

Facial Preferences in Early Adolescent Girls: Pubertal Maturity Predicts Preferences Maturity

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ABSTRACT

Despite numerous studies on perception of facial attractiveness in adults, preferences in adolescents remain poorly recognized. The aim of present study was to explore facial preferences in girls at early adolescence (11–14 years old) and compare them with preferences of women. All females evaluated the same 30 male faces, which were also assessed by independent judges for several perceived features. Regardless of age, girls assessed attractiveness much the same as women, and the strengths of their preferences for specific facial features were similar to those of women. Except for the youngest girls, pubertal maturity (measured as the time elapsed since the menarche and breast development) correlated positively with the similarity of the girls' attractiveness evaluations to those of adult women and with strength of preference for cues to good biological quality (skin healthiness and sexy appearance). This remained true even after controlling for age and psychosexual development, suggesting thus that sex hormones are involved in development of facial preferences in pubescent girls.

Key words: facial attractiveness, preference, development, puberty, sex hormones

Introduction

Research on facial attractiveness has become very popular in last decades and a growing body of evidence indicates that the perception of physical attractiveness has been moulded by natural selection so that the pursuit of and contact with individuals perceived as attractive is beneficial for one's reproductive success^{1,2}. Facial attractiveness is related to an individual's biological quality, specifically, genotype³, physical⁴ and reproductive fitness⁵ and resistance to infections⁶. Attractive people are favorably treated in many social situations, are desired for dating, sex and marriage, have more sexual partners in their lifetime, and attractive women marry at a younger age and less frequently remain unmarried^{2,7}. Finally, facially attractive men and women have greater reproductive success^{8–11}.

Despite numerous studies on perception of facial attractiveness in adults, preferences in adolescents remain poorly understood. It is currently known that children at ages 7 to 17 evaluate facial attractiveness similarly as adult do^{12,13} and that intra-group consistency in attractiveness evaluations, although being lower in children than in adults, gradually increases with increasing age of

children^{13,14}. However, the mechanisms governing the development of facial preferences in childhood and adolescence remain largely unknown.

Little et al.¹⁵ observed that digitally masculinized male faces were preferred more strongly by women within reproductive age range than by pubescent girls or postmenopausal women and argued that these effects derived from changes in hormonal profile throughout the female life. Cooper et al.¹⁶ 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 peers' 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.¹⁶ 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.¹⁷ observed that early adolescent girls and boys attending single-sex schools (thus mainly exposed to own-sex faces) preferred, respectively, more feminine and masculine faces, compared with counterparts attending mixed-sex schools.

Saxton et al.¹⁸ tested the hypothesis of hormonal impact on preferences by checking whether pubertal development of 11- and 13-year-old girls and boys correlate with preferences for facial symmetry, geometric typicality and femininity (digitally manipulated faces of their respective peers were presented for evaluation). No correlation was found between pubertal maturity of girls and boys and their evaluations of opposite-sex faces, although boys' pubertal development correlated with their preferences for male facial masculinity. In a similar study, Saxton et al.¹⁹ found that in 12–14 year-old boys and girls (analyzed together), pubertal maturity was positively related to preference for facial symmetry. It is, however, difficult to say whether this reflects the development of preferences per se or improvement of asymmetry detection. If efficiency in asymmetry detection improves with pubertal development, an individual may display an increasingly strong preference for symmetry in a psychological test even when his/her actual liking for symmetry remains unchanged.

Kościński²⁰ found in 13-year-old girls that the time elapsed since the menarche and breast development 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. Although these results suggest the role of biological (hormonal) factors for development of adult-like facial preferences, the author did not control for social factors which could possibly have confounded the result^{21,22}. For example, biologically more developed children may be treated more as adults by others and be expected to behave in more mature manner, which may consequently stimulate the development of their preferences. Kościński²³ found that in 11–13 year old boys pubertal maturity (calculated on the basis of development of pubic hair) positively correlated with strength of preference for sexy- and friendly-looking female faces (as assessed by adult men). 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.

