reported by 37 (73%) boys at the first session and by 46 (90%) at the second. Of the 14 participants who had no pubic hair at the first session, nine reported hair at the second session. The index of Pubertal Maturity was then constructed as follows: The value of zero was assigned to five boys who had no pubic hair at any session, the value of one was assigned to nine boys who had pubic hair only at the second session, and the value of two was assigned to 37 boys who already had pubic hair at the first session.

None of the psychosexual variables changed significantly between sessions (all Ps > 0.1 according to dependent t-test for paired samples) so their average values from the first and second sessions were further analyzed. The factorial analysis performed on the questionnaire items pertaining to biological and psychosexual development determined two factors: the first factor was weighted mainly by care about own appearance so as to appeal to girls, gazing at girls, and the desire to go out with a girl – this factor will be referred to as Romantic Interest. The second factor was highly weighted by previous and current going out with a girl – this factor will be referred to as Romantic Experience. Liking girls and Pubertal Maturity had a relatively small influence on both factors.

Indices of biological and psychosexual development were not normally distributed and so we applied the Spearman's rank correlation coefficient to check their pair-wise associations with other variables. As a multivariate approach we used multiple linear regression analysis as it is robust to violations of the normality assumption [Ogasawara 2007].

Results

Facial preferences by boys and men

Attractiveness evaluations of 30 female faces averaged across the boys correlated with those by men at 0.95 in each session, indicating a marked similarity between boys' and men's perception of female facial attractiveness. Strengths of preference for facial features by each male group are shown in Figure 1. It is clear from this that the most important criteria for facial evaluation by all male groups was sexy, marital and friendly appearance. The importance of skin healthiness, mouth positivity and youthfulness was noticeably lower.

T-test for paired samples did not provide evidence that boys' preferences changed between sessions for any facial feature (all $|t\text{s}| < 1.82$, $P\text{s} > 0.07$). We then averaged boys' preferences from two sessions and compared them with respective men's preferences. The T-test for independent samples revealed that, in comparison to men, boys displayed weaker preference for skin healthiness ($t_{149} = 2.02$, $P = 0.045$), youthfulness ($t_{149} = 2.59$, $P = 0.011$), sexy appearance ($t_{149} = 3.53$, $P < 0.001$), marital appearance ($t_{149} = 3.93$, $P < 0.001$), and friendly appearance ($t_{149} = 3.88$, $P < 0.001$), but not for mouth positivity ($t_{149} = 1.22$, $P = 0.26$). The effects for sexy appearance, marital appearance and friendly appearance survive the Bonferroni correction for multiple comparisons (the corrected

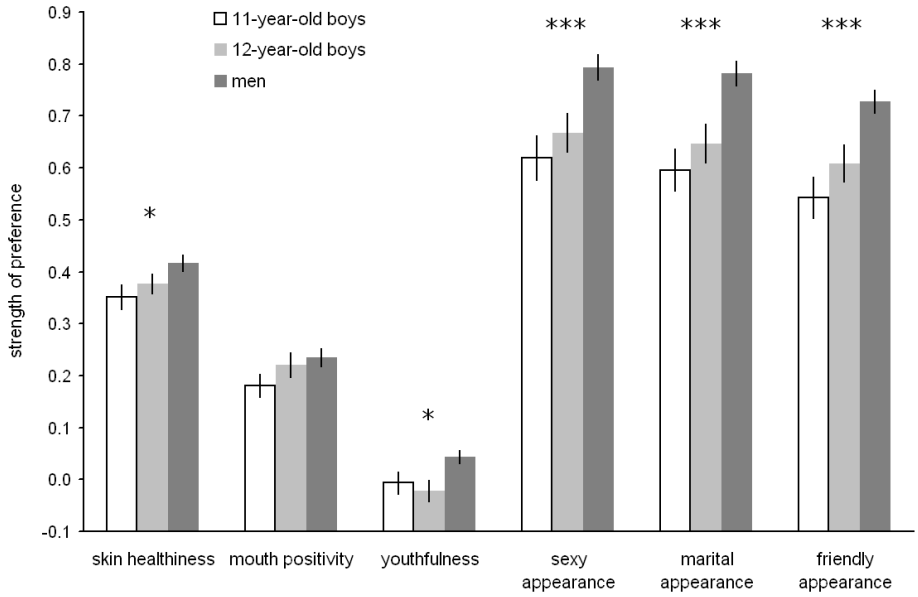

Fig. 1. Strengths of preference for facial features by examined male groups. Error bars indicate standard errors. Asterisks indicate significant differences in preference strength between boys (assessments averaged across two sessions) and men according to t-test for independent samples, * $P < 0.05$, *** $P < 0.001$.

