Effects of Parental Socio-Economic Conditions on Facial Attractiveness

Susanne Huber, Department of Anthropology, University of Vienna, Vienna, Austria. Email: Susanne.huber@univie.ac.at (corresponding author).

Martin Fieder, Department of Anthropology, University of Vienna, Vienna, Austria.

Abstract: Socio-economic conditions during early life are known to affect later life outcomes such as health or social success. We investigated whether family socio-economic background may also affect facial attractiveness. We used the Wisconsin Longitudinal Study (n = 8434) to analyze the association between an individual’s parental socio-economic background (in terms of father’s highest education and parental income) and that individual’s facial attractiveness (estimated by rating of high school yearbook photographs when subjects were between 17 and 20 years old), controlling for subjects’ sex, year of birth, and father’s age at subjects’ birth. Subjects’ facial attractiveness increased with increasing father’s highest educational attainment as well as increasing parental income, with the latter effect being stronger for female subjects as well. We conclude that early socio-economic conditions predict, to some extent, facial attractiveness in young adulthood.

Keywords: facial attractiveness, early life conditions, socio-economic status

Introduction

Socio-economic conditions during early life have been shown to affect adult traits such as health or social success (e.g., Bosma, van de Mheen, and Mackenbach, 1999; Kestilä et al., 2005; Marmot, Shipley, Brunner, and Hemingway, 2001). These effects seem to be independent of adult socio-economic status (SES) (e.g., Blane et al., 1996; Braveman et al., 2005; Galobardes, Lynch, and Smith, 2004; Power, Matthews, and Manor, 1998; Rahkonen, Arber, and Lahelma, 1995). In addition, children from a low SES background show different growth patterns compared to children from high SES families (Silva et al., 2012). Even overall mortality is associated with socio-economic circumstances during childhood, again independent of adult socio-economic position (e.g., Beebe-Dimmer et al., 2004; Davey Smith, Hart, Blane, and Hole, 1998; Galobardes et al., 2004; Kuh, Hardy, Langenberg, Richards, and Wadsworth, 2002; Vagero and Leon, 1994).
Hope et al. (2013) only recently demonstrated that facial symmetry in adulthood was likewise lower if socio-economic status in early life was poorer. As symmetry is an important component of facial attractiveness (Grammer and Thornhill, 1994), we hypothesized that facial attractiveness might be affected by family socio-economic background. A potential influence of early life conditions seems plausible because facial attractiveness is thought to reflect developmental stability, resistance to pathogens, and a low mutation rate (Thornhill and Gangestad, 1999).

We investigated whether early life conditions in terms of socio-economic background (i.e. father’s education and parental income) may affect facial attractiveness in young adulthood while controlling for subjects’ sex, year of birth, as well as father’s age at subjects’ birth. We controlled for paternal age because we recently showed a significant effect of father’s age at subjects’ birth on facial attractiveness (Huber and Fieder, 2014). We used the Wisconsin Longitudinal Study for our analyses as it is one of the most comprehensive existing longitudinal studies, tracing the life of several thousand individuals. In addition, the suitability of this dataset for research on attractiveness has been previously demonstrated (Huber and Fieder, 2014; Jokela, 2009).

Materials and Methods

The Wisconsin Longitudinal Study (WLS) is a long-term study of a random sample of 10,317 men and women, born in the years 1937–1940, who graduated from Wisconsin high schools in 1957. In 2004 and 2008, yearbook photos from 1957—when the subjects were, on average, 18 years of age ($M = 18.2$, $SD = 0.26$)—were rated by 33 judges recruited from roughly the same cohort as the WLS participants and thus between 63 and 91 years old ($M = 78.5$). Yearbook pictures were not standardized in terms of facial expressions and head posture and showed mostly—but not exclusively—faces (Jokela, 2009). Each yearbook photo was rated by six male and six female judges using a photo-labeled 11-point rating scale ranging from “not at all attractive” (1) to “extremely attractive” (11). We used the second release of the rating data, for which Wisconsin Longitudinal removed cases with less than 11 ratings and added approximately 5,500 new cases using the same procedure, for a total of 8,434 cases. The mean ($SD$) attractiveness raw score of all 12 raters was 5.36 (2.13) for female subjects and 5.50 (2.05) for male subjects. Inter-rater reliability was good: average Cronbach’s alpha, calculated based on the raw rating scores of the 12 raters, was 0.83. We used the “normed average coder rating” ($M = 0.013$, $SD = 1.257$) from all 12 raters as the measure of attractiveness (further termed “facial attractiveness”) because, according to the WLS, norming effectively removed coder fixed effects. Norming was done in the WLS by subtracting the mean from the original values and then dividing the resulting values by the standard deviation.