In the present study, we attempted to provide more evidence for the impact of pubertal maturity on development of adult-like facial preferences. Two female groups were analyzed. The first one consisted of 13–14 year-old girls previously examined by Kościński²⁰, in order to verify the results obtained in that study by a more restrictive analysis. Because those girls perceived facial attractiveness much the same as adult women, we were also interested in facial preferences by somewhat younger girls. Therefore, the second group consisted of girls of

ages 11–13. In addition, attractiveness evaluations by young women were used as the reference point for the assessments provided by the girls. All pubescent girls and women rated the same 30 male faces according to the same methodology, thus making the answers provided by these groups comparable. Separate groups of women also assessed all 30 male faces for perceived age, skin healthiness, mouth positivity and suitability for short-term relationship, long-term relationship and friendship. This enabled comparison of the girls with women in respect of preference for each of the assessed facial features. The girls also filled in a questionnaire regarding their pubertal and psychosexual development. Their psychosexual development and chronological age were then statistically controlled for in analyses aimed at revealing the effects of pubertal maturity on facial preferences.

The level of sex hormones increases enormously during female puberty²⁴, and these hormones then stimulate pubertal maturation²⁴, give rise to sexual desire and activity^{22,25}, and influence neurocognitive development²⁶ including the neural apparatus for facial perception^{27,28}. The hormones also influence facial preferences in adults^{29–33}. We therefore predict that pubertal maturity will correlate positively with the similarity of the girls' attractiveness evaluations to those of adult women.

Puberty is the period when a girl becomes fertile and it is only from that time onwards that she may obtain genetic benefits from sex with a man. Pubertal maturity may then correlate with strength of preference for cues to good genes and good biological quality. One such cue may be the perceived suitability for a short-term bond because adult women's preference for cues to high genetic quality in male faces is stronger in the context of a short-term rather than a long-term bond^{34–36}. Another cue to good genes may be skin healthiness³⁷. We therefore predict that pubertal maturity will correlate with strength of preference for perceived suitability for short-term bonds and skin healthiness. On the other hand, we do not predict any specific relationship between pubertal maturity and strength of preference for facial cues to good personality, namely, mouth positivity and perceived suitability for friendship^{35,38}.

Materials and Methods

Participants

Two female groups were analyzed: the group of 11–13 year-old girls was recruited for purposes of the present study, while 13–14 year-old girls and adult women were already assessed in our previous work^{20,39}. The youngest group consisted of 35 girls aged 11.2–12.3 ($M=11.7$), examined in 2008 from February to April. The same 35 girls were also assessed a year later (from Dec-2008 to Jan-2009) when they were aged 12.0–13.0 ($M=12.5$). The girls were pupils of three elementary schools in Poznan and Leszno, both relatively large Polish cities. They underwent equivalent procedure in both examinations. This design was intended to reveal a change in facial preferences over a year period. Another group comprised

64 girls aged 13.2–14.2 ($M=13.6$) who were recruited from two secondary schools in Poznan and who were examined in January and February of 2007. This group was originally analyzed in our previous work. For the sake of brevity, the three sample groups of girls will henceforth be referred to as GIRLS-11, GIRLS-12, and GIRLS-13, respectively. Attractiveness assessments by 261 nonpregnant women (aged 16.6–34.3, $M=22.3$) served as the reference point for girls' judgements. They were mainly college students in Poznan and were recruited in student hostels and lecture buildings. Informed consent was provided by all participants and, in the case of girls, also by their parents, class tutors and school headmasters. All participants were of European origin.

Procedure

All participants viewed the same full-face color photographs of 30 clean-shaven male students (19–25 years old, of European origin). The photographs were taken with a digital camera (Panasonic DMC-FZ18, 8.1MPx); subjects were illuminated with fluorescent light with no flash. The male 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, 7×7cm). Preliminarily, all 30 faces were ranked by four other young women (22–30 years old), 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 with regard to attractiveness, and distribution of extraneous facial features was balanced across the sets of faces.

All the groups of judges, girls and women, evaluated attractiveness in the following way: Each participant was provided with one of the three stimuli sets, with the series order within the set balanced between the judges. Ten photos (i.e., one series) were taken from an envelope and laid out in front of 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, all three facial series were viewed one by one; each participant thus assessing all 30 faces. We applied the ranking method instead of ratings on a numerical scale because ranking may be a more precise method than rating⁴⁰.

After completion of the attractiveness evaluations, the girls were asked to fill in a questionnaire. Apart from several demographic items it focused on biological and psychosexual development. Two items addressed biological maturity. Firstly, all girls supplied the age of their menarche, if any. This served to gauge gynecological age,

i.e., time elapsed since the menarche. Secondly, from among five drawings depicting stages of female breast development⁴¹, the girls indicated the one best corresponding to their own breasts. (Their biology teacher had familiarized them with these stages beforehand).