P-level is 0.05 / 6 = 0.008), and the effect for youthfulness is marginally significant after the correction.

Pubertal maturity and facial preferences

Table 1 presents the Spearman correlations between Pubertal Maturity, Romantic Interest and Romantic Experience on the one hand, and Maturity of Preferences and strengths of preference for facial features on the other. As can be seen from the table, the preferences of BOYS-11 did not depend on Pubertal Maturity, although marginally significant positive correlations appeared for preference for sexy and marital appearance (see also Fig. 2A). For BOYS-12, Pubertal Maturity was positively associated with the preference for sexy, marital and friendly appearance, and negatively associated with the preference for youthful appearance (see also Fig. 2B). Romantic Experience displayed similar results at both sessions: it correlated positively with the preference for sexy, marital and friendly appearance, and negatively with the preference for youthfulness (see also Figs. 3,4). In addition, it was positively related to Maturity of Preferences in BOYS-11. Interestingly, no significant correlations were observed for Romantic Interest.

In a series of pair-wise correlations some (if not all) significant results may occur by chance, so we performed omnibus tests to determine whether indices of pubertal and psychological maturity influenced the boys' preferences. A general linear model (GLM) was carried out with Session (BOYS-11 / BOYS-12) and Facial Feature

Table 1. Spearman's correlations between pubertal and psychosexual development and strengths of preference for facial features and maturity of preferences in examined groups of boys

Preference for:	Skin healthiness	Mouth positivity	Youthfulness	Sexy appearance	Marital appearance	Friendly appearance	Maturity of preferences
11-year-old boys							
Pubertal Maturity	-0.04	0.22	-0.22	0.25†	0.24†	0.24†	0.22
Romantic Interest	-0.16	0.04	-0.21	0.10	0.12	0.08	0.02
Romantic Experience	-0.01	0.24	-0.35*	0.32*	0.34*	0.31*	0.30*
12-year-old boys							
Pubertal Maturity	-0.21	0.24†	-0.32*	0.33**	0.29*	0.34**	0.11
Romantic Interest	-0.24†	0.09	-0.17	0.11	0.05	0.05	0.06
Romantic Experience	0.03	0.06	-0.44***	0.36***	0.33**	0.34**	0.18

† $P < 0.10$, * $P < 0.05$, ** $P < 0.02$, *** $P < 0.01$.
Values in bold indicate effects significant in multiple regression analysis (see text for details).

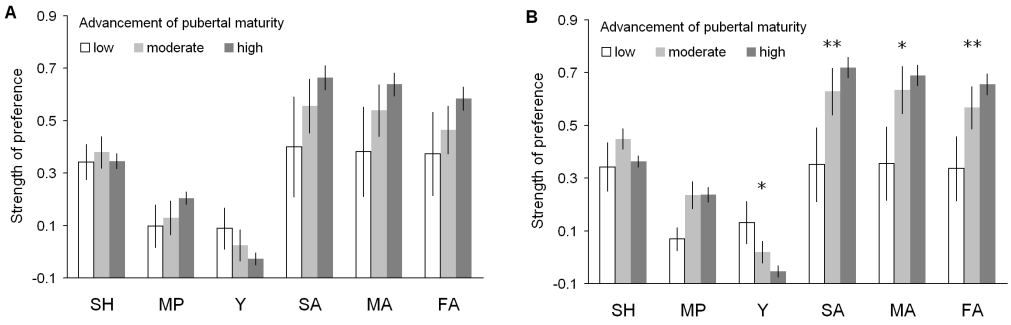

Fig. 2. Strengths of preference for facial features by (A) 11-year-old and (B) 12-year-old boys according to advancement of their pubertal maturity. SH – skin healthiness; MP – mouth positivity; Y – youthfulness; SA – sexy appearance; MA – marital appearance; FA – friendly appearance. Error bars indicate standard errors. Asterisks indicate significant Spearman correlations between pubertal maturity and strength of preference, * $P < 0.05$, ** $P < 0.02$.