For those subjects for whom attractiveness ratings were available ($n = 8,434$), we further included the following variables, surveyed by the WLS, in the analysis: year of birth ($n = 8,434$); sex, encoded as 1 = male ($n = 4,018$) and 2 = female ($n = 4,416$); subjects’ father’s highest education, encoded as 1 = no high school ($n = 3,002$), 2 = attended high school ($n = 1,399$), 3 = graduated from high school ($n = 1,522$), 4 = attended trade/bus school ($n = 688$), 5 = attended college ($n = 478$), 6 = graduated from college ($n = 521$), 7 = has masters or Ph.D. ($n = 162$); parental income collected in 1957 in $100$ (truncated at $99,800$ in the WLS; $n = 7,910$; $M = $63.08; $SD = $57.76); and father’s age at subjects’
birth ($n = 5,111; M = 31.56, SD = 6.78$).

We used R 3.0.2 for statistical analysis (R Core Team 2013). We calculated an ANOVA of father’s education on subjects’ facial attractiveness (including a posthoc Bonferroni comparison of facial attractiveness according to father’s educational level) as well as a Pearson correlation of parental income on subjects’ facial attractiveness. To control for confounding variables, we further calculated a general linear model (GLM), regressing the subjects’ father’s highest education and parental income as well as subjects’ sex, year of birth, and father’s age at subjects’ birth, respectively, on the subjects’ facial attractiveness (parental income, year of birth, and father’s age at subjects’ birth were centered around their means). Initially we included all two-way interactions with subjects’ sex as well as the interactions between the indicators of parental SES (i.e. father’s highest education and parental income). The reasons are that attractiveness and its association with the other explaining variables may differ between men and women and that parental income and father’s education are highly correlated ($\text{Spearman } r = 0.35, p < 0.001$). Then we reduced the models by variable selection according to the Akaike information criterion (AIC), applying the “step AIC” algorithm implemented in R. The full model is presented in the Appendix (see Table A1). We further performed an ANOVA to calculate the variance explained by father’s education and parental income. In the multivariate models, overall sample sizes are considerably lower because missing cases in any variable are excluded.

**Results**

Subjects’ facial attractiveness increased with increasing father’s highest educational attainment, $F(7771) = 18.98, p < 0.0001$ (see Figure 1). Posthoc comparisons reveal that subjects whose fathers attained the lowest level of education are either significantly or marginally significantly less attractive compared to subjects whose fathers attained any other educational level (see Table 1a). In addition, subjects whose fathers attended a trade or business school are significantly less attractive than subjects whose fathers attended or graduated from college (see Table 1b).

Furthermore, increasing parental income is positively associated with facial attractiveness (see Figure 2). Parental income is more strongly associated with facial attractiveness in female (see Figure 2a; Pearson correlation, $r(4095) = 0.117, p < 0.0001$) than in male subjects (see Figure 2b; Pearson correlation, $r(3811) = 0.042, p = 0.01$). Also, in a multivariate model including father’s education and parental income, as well as subjects’ sex, birth year, and father’s age at subjects’ birth, subjects’ facial attractiveness was affected by both father’s education and parental income (see Table 2). In this multivariate model, attractiveness ratings for all but the highest father’s educational categories are significantly or marginally significantly higher than those for the lowest educational category, indicating that facial attractiveness was significantly lowest in the offspring of the least educated fathers. In addition, the interaction between sex and parental income is significantly positive, again showing that parental income exerted a stronger effect on facial attractiveness of female than male subjects. The effect of father’s age at subjects’ birth is significantly negative, which implies that subjects’ facial attractiveness decreased with advancing paternal age. Furthermore, sex exerts a significantly negative effect, denoting that female subjects were by trend rated less attractive than male subjects. Also, the interaction between sex and birth year (1937–1940) is significantly positive,
indicating that in female—but not male—subjects, birth year exerted a significant positive effect on facial attractiveness.

**Figure 1.** Mean (± SE) subjects’ facial attractiveness according to father’s education

**Figure 2.** Parental income and facial attractiveness (scatter plots and linear slopes) of (a) male and (b) female subjects
Parental socio-economic conditions

Table 1. Posthoc Bonferroni comparison of facial attractiveness of subjects (a) whose fathers attained no high school compared to subjects whose fathers attained any higher level of education, and (b) whose fathers attended trade or business school compared to subjects whose fathers attained any other level of education.