As regards psychosexual development, GIRLS-11 and GIRLS-12 answered the following questions: »Do you care about your appearance so to appeal to boys?« (coded from 0 – »No«, to 3 – »Yes! A lot!«), »What is your attitude to boys?« (coded from 0 – »I don't like boys and avoid them«, to 3 – »I like them and associate with them willingly«), »Do you pay attention to boys' appearance?« (coded from 0 – »I don't care how they look«, to 3 – »Yes, I like to gaze at the best-looking ones very much!«), »Have you ever gone out with a boy?« (coded as 0 for »No«, and 1 for »Yes«), »Do you currently go out with a boy?« (coded as 0 for »No«, and 1 for »Yes«), »Would you like to go out with a boy?« (coded from 0 – »No«, to 3 – »Yes! A lot!«). GIRLS-13 answered a similar set of questions but which did not include the »What is your attitude to boys?« item, and instead of a four-level scale of answers had a three-level scale (No / Somewhat / Yes).

Auxiliary facial evaluations

Several independent groups of young women (20–21 years of age, university students) evaluated the stimulus faces in respect of perceived age ($N=19$), skin healthiness ($N=34$), mouth positivity ($N=15$), and suitability for short-term relationship ($N=40$), long-term relationship ($N=40$) and friendship ($N=40$). The women 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. 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. These skin patches were extracted using Adobe Photoshop software and placed next to one another so as to obtain the image to be assessed. Mouth positivity was rated on a scale from one (»distinct discontent – sadness or anger«) to five (»distinct content«) on the basis of a cutting containing the lips' region. Evaluations of these six features had good reliabilities (all Cronbach's alphas ≥ 0.88), and were therefore averaged across all raters, yielding estimates of youthfulness, skin healthiness, mouth positivity, and suitability for short-term relationship, long-term relationship, and friendship for each face. For purposes of brevity, the last three characteristics mentioned above will henceforth be referred to as sexy, marital and friendly appearance, respectively. Table 1 presents the intercorrelations among the facial evaluations.

Data treatment

Facial attractiveness may be regarded as normally distributed⁴² while ranks are, by definition, uniformly distributed. Therefore, the rank values of facial attractiveness (from 1 to 10) collected from raters were trans-

TABLE 1
PEARSON CORRELATIONS BETWEEN FACIAL EVALUATIONS (ABOVE THE DIAGONAL) AND THEIR P-LEVELS¹
(BELOW THE DIAGONAL; N = 30)

	(1)	(2)	(3)	(4)	(5)	(6)
(1) Skin healthiness		-0.01	-0.17	0.54	0.41	0.07
(2) Mouth positivity	0.951		0.09	0.17	0.33	0.65
(3) Youthfulness	0.380	0.653		-0.13	-0.13	-0.08
(4) Sexy appearance	0.002	0.376	0.499		0.89	0.46
(5) Marital appearance	0.023	0.075	0.481	0.000		0.75
(6) Friendly appearance	0.701	0.000	0.667	0.010	0.000	

¹ For these 15 tests, the Bonferroni-corrected p-value is $0.05/15 = 0.0033$.

formed into standard normal values. The applied formula was $\Phi^{-1}[(\text{rank}-3/8)/(10+1/4)]$, where Φ^{-1} is the inverse standard normal cumulative distribution function⁴³. 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 to make their distribution normal-like, and thereby parametric tests applicable⁴⁴. The strength of preference for each facial feature characteristic for each female group was calculated as the mean of the group members’ strength of preference for the feature. In addition, Maturity of Preferences was calculated for each girl as the correlation of facial assessments by the girl with average assessments by women.

Among GIRLS-13 only four individuals (6%) were premenarchal. Gynecological age, i.e., the time elapsed since the menarche, was then estimated for each girl. The value of »-1 month« was assigned to premenarchal girls, as if they were one month before menarche. On the other hand, only six individuals (17%) among GIRLS-11 and 17 individuals (49%) among GIRLS-12 were postmenarchal, which made the calculation of gynecological age pointless. We thus defined the menarchal index, which took the value of 1 for those 17 girls who were postmenarchal at the second examination, and the value of 0 for the remaining 18 girls who were not.