(six features) as within-subject variables and age, Pubertal Maturity, Romantic Interest and Romantic Experience as between-subject variables; all second and third order interactions were also included in the model. The only significant terms were found to be Facial Feature × Pubertal Maturity interaction ($F_{5, 230} = 3.27$, $P = 0.007$) and Facial Feature × Romantic Experience interaction ($F_{5, 230} = 7.07$, $P = 0.000004$). This means that both Pubertal Maturity and Romantic Experience influence preferences for at least some facial features. Follow-up analyses conducted for each facial feature separately revealed significant effects of Romantic Experience on the preference for youthfulness ($F_{1, 46} = 7.98$, $P = 0.007$), sexy appearance ($F_{1, 46} = 5.78$, $P = 0.020$), marital appearance ($F_{1, 46} = 5.82$, $P = 0.020$), and friendly appearance ($F_{1, 46} = 5.20$, $P = 0.027$); unexpectedly, however, no significant effects of Pubertal Maturity or Romantic In-

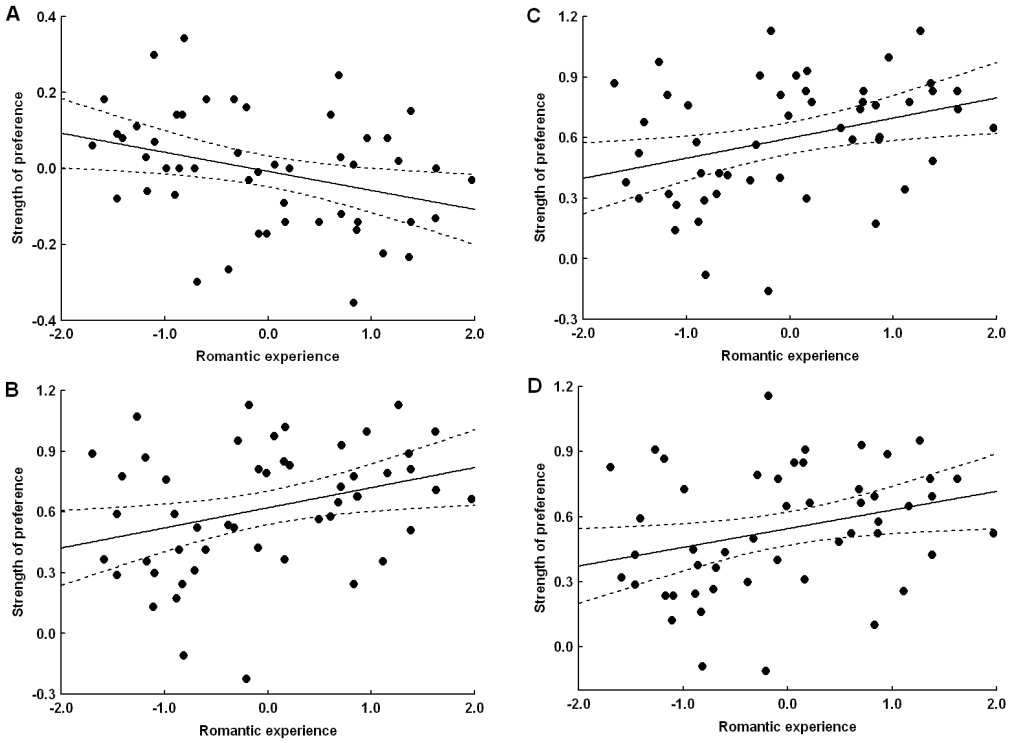

Fig. 3. Preferences for (A) youthful-, (B) sexy-, (C) marital-, and (D) friendly appearance as related to romantic experience in 11-year-old boys.

terest were revealed. We therefore decided to analyze BOYS-11 and BOYS-12 separately.