|                                | M    | SE   | p       | 95% CI          |
|--------------------------------|------|------|---------|-----------------|
| (a) Father attended no high school compared to |       |      |         |                 |
| Attended high school           | -0.246| 0.040| < 0.001| -0.369 -0.123   |
| Graduated from high school     | -0.265| 0.039| < 0.001| -0.384 -0.146   |
| Attended trade/bus school      | -0.171| 0.053| 0.024   | -0.331 -0.111   |
| Attended college               | -0.398| 0.062| < 0.001| -0.584 -0.211   |
| Graduated from college         | -0.438| 0.059| < 0.001| -0.618 -0.260   |
| Has masters or PhD             | -0.300| 0.101| 0.061   | -0.610 0.0058   |
| (b) Father attended trade/bus school compared to |       |      |         |                 |
| Attended no high school        | 0.171 | 0.053| 0.024   | 0.0113 0.331    |
| Attended high school           | -0.075| 0.058| ns      | -0.251 0.102    |
| Graduated from high school     | -0.094| 0.057| ns      | -0.268 0.080    |
| Attended college               | -0.226| 0.074| 0.048   | -0.452 -0.001   |
| Graduated from college         | -0.267| 0.072| 0.005   | -0.489 -0.047   |
| Has masters or PhD             | -0.128| 0.108| ns      | -0.459 0.2027   |

Table 2. GLM of the subjects’ father’s highest education and parental income in 1957 as well as subjects’ sex, year of birth, and father’s age at subjects’ birth regressing on the subjects’ facial attractiveness.

|                                | \( \beta \) | SE   | t      | p       |
|--------------------------------|-------------|------|--------|---------|
| (Intercept)                    | -0.0410     | 0.0374| -1.10  | 0.273   |
| Sex female (ref. male)         | -0.1072     | 0.0377| -2.84  | 0.005   |
| Father’s age at subject’s birth| -0.0594     | 0.0198| -3.00  | 0.003   |
| Year of birth (1937-1940)      | -0.0012     | 0.0275| -0.04  | 0.966   |
| Father’s highest education (ref. = 1): |     |      |        |         |
| 2                              | 0.2443      | 0.0541| 4.51   | < 0.0001|
| 3                              | 0.2193      | 0.0528| 4.15   | < 0.0001|
| 4                              | 0.1133      | 0.0700| 1.62   | 0.106   |
| 5                              | 0.2811      | 0.0780| 3.60   | < 0.001 |
| 6                              | 0.3070      | 0.0796| 3.85   | < 0.001 |
| 7                              | 0.0806      | 0.1311| 0.62   | 0.539   |
| Parental income in 1957        | 0.0108      | 0.0253| 0.43   | 0.670   |
| Sex female: year of birth      | 0.0859      | 0.0395| 2.18   | 0.030   |
| Sex female: parental income    | 0.1074      | 0.0353| 3.04   | 0.002   |

Note. residual standard error = 1.212 on 4253 df (6051 cases are missing in any variable and thus excluded); multiple \( R^2 = 0.025; R^2 adj. = 0.022; F(12, 4253) = 9.03; p < 2.2e^{-16} \)

Evolutionary Psychology – ISSN 1474-7049 – Volume 12(5). 2014. -1060-
Discussion

We found that family socio-economic background, in terms of both father’s highest education and parental income, predicts offspring facial attractiveness, the latter effect being stronger in female than in male subjects. Together with studies of a link between early life conditions and later health outcomes (e.g., Bosma et al., 1999; Kestilä et al., 2005; Marmot et al., 2001) as well as our recent finding that facial attractiveness may be a cue to an individual’s mutation load (Huber and Fieder, 2014), this association between facial attractiveness and early socio-economic conditions supports the view that attractiveness may signal an individual’s health status (Gray and Boothroyd, 2012). Our results are also in line with Hope et al. (2013), who recently demonstrated that facial symmetry in adulthood was likewise lower if socio-economic status in early life was poorer. A likely explanation for the effect of socio-economic background on facial attractiveness is that low parental income and education are typically associated with poorer living conditions, lower diet quality, and a higher risk for diseases and accidents (Brooks-Gunn and Duncan, 1997; Gregg, Propper, and Washbrook, 2007; Shah, Kahan, and Krauser, 1987). Also, poor socio-economic family conditions may increase the risk of adversities due to family problems such as unemployment, parental illness, or alcohol abuse (Brooks-Gunn and Duncan, 1997; Makela, 1999; Wilkinson and Marmot, 2003).

Alternatively, the subjects’ mother’s and father’s own attractiveness might explain our findings. For instance, higher educated men with higher income may find more attractive spouses and/or may be more attractive themselves (Udry and Eckland, 1984; Umberson and Hughes, 1987). If attractiveness is to some degree heritable (see McGovern, Neale, and Kendler, 1996; Rowe, Clapp, and Wallis, 1987), then any association between family socio-economic background and offspring attractiveness could also reflect parental attractiveness. Of course, both explanations, namely an effect of early life socio-economic conditions as well as heritable paternal factors, are not mutually exclusive. Additional studies are needed to disentangle both effects.