Next, factor analysis with varimax rotation was performed on the variables related to biological and psychosexual development. Two factors emerged for GIRLS-13: the first one accounted for 28.9% of the total variance and was highly loaded by care about own appearance so as to appeal to boys (a factor loading of 0.81) and the desire to go out with a boy (0.73) – further, Psychosexual Development, and the second one accounted for 26.0% of the variance and was highly loaded by gynecological age (0.85) and breast development (0.77) – further, Pubertal

Maturity. Another factor analysis was conducted on the averages from responses provided at the first and second examination by the younger female group (the averaging was legitimized by the fact that none of psychosexual variables has changed significantly between sessions; all $ps > 0.14$ according to Wilcoxon signed-rank test). This came down to three factors: (1) the first one accounted for 22.9% of the total variance and was loaded mainly by care about own appearance so as to appeal to boys (a factor loading of 0.61), the desire to go out with a boy (0.87), and by currently going out with a boy (0.62) – and, further, Psychosexual Development-1, (2) the second one accounted for 19.9% of the variance and was highly loaded by liking of boys (0.77), gazing at them (0.71), and previous going out with a boy (0.62) – Psychosexual Development-2, (3) the third one accounted 19.6% of the variance and was loaded predominantly by menarchal index (0.83) and breast development (0.87) – Pubertal Maturity.

Five individuals from GIRLS-13 group were excluded from further analysis because their attractiveness ratings correlated poorly with their peers’ ratings ($r < 0.3$),

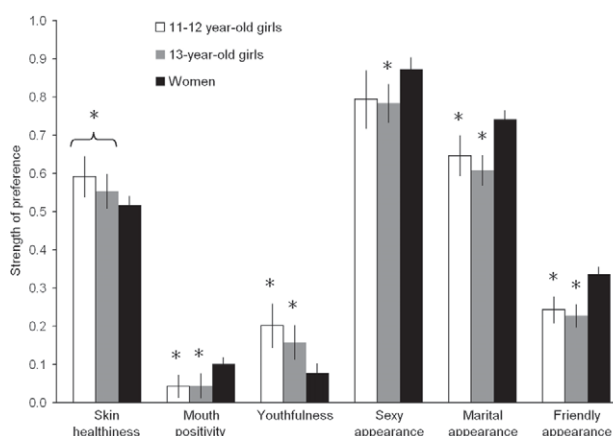


Fig. 1. Strengths of preference for facial features by examined female groups. Error bars indicate 95% confidence intervals. Asterisks indicate groups of girls that significantly differ from women ($p < 0.05$ according to Tukey’s test). In the case of preference for skin healthiness, the asterisk indicates significant difference in the planned comparison between women and both girls’ groups taken together.

which is, according to the author's experience, indicative of negligent performance. No girl was omitted in the analysis of GIRLS-12, while one girl was omitted in the analysis of GIRLS-11 because of the negative correlation of her judgments with her peers' average judgments ($r=-0.01$). The relatively high incidence of purported negligent performance among GIRLS-13 concurs with an abrupt increase of pupil unruliness after their transition from primary to secondary schools in Poland⁴⁵. Another two girls provided data indicating distinctly low age of menarche, 9.84 and 10.08 years, which corresponded to z-scores of -3.0 and -2.7 according to Polish large-city standards⁴⁶. Values below -2.5 are indicative of precocious puberty⁴⁷, so these girls were omitted in further analysis. Finally, we excluded a girl that provided several dubious answers (indicating, for example, her mother being only 15 years older than herself). The exclusion procedure narrowed the GIRLS-13 group to 56 subjects.

Results

Facial preferences by female groups

Pearson correlation coefficients between average evaluations of faces by GIRLS-11, GIRLS-12 and GIRLS-13 and average women's assessments were 0.96, 0.96 and 0.95, respectively, revealing a marked similarity between girls' and women's perception of male facial attractiveness. Strengths of preference for facial features by each female group are shown in Fig. 1. It is clear from this that the most important criteria of facial evaluations by every female group were skin healthiness, sexy appear-

ance and marital appearance. The importance of friendly appearance, mouth positivity and youthfulness was substantially lower.

T-test for dependent samples revealed no difference between GIRLS-11 and GIRLS-12 in preference for any facial feature or Maturity of Preferences (all $|t| < 1.6$, all $ps > 0.13$). No change in facial preferences was thus found over a year period in those girls. To test equality of strengths of preference for a facial feature by female groups, we conducted a series of one-way ANOVAs with facial feature as dependent variable and female group as independent variable. Because GIRLS-11 and GIRLS-12 were dependent samples, the average values from two sessions were taken into the analysis (further, GIRLS-11/12). Significant results were revealed for mouth positivity ($F_{2,348}=6.20$, $p=0.002$), youthfulness ($F_{2,348}=8.44$, $p<0.001$), sexy appearance ($F_{2,348}=4.31$, $p=0.014$), marital appearance ($F_{2,348}=14.83$, $p<0.001$), and friendly appearance ($F_{2,348}=17.35$, $p<0.001$). The effect for skin healthiness was only marginally significant ($F_{2,348}=2.82$, $p=0.061$).