The GLM analysis for BOYS-11 revealed Facial Feature × Romantic Experience interaction as the only significant terms ($F_{5, 230}$ = 5.04, P = 0.0002). An analogous analysis for BOYS-12 revealed significant effects for Facial Feature × Pubertal Maturity ($F_{5, 230}$ = 5.02, P = 0.0002) and Facial Feature × Romantic Experience interaction ($F_{5, 230}$ = 5.21, P = 0.0002). This suggests that Pubertal Maturity influenced (at least some) facial preferences of boys at the second session only. A series of multiple regression analyses was then conducted separately for each boys group. The dependent variable was Maturity of Preferences or the strength of preference for a facial feature, and independent variables were age, Pubertal Maturity, Romantic Interest and Romantic Experience. The analysis demonstrated that for BOYS-11 the only significant effects were those of Romantic Experience on the preference for youthfulness (β = –0.048, P = 0.031), sexy appearance (β = 0.093, P = 0.041), and marital appearance (β = 0.093, P = 0.031). More effects were found for BOYS-12: (1) the preference for youthful appearance was predicted by Romantic Experience (β = –0.047, P = 0.021), (2) the preference for sexy appearance was predicted by Pubertal Maturity (β = 0.137, P = 0.027) and Romantic Experience (β = 0.075, P = 0.048), (3)the preference for marital appearance was pre-

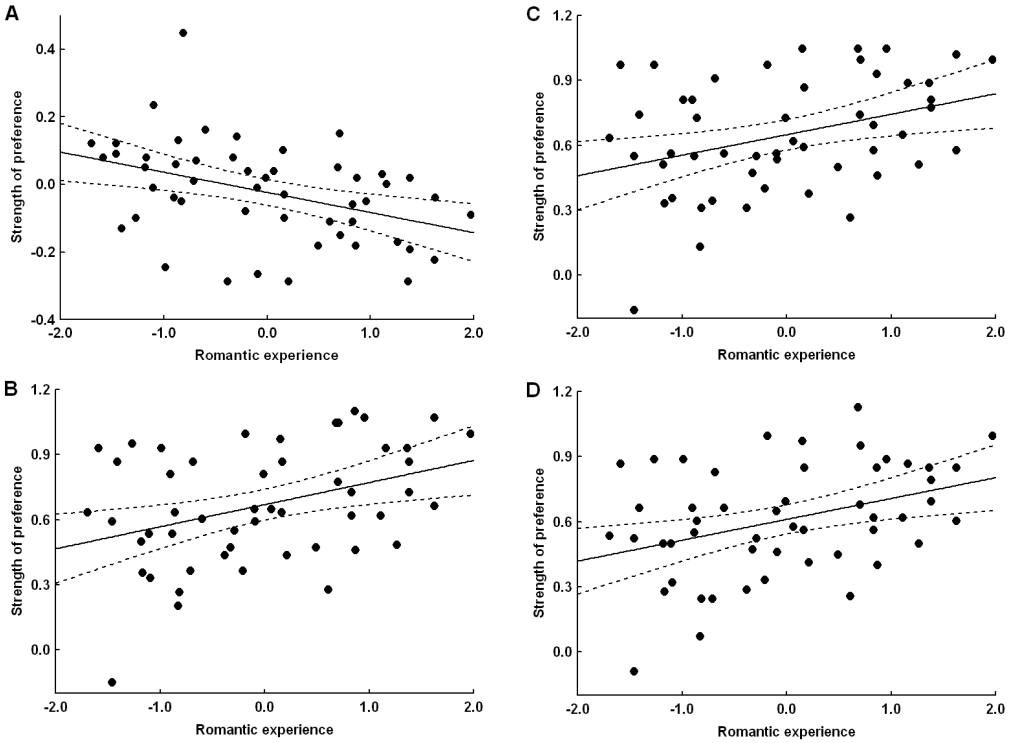

Fig. 4. Preferences for (A) youthful-, (B) sexy-, (C) marital-, and (D) friendly appearance as related to romantic experience in 12-year-old boys.

dicted by Pubertal Maturity (β = 0.124, $P = 0.045$), (4) the preference for friendly appearance was predicted by Pubertal Maturity (β = 0.127, $P = 0.033$) and Romantic Experience (β = 0.072, $P = 0.048$). No criterion variable was predicted by age or Romantic Interest. Surprisingly, correlations between Pubertal Maturity and Maturity of Preferences, though positive, were not significant (Table 1).