The equality between pairs of female groups was then tested with Tukey's test. This revealed the following differences (see also Fig. 1): Mouth positivity was preferred more strongly by adult women than by GIRLS-11/12 ($p=0.044$) and GIRLS-13 ($p=0.010$), youthful appearance was preferred less strongly by adult women than by GIRLS-11/12 ($p=0.002$) and GIRLS-13 ($p=0.017$), sexy appearance was preferred more strongly by adult women than by GIRLS-13 ($p=0.029$), marital appearance was preferred more strongly by adult women than by GIRLS-

TABLE 2
PEARSON CORRELATIONS BETWEEN PUBERTAL AND PSYCHOSEXUAL DEVELOPMENT INDICES AND STRENGTHS OF PREFERENCE FOR FACIAL FEATURES AND MATURITY OF PREFERENCES IN EXAMINED GROUPS OF GIRLS

Preference for:	Skin healthiness	Mouth positivity	Youthfulness	Sexy appearance	Marital appearance	Friendly appearance	Maturity of preferences
11-year-old girls							
MENARCHE	0.24	0.03	-0.09	0.18	0.27	0.14	0.21
BREASTS	0.12	-0.22	-0.04	0.19	0.21	-0.02	0.17
PSYCHO-1	0.22	0.23	-0.08	0.18	0.09	-0.07	0.06
PSYCHO-2	0.19	0.14	-0.22	0.30	0.37*	0.21	0.34*
12-year-old girls							
MENARCHE	0.43**	0.08	-0.16	0.32†	0.37*	0.25	0.38*
BREASTS	0.07	0.10	-0.21	0.01	0.02	0.07	0.04
PSYCHO-1	0.18	-0.03	-0.07	0.15	0.04	-0.19	0.19
PSYCHO-2	0.19	0.20	-0.18	0.25	0.34*	0.42**	0.26
13-year-old girls							
MENARCHE	0.26†	0.11	0.14	0.27*	0.34***	0.26*	0.31*
BREASTS	0.19	-0.21	0.07	0.34**	0.29*	0.05	0.32**
PSYCHO	-0.01	-0.10	-0.10	-0.12	-0.14	-0.21	-0.06

MENARCHE – time elapsed since the menarche, BREASTS – stage of breast development, PSYCHO-1, PSYCHO-2 and PSYCHO – indices of psychosexual development (see the text for details).

† – $p<0.06$, * – $p<0.05$, ** – $p<0.02$, *** – $p<0.01$.

11/12 ($p=0.012$) and GIRLS-13 ($p < 0.001$), friendly appearance was preferred more strongly by adult women than by GIRLS-11/12 ($p=0.001$) and GIRLS-13 ($p < 0.001$). Although the ANOVA test revealed only marginally significant effect of female group on preference for skin healthiness, a planned comparison between women and all girls altogether was carried out. This difference proved significant ($F_{1,348}=5.44$, $p=0.020$), indicating that the preference is stronger in girls than women. Note that GIRLS-11/12 did not differ from GIRLS-13 in respect of preference for any facial feature.

Pubertal development and maturity of preferences

Our main prediction was that girls' pubertal maturity correlates positively with maturity of their facial preferences (i.e. with the similarity of their attractiveness evaluations to those of adult women). We thus first conducted a general linear model (GLM) analysis with Maturity of Preferences as dependent variable and Pubertal Maturity, age and group (GIRLS-11/12 and GIRLS-13) as independent variables. The analysis revealed only one significant effect, specifically, Pubertal Maturity was positively related to Maturity of Preferences (standardized $\beta=0.31$, $p=0.005$). Next, we went on to a more detailed analysis of relationships between pubertal development and facial preferences.