Discussion

The present study has shown that 11-13 year-old boys evaluate attractiveness of female faces in much the same way as adult men. This is consistent with literature findings that boys and girls in early teens perceive facial attractiveness similar to adults [Kissler & Bauml 2000; Saxton *et al*. 2006; Kościński in press]. More importantly, this study is the first to demonstrate that the structure of facial preferences (i.e., strength of preferences for specific facial features) between boys at early adolescence and adult men is very similar. Each of the groups examined here displayed most strongly the preference for sexy and marital appearance, and successively weaker preferences for friendly appearance, skin healthiness, mouth positivity and youthfulness. At the same time, each facial feature was preferred by boys slightly less strongly (and not always significantly) than men. This may mean that boys are less interested in those facial features than men

or discriminate them less efficiently. The latter explanation seems the more plausible because the efficiency of facial processing develops throughout childhood and adolescence and reaches the adult level at the age of about 16 [Itier & Taylor 2004], so the apparatus for facial perception in the presently examined boys was not yet fully mature.

Our prediction that mouth positivity and friendly appearance are preferred more strongly by boys than men has not been supported. Although one could claim that the relatively low preference for friendly appearance by boys is derived from the not fully mature apparatus for facial perception rather than a low interest in physical cues to benevolence, this cannot be applicable to the preference for mouth positivity. Mouth positivity is clearly much easier to interpret than whole-face cues to friendliness (featural processing is sufficient for the former, while the latter potentially requires more elaborate configural processing; see Mondloch *et al*. [2002]), yet the boys' preference for mouth positivity was decidedly weak.

The present results indicate that the perception of facial attractiveness by boys at early adolescence is much more adult-like than child-like and that facial signals of readiness for supportive behaviors are not much valued at this time. It may seem surprising that males of that youthful age manifest such mature facial preferences and appreciate sexy looking female faces to the extent they do. After all, the examined boys were 11-13, and boys of that age still have the child-like body build and a below-adult stature [Tanner 1962]. Furthermore, their semen, if any, is not yet capable of fertilization [Janczewski & Bablok 1985]. This is also the typical age at which the testes start to enlarge and pubic hair appears [Tanner 1962], and at which boys experience their first ejaculation and orgasm [Janssen 2007]. Sexual attraction, however, emerges in boys markedly earlier, at about the age of 10 years, probably as a result of a substantial increase of DHEAS (an androgenic hormone) at this time [Herdt & McClintock 2000]. This indicates that psychosexual development begins well before morphological and gonadal ones, and prepares an individual for mating behavior in further life. Bearing this in mind, the presently found similarity in the pattern of facial preferences between boys and men ceases to be so surprising.

Consistent with our second prediction, Pubertal Maturity, as measured by the presence of pubic hair at two sessions separated by ten months, was shown to influence facial preferences, although these relationships were statistically significant only at the second examination (i.e., in 12-year-old boys). Specifically, boys more advanced in biological development displayed stronger preferences for sexy, marital and friendly appearance and weaker preference for youthful appearance compared to less advanced boys. Moreover, the effects of Pubertal Maturity on sexy, marital and friendly appearance remained significant in multivariate analyses, where the age and several measures of psychosexual development were controlled for. This finding points to sex hormones as a possible causative factor of attractiveness perception development. These hormones are related to sexual drive [Regan 1999], and facial preferences by adults have been reported to depend on the level of androgens [Scarbrough & Johnston 2005; Welling *et al*. 2007, 2008], estrogens [Roney & Simmons 2008] and progesterone [Jones *et al*. 2008, Kościński in press]. The levels of all these hormones increase markedly during male puberty [Winter 1978]. Pubertal increase in testosterone level gives rise to male sexual desire and activity [Halpern *et al*. 1994, 1998], and the

increase in estrogen level may contribute to cognitive developmental changes [Williams 1998, Lebrun *et al*. 2005]. Hormonal changes at puberty reorganize the cerebral cortex [Sisk & Zehr 2005] and, supposedly, also the neural apparatus for facial perception [Diamond *et al*. 1983, McGivern *et al*. 2002]. We postulate, therefore, that the associations obtained between facial preferences and Pubertal Maturity in 12-year-old boys are underpinned by a concurrent increase in sex hormone levels. Pubertal development of the 11-year-old boys might have been, on average, not sufficiently advanced for these hormonal effects to have emerged, or, alternatively, the sample size was too small for these effects to be revealed.

More specifically, our prediction posited Pubertal Maturity to correlate with preferences for facial cues to high reproductive fitness, such as skin healthiness and sexy appearance (and possibly also marital appearance). In a previous study by Kościński[*], measures of pubertal maturity in early adolescent girls correlated with their preferences in male faces for supposed cues to good biological quality (specifically, skin healthiness, sexy and marital appearance) but not with the other preferences. Why, then, did Pubertal Maturity of the currently examined boys correlate with the preference for friendly appearance and not with preference for skin healthiness? Sexy and friendly appearances in the present study showed a 0.92 correlation which made it difficult for a judge to strongly prefer one of these traits while the other more weakly. In the previous study mentioned above[*] both qualities were only moderately correlated for male faces ($R = 0.46$), thus providing good grounds to prefer them differentially. As regards skin healthiness, conspicuous skin flaws (e.g., strong acne) were more frequent in male than female faces (probably as a result of women being more engaged with skin care than men). A scarcity of obviously unhealthy complexions might therefore be the reason that the present boys and men displayed relatively weak preference for skin healthiness, and Pubertal Maturity of boys did not correlate with the strength of this preference. Additionally, all the evaluated faces were from girls within a narrow age interval (19-25 years), which may also explain why male preferences for youthfulness were so low.

One may deliberate on whether the observed effects of pubertal maturity on facial preferences reflect changing preferences per se or, alternatively, improvement in facial processing. It has repeatedly been shown that the efficiency of facial processing temporarily *decreases* at the age of 11-12 years, which is ascribed to pubertal reorganization of the cerebral cortex [Diamond *et al*. 1983, Flin 1985, McGivern *et al*. 2002]. Because this mechanism would make the strength of facial preferences negatively related to pubertal maturity, it cannot be said to underlie the positive relationship between these variables in the present study. This suggests that the dependence of facial preferences on pubertal maturity reflects changes in the preferences themselves.

Romantic Experience was another variable associated with facial preferences. It predicted preferences for youthful, sexy, marital and friendly appearance in both boys' groups, and most of these effects remained significant while controlling for potential confounds. The multivariate analysis performed suggests that the effects of Romantic Experience were independent of biological development. The underlying mechanism of these effects is

[*] Kościński, unpublished data

not clear, though one can speculate that a boy who has/had a close relationship with a girl is informed by her about standards of female beauty, or that boys who are sociable and/or socially skilled associate with girls and, independently, learn standards of female beauty from society more frequently than other boys. Also, girls who form relationships with boys may be biologically more developed, and thereby possess a more mature face than average; so a preference for older-looking female faces may develop in romantically experienced boys due to the effect of exposure [Zajonc 2001].

Limitations and future directions

One potential problem with this study is that pubescent boys evaluated faces of adult women instead of girl peers, with whom they are better acquainted. However, Saxton *et al*. [2009*a*] presented the younger and the older groups of teenagers with faces of their respective peers for evaluation and got into interpretative difficulties in trying to decide whether differences in facial assessments by those groups stemmed from having different facial preferences or from differences in the faces being judged (the older ones were more mature than the younger ones). The boys examined in the present study were intended to be compared with adult men, hence the decision to show the same female faces to all males irrespective of their age. Our choice of adult faces was also legitimized by the fact that children at early adolescence recognize adults' faces as accurately as they do children's faces [Chung 1997]. Nevertheless, future research may gain from presenting both own-age and other-age faces to each group of participants.

Another limitation of the present study is that the sex hormones levels which are the putative causative factors of preference development, were inferred from pubic hair development declared by the studied subjects themselves. The inference would seem to be solid, however, because secondary sexual characteristics (including pubic hair) in boys at early adolescence are strongly correlated with testosterone level [Nottelmann *et al*. 1987]. In addition, the fact that Pubertal Maturity predicted facial preferences even when several psychosexual variables were statistically controlled for, challenges the suspicion that the participants' personality biased their reports on pubic hair presence and confounded the relationship between declared pubertal development and facial preferences. Nonetheless, although multivariate analyses controlling for age and psychosexual development supported the causal association between sex hormones and facial preferences, future research involving direct measuring of hormone levels may provide more reliable results.