Table 2 presents Pearson correlations between measures of biological and psychosexual development, and Maturity of Preferences and strengths of preference for facial features. As can be seen from it, preferences by GIRLS-11 did not depend on Pubertal Maturity. In GIRLS-12, the Maturity of Preferences and the preference for skin healthiness, sexy appearance, and marital appearance were greater in those girls who were post-menarchal at the second examination, as opposed to premenarchal ones. Interestingly, no associations between facial preferences and the stage of breast development were found. In GIRLS-13, however, both measures of biological maturity were related to facial judgments: the time elapsed since the menarche positively correlated with Maturity of Preferences, the preference for sexy appearance, marital appearance, friendly appearance, and marginally with the preference for skin healthiness. Breast development was positively associated with Maturity of Preferences, and preferences for sexy and marital appearance. Several effects of psychosexual development also emerged: Psychosexual Development-2 positively correlated with Maturity of Preferences and the preference for marital appearance in GIRLS-11, and with preferences for marital and friendly appearance in GIRLS-12.

To estimate the unique contributions of biological and psychosexual development to facial preferences, a series of GLM analyses was conducted separately for each girls' group. The dependent variable was Maturity of Preferences or the strength of preference for a facial feature. In GIRLS-11 and GIRLS-12, independent variables were age, menarchal index, the stage of breast development, two indices of psychosexual development, and the terms for interaction between menarchal index and each index

of psychosexual development. In GIRLS-13, independent variables were age, Pubertal Maturity, Psychosexual Development, and the term for interaction between these indices. We decided to take Pubertal Maturity as encompassing both gynecological age and breast development instead of both these variables separately, because they seemed to be partly redundant: they correlated with each other at 0.41 ($p=0.002$), and revealed similar pattern of relationships with facial preferences. In GIRLS-11 and GIRLS-12, however, both variables were introduced into the analysis separately because they differently correlated with facial preferences (see Table 2).

The analysis revealed no significant effects of any predictor variable on any criterion variable in GIRLS-11 (all $p>0.05$). In GIRLS-12, however, menarchal index proved a significant predictor of the preference for skin healthiness ($\beta=0.42$, $p=0.047$, all reported β s are standardized) and marital appearance ($\beta=0.48$, $p=0.028$), and a marginally significant predictor of the preference for sexy appearance ($\beta=0.41$, $p=0.073$) and Maturity of Preferences ($\beta=0.42$, $p=0.057$). Psychosexual Development-1 contributed to the preference for friendly appearance ($\beta=-0.47$, $p=0.048$), and Psychosexual Development-2 was marginally significant predictor of the preference for marital ($\beta=0.59$, $p=0.077$) and friendly appearance ($\beta=0.56$, $p=0.086$). No other effects were observed. In GIRLS-13, Pubertal Maturity significantly predicted Maturity of Preferences ($\beta=0.30$, $p=0.028$), the preference for sexy appearance ($\beta=0.30$, $p=0.026$), marital appearance ($\beta=0.31$, $p=0.023$), and, marginally, preference for skin healthiness ($\beta=0.24$, $p=0.089$). No significant effects of age, Psychosexual Development, or the interaction term were observed.

Discussion

The present study has shown that 11–14 year-old girls perceive facial attractiveness much the same as adult women do, which is consistent with previous research^{12,13}. More importantly, this study is first to demonstrate that the structure of facial preferences is very similar between girls at early adolescence and adult women. The most and second most strongly preferred facial features by girls and women were sexy and marital appearance, respectively. Girls preferred both features only slightly less strongly than adult women did. Furthermore, preferences for mouth positivity and friendly appearance were lower in girls than in women. Even though the efficiency of facial processing at early adolescence is lower than in adult women^{27,28,48}, it seems doubtful that poor facial processing could have accounted for the results, because recognition of mouth appearance is a relatively easy task (requires only featural, not configural, processing), which is efficiently performed by children⁴⁹. This implies that facial signals of readiness for supportive behaviors are simply not much valued by girls at early adolescence.

The average age of menarche in Polish urban girls is 13.1 years⁴⁶ and the first ovulation occurs about three

years after menarche⁵⁰. This means that many years before becoming fertile girls display strong preference for sexy appearance, i.e. the preference apparently relevant only for fertile females. This phenomenon however seems functional, or at least was so in the evolutionary past. Pubic hair, breasts and the hourglass figure begin to develop many months before menarche^{41,51,52}, such that even premenarchal girls may be sexually appealing to men. Visually mature but still infertile girls can attract men and trade sex for meat, protection and other goods without a risk of impregnation^{53,54}, as is practiced in hunter-gatherer populations⁵⁵. Physical cues to maturity in still infertile female adolescents and the subsequent attraction of males also occur in many catarrhine primates⁵⁶. Moreover, premenarchal girls have an early opportunity to accrue experience in relationships with men, which would assist in their later partner choices⁵³. The experience may modify facial preferences in a functional manner: experiments have shown that, if among previously seen faces, a facial feature coexists with a negative stimulus (e.g. a harsh personality), then the observer will develop an aversion for other faces possessing that feature⁵⁷.