Pubertal maturity was determined on the basis of only one trait in the present study (the presence of pubic hair at two sessions separated by ten months). This led to a measure of pubertal maturity that had only three values and was strongly negatively skewed. Future research on boys at early adolescence would therefore benefit from including additional indices such as axillary or facial hair. Furthermore, boys younger than 11 have not yet been investigated for preferences for the facial features used in present study. Research to address this issue would thus be welcome. Finally, a study similar to the present one but conducted on digitally manipulated faces (whose features are objectively controlled) would be valuable.

Conclusions

Previous research has shown that young teenagers perceive facial attractiveness in much the same way as adults. The present study has confirmed this and, for the first time, demonstrated that the similarity of early adolescent boys to men pertains not only to judgements of individual female faces but also to strengths of preference for particular facial features, including sexy look. This is also the first study that has shown an association between boys' pubertal maturity and preferences for opposite-sex faces. It has also shown that this association remained significant after controlling for age and psychosexual development, implying that sex hormones are involved in the progression of facial preferences at puberty.

The early development of the adult-like pattern of facial preferences would seem to be adaptive, as it prepares an individual for mating behavior in further life. The association of facial preferences with pubic hair development was found to be independent of age and psychosexual factors, suggesting that biological factors underlie this association. Taken together, the results support the psychoevolutionary view that the perception of facial attractiveness has to some extent, been molded in the course of biological evolution.

Notes

Acknowledgements The author wishes to thank his master students – Kamil Puzdrowski and Sebastian Świerzewski for collection of the data. He would also like to thank two anonymous reviewers for their helpful suggestions and comments on earlier versions of the manuscript.

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Streszczenie

Zagadnienie postrzegania atrakcyjności twarzy było już wielokrotnie podejmowane, jednak zdecydowaną większość badań przeprowadzono na osobach dorosłych. W rezultacie, o preferencjach dzieci wiadomo niewiele więcej ponad to, że oceniają atrakcyjność twarzy podobnie jak dorośli, i że stopień tego podobieństwa zwiększa się z wiekiem dziecka. Celem niniejszego badania było sprawdzenie, jakimi kryteriami oceny twarzy posługują się chłopcy na początku okresu pokwitania oraz czy kryteria te zmieniają się wraz z ich rozwojem biologicznym. Na gruncie psychologii ewolucyjnej, oczekiwano, że chłopcy bardziej zaawansowani w rozwoju biologicznym odznaczać się będą dojrzalszą percepcją atrakcyjności twarzy niż ich rówieśnicy.

Pięćdziesięciu trzech chłopców wzięło udział w dwóch identycznych sesjach badawczych w odstępie dziesięciu miesięcy. Ich średni wiek wynosił 11,7 lat podczas pierwszego badania i 12,5 lat podczas drugiego. W czasie badania, chłopcy rangowali zdjęcia twarzy 30 młodych kobiet według postrzeganej atrakcyjności oraz wypełniali ankietę diagnozującą poziom ich rozwoju biologicznego oraz psychoseksualnego. Zdjęcia przedstawiały twarze w widoku *en face*, bez ekspresji mimicznej, z nałożoną elipsoidalną maską, która zakrywała włosy i ubranie. Ze względu na wiek badanych, w ankiecie zapytano tylko o jedną cechę biologiczną – obecność

owłosienia łonowego, ponieważ pojawia się ona na samym początku pokwitania. Sześć pytań dotyczyło rozwoju psychoseksualnego: dbanie o wygląd, by podobać się dziewczynom, zwracanie uwagi na wygląd dziewczyn, lubienie dziewczyn, chęć chodzenia z dziewczyną, chodzenie z dziewczyną w przeszłości oraz aktualne chodzenie z dziewczyną. W celach porównawczych, atrakcyjność tych samych twarzy kobiet została oceniona przez stu mężczyzn (18-26 lat). Ponadto, osobne grupy mężczyzn oceniały te twarze pod względem kilku innych cech: młodzieńczość wyglądu, zdrowie skóry, pozytywny wyraz ust, seksowny wygląd, przyjacielski wygląd oraz „małżeński" wygląd (na jak dobrą kandydatkę na żonę wygląda dana kobieta).