Skin healthiness and youthful appearance were preferred more strongly by girls than women. One reason for this finding may be the exposure effect. Male faces most frequently seen by pubescent girls belong to younger individuals than those seen most frequently by adult women, and this may result in girls preferring youthful appearance more strongly than women¹⁷. Skin smoothness (i.e., lack of wrinkles) and uniformity of color distribution are greater in faces of young teenagers than young adults^{58,59}, and both influence assessments of facial health and attractiveness^{58,60}. The exposure effect may therefore make young women more tolerant of skin flaws compared with girls.

In accordance with our predictions, the advancement of pubertal development in 12–14 year-old girls, as measured by the time elapsed since the menarche and the stage of breast development, was related to facial preferences. Biologically more mature girls were more similar in their facial assessments to adult women than their biologically less advanced peers. More specifically, these girls displayed stronger preferences for cues to good biological quality, such as skin healthiness and sexy appearance, but not for cues to good personality – mouth positivity and friendly appearance. All these effects remained significant (or marginally significant) in multivariate analyses, in which age and psychosexual development were controlled for. This points to sex hormones as possible factors of attractiveness perception. Facial preferences by adults have been reported to depend on the level of androgens^{29–31}, estrogens³² and progesterone³³. The levels of all these hormones increase markedly during female puberty²⁴. Estrogen levels rise as the menarche approaches, strongly predict the age of menarche^{50,61–63} and stimulate breast development^{64,65}. Pubertal increase in testosterone level gives rise to female sexual desire and activity^{22,25}, and the increase in estrogen level may

contribute to cognitive developmental changes^{66,67}. Hormonal changes at puberty reorganize the cerebral cortex²⁶ and, supposedly, also the neural apparatus for facial perception^{27,28}. We therefore postulate that the associations obtained between facial preferences and pubertal development of 12–14 year-old girls are underpinned by the concurrent increase of sex hormone levels. Such associations were not observed in 11-year-old girls (although nonsignificant trends were present; see Table 2), probably because of pubertal development being relatively weakly advanced at that age yet.

No effects of chronological age on the girls' perception of attractiveness were found, neither in between-group nor within-group analyses. This supports our claim that biological age is a more important factor of facial preferences than chronological age. A couple of significant correlations between psychosexual development (particularly the liking and gazing at boys) and facial preferences were obtained, but most of these lost significance when the biological development was statistically controlled for. This suggests that the association between liking and gazing at boys and facial preferences was mediated by biological development. Specifically, the increase of sex hormones during puberty may act upon brain development and thereby influence attitudes toward boys and the perception of male attractiveness.

Finally, it needs to be explained why preferences by GIRLS-12 were related only to menarchal index but not to breast development, while in GIRLS-13 both gynecological age and the stage of breast development were associated with facial preferences. Girls who develop breasts at relatively young age stand out with their perceptible bust against their peers. This provokes crude and sexual jokes from their family members, boy peers and older males^{68,69}. These behaviors are very stressful for girls and may disturb their normal psychosexual development even for years⁶⁹. A disturbance of preferences development in these girls seems all the more probable given that studies conducted on adults have shown that facial preferences are dependent on mood^{39,70}, anxiety⁷¹ and feelings of threat^{72,73}. We propose therefore that the association between breast development and preferences is mediated not only by biological factors (sex hormones) but also by many psychosocial factors, including amount of teasing endured, parental support and the girl's sensitivity⁶⁹. Consequently, the biologically based association between breast development and facial preferences may be obscured by confounding psychosocial factors. For this reason, the perception of facial attractiveness by GIRLS-12 was shown to be related to menarchal index but not to breast development. Preferences by GIRLS-13, however, correlated with both gynecological age and the stage of breast development. This indicates that mediation of the breast-preferences relationship by the psychosocial pathway is substantially weakened at that age. Two mechanisms could underlie this change. First, conspicuous breasts are more frequent at age 13–14 years than at 12–13 years, hence a busty girl at age 14 does not stand out from her peers. For example, the first and sec-

ond stage of breast development (i.e., none, or minute breast elevation) were reported by 40% of GIRLS-12 and only 22% of GIRLS-13. Second, the examined GIRLS-12 attended elementary schools where the sight of a busty girl was infrequent, while GIRLS-13 attended secondary schools where busty girls constituted a majority. This may lessen teasing behaviors from males and reduce stress in girls with developing breasts. In accordance with our proposal, Williams & Currie⁷⁴ found among 11-year-old girls that those who were biologically more mature had lower self-esteem than their less developed peers, and that this was mediated by their body image. Conversely, among 13-year-old girls low self-esteem was more frequent in the biologically less developed girls.

Limitations and future directions

One potential problem of this study is that pubescent girls evaluated faces of adult men (aged 19–25) instead of boy peers, with whom they were better acquainted. However, Saxton et al.¹⁸ presented the younger and the older groups of teenagers with faces of their respective peers for evaluation and got into interpretative troubles: whether differences in facial assessments by those groups stemmed from having different facial preferences or from the differences in faces being judged (the older ones were more mature than the younger ones). The girls examined in the current study were intended to be compared with adult women, hence the decision to show the same male faces to all females 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 children's faces⁷⁵.

Another limitation of the present study is that sex hormones' levels which are the putative causative factors of preference development, were inferred from physical correlatives declared by the studied subjects themselves. Although the causal association between sex hormones and facial preferences was supported by multivariate analyses that controlled for age and psychosexual development, future research involving direct measuring of hormone levels may provide more reliable results. Furthermore, girls younger than 11 have not yet been investigated for preferences of the facial features used in present study. Research to address this issue would also be welcome. Finally, facial characteristics different from

those surveyed here (e.g. gaze direction⁷⁶) also influence attractiveness, but development of preferences for these has not been studied yet.

Conclusions

Previous research has shown that young teenagers perceive facial attractiveness in much the same way as adults. The present study confirmed this for early adolescent girls and demonstrated that this similarity pertains not only to judgements of individual male faces but also to strengths of preference for particular facial features, including sexy appearance. This study also found a clear-cut association between pubertal development and preferences for opposite-sex faces. This was possibly facilitated by focusing on those facial features possessing direct social relevance, such as skin healthiness or sexy appearance. Findings by Saxton et al.^{18,19} are more equivocal – they were focused on facial averageness, symmetry and sex-typicality, and the perception of these features may depend more on efficiency of facial processing or exposure effects than on puberty-related changes in hormone levels and the brain. The presently shown associations between preferences and pubertal maturity remained significant even after controlling for age and psychosexual development, which implies that sex hormones are involved in the progression of facial preferences at puberty. Since the way in which hormones operate has been evolutionarily established, the results also contribute to evidence for an evolutionary basis of attractiveness perception. At the same time, other than hormonal factors of adolescent preferences should not be dismissed: exposure to faces of peers may modify the preference for youthful appearance and skin healthiness, and social stress may hamper development of adult-like preferences. Therefore, both biological and environmental factors seem to influence adolescents' facial preferences.

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PREFERENCIJE LICA DJEVOJAKA U RANOJ ADOLESCENCIJI: PUBERTETNA ZRELOST PREDVIĐA ZRELOST ODABIRA

SAŽETAK

Unatoč brojnim studijama o percepciji privlačnosti lica u odraslih, preferencije u adolescenata slabo su istraživane. Cilj ovog rada bio je istražiti preferencije lica djevojaka u ranoj adolescenciji (11–14 godine starosti) te ih usporediti sa onima od žena. Sve su žene ocijenile istih 30 muških lica, koja su također ocijenili i nezavisni procjenitelji. Bez obzira na dob, djevojke procjenjuju privlačnost slično kao i žene, te je jačina njihove sklonosti za određene crte lica slična kao onima u žena. Osim za najmlađe djevojčice, pubertetna zrelost (mjerena kao rast grudi i vrijeme proteklo od zadnje menstruacije) u pozitivnoj je korelaciji sa sličnošću djevojačkih ocjena atraktivnosti i onima u odraslih žena, te sa jačinom preferencija za znakove dobre biološke kvalitete (zdravlje kože i seksi izgled). Ovaj odnos važi i nakon kontrole za dob i psihoseksualni razvoj što sugerira da su spolni hormoni uključeni u razvoj preferencija lica u pubertetnih djevojaka.