Oceny atrakcyjności dokonane przez chłopców były wysoce zgodne z ocenami dorosłych mężczyzn (w każdej sesji R = 0,95). Co więcej, hierarchia ważności cech twarzy była u chłopców taka sama jak u mężczyzn: największy (choć nie tak duży jak u mężczyzn) wpływ na ocenę atrakcyjności miał seksowny wygląd, natomiast pozytywny wyraz ust (oznaka pozytywnego nastawienia i gotowości niesienia pomocy) miał niewielkie znaczenie (Fig. 1). Zaskakujący może wydawać się fakt, że biologicznie niedojrzałe osoby, w niemałym stopniu zależne bytowo od rodziców, posiadają tak dorosły sposób postrzegania atrakcyjności fizycznej. Obserwacja ta pozostaje jednak w zgodzie z wynikami innych badań, które pokazują, że rozwój psychoseksualny rozpoczyna się wcześniej niż morfologiczny i gonadalny (np. pociąg płciowy pojawia się u chłopców w wieku ok. 10 lat) i przygotowuje osobnika do zachowań partnerskich w dalszym życiu.

Dalsze analizy pokazały, że siła preferowania niektórych cech twarzy (seksownego, „małżeńskiego" i przyjacielskiego wyglądu) zależy od wieku biologicznego (oszacowanego na podstawie obecności owłosienia łonowego w dwóch sesjach badawczych) przy statystycznej kontroli wieku kalendarzowego oraz miar rozwoju psychoseksualnego (Tab. 1, Fig. 2). Sugeruje to, że rozwój percepcji atrakcyjności przynajmniej częściowo jest uwarunkowany czynnikami czysto biologicznymi. Czynnikami tymi najprawdopodobniej są hormony płciowe (androgeny i estrogeny), ponieważ wiadomo, że podczas pokwitania ich stężenie znacznie wzrasta, co powoduje nasilenie popędu płciowego oraz dojrzewanie kory mózgowej, w tym również ośrodków związanych z analizą twarzy. Ponadto, badania na osobach dorosłych dowiodły wpływu hormonów płciowych na preferencje dla twarzy. Wiadomo też, że reorganizacja kory mózgowej na początku pokwitania (w wieku 11-12 lat) prowadzi do czasowego spadku sprawności analizy twarzy, zatem zaobserwowane w niniejszym badaniu nasilenie preferencji dla niektórych cech twarzy należy uznać za objaw zmiany kryteriów preferencji, a nie skutek rozwoju zdolności poznawczych.

Niezależnie od wpływu wieku biologicznego, siła preferowania twarzy o seksownym, „małżeńskim" i przyjacielskim wyglądzie korelowała dodatnio również z doświadczeniem romantycznym chłopca (czy chodził lub aktualnie chodzi z dziewczyną; Fig. 3, 4). Przyczyna tej zależności nie jest jasna, można jedynie podejrzewać, że chłopcy, którzy są lub byli blisko związani z dziewczyną, byli przez nią informowani o standardach kobiecej urody, albo że chłopcy, którzy są towarzyscy i/lub sprawni społecznie stosunkowo często tworzą związki z dziewczętami, a także uczą się standardów atrakcyjności od społeczeństwa.

Podsumowując, rozwój dorosłego sposobu oceny atrakcyjności twarzy już na początku okresu pokwitania wydaje się adaptacyjny, ponieważ przygotowuje osobnika do zachowań partnerskich w dalszym życiu. Z kolei związek rozwoju owłosienia łonowego z preferencjami dla twarzy jest niezależny od wieku i czynników psychoseksualnych, co wskazuje na jego biologiczne (prawdopodobnie hormonalne) podłoże. Wyniki te wspierają więc psychoewolucyjne ujęcie preferencji głoszące, że sposób postrzegania atrakcyjności twarzy został, do pewnego stopnia, ukształtowany na drodze ewolucji biologicznej.