It has to be noted that the found effects are relatively small, with the overall model explaining less than 3% of the variance. In addition, it cannot be excluded that cues to socioeconomic status (e.g., clothing) may have been present in the photographs, which might have affected ratings of attractiveness.

Our findings further demonstrate that parental income is important for facial attractiveness, particularly for female subjects, whereas father’s education affects the facial attractiveness of both male and female subjects. Although we have no explicit explanation for this sex difference in susceptibility to different aspects of socio-economic status, it seems to us that both sexes respond differently to economic conditions, which are primarily linked to parental income, but rather similarly to lifestyle factors, which may be more strongly affected by father’s education.

In addition, indicated by the significant interaction between subjects’ sex and birth year, birth year also exerted a significant effect on facial attractiveness of female but not male subjects. As already discussed in Huber and Fieder (2014), this discrepancy may be explained by female subjects, who were slightly younger when the yearbook photos were taken, being rated more attractive than those who were a few years older.

We conclude that early socio-economic conditions as indicated by father’s education and parental income to some extent predict facial attractiveness. Future studies
should address possible underlying mechanisms, notably whether and how epigenetic effects might play a role. In addition, because attractiveness is important for mating and reproductive success (Jokela, 2009; Pflüger, Oberzaucher, Katina, Holzleitner, and Grammer, 2012), future research may also address the consequences of early life socio-economic conditions and resulting attractiveness for later mating success.

**Acknowledgements:** This work was supported by the University of Vienna (Back-to-Research Grant to Susanne Huber). This research uses data from the Wisconsin Longitudinal Study (WLS) of the University of Wisconsin-Madison. Since 1991, the WLS has been supported principally by the National Institute of Aging (AG-9775 AG-21079 and AG-033285), with additional support from the Vilas Estate Trust, the National Science Foundation, the Spencer Foundation, and the Graduate School of the University of Wisconsin-Madison. A public use file of data from the Wisconsin Longitudinal Study is available from the Wisconsin Longitudinal Study, University of Wisconsin-Madison, 1180 Observatory Drive, Madison, Wisconsin 53706 and at http://www.ssc.wisc.edu/wlsresearch/data/. The opinions expressed herein are those of the authors.

**Received 23 June 2014; Revision submitted 22 July 2014; Accepted 25 August 2014**

**References**

Beebe-Dimmer, J., Lynch, J. W., Turrell, G., Lustgarten, S., Raghunathan, T., and Kaplan, G. A. (2004). Childhood and adult socioeconomic conditions and 31-year mortality risk in women. *American Journal of Epidemiology, 159*, 481–490.

Blane, D., Hart, C. L., Davey Smith, G., Gillis, C. R., Hole, D. J., and Hawthorne, V. M. (1996). Association of cardiovascular disease risk factors with socioeconomic position during childhood and during adulthood. *British Medical Journal, 313*, 1434-1438.

Bosma, H., van de Mheen, H. D., and Mackenbach, J. P. (1999). Social class in childhood and general health in adulthood: Questionnaire study of contribution of psychological attributes. *British Medical Journal, 318*, 18–22.

Braveman, P. A., Cubbin, C., Egerter, S., Chideya, S., Marchi, K. S., Metzler, M., and Posner, S. (2005). Socioeconomic status in health research: One size does not fit all. *The Journal of the American Medical Association, 294*, 2879-2888.

Brooks-Gunn, J., and Duncan, G. J. (1997). The effects of poverty on children. *The Future of Children, 7*, 55–71.

Davey Smith, G., Hart, C., Blane, D., and Hole, D. (1998). Adverse socioeconomic conditions in childhood and cause specific adult mortality: Prospective observational study. *British Medical Journal, 316*, 1631–1635.

Galobardes, B., Lynch, J. W., and Smith, G. D. (2004). Childhood socioeconomic circumstances and cause-specific mortality in adulthood: Systematic review and interpretation. *Epidemiologic Reviews, 26*, 7–21.

Grammer, G., and Thornhill, R. (1994). Human (*Homo sapiens*) facial attractiveness and sexual selection: The role of symmetry and averageness. *Journal of Comparative Psychology, 108*, 233–242.
Gray, A. W., and Boothroyd, L. G. (2012). Female facial appearance and health. *Evolutionary Psychology, 10*, 66–77.

Gregg, P., Propper, C., and Washbrook, E. (2007). Understanding the relationship between parental income and multiple child outcomes: A decomposition analysis. *LSE STICERD Research Paper No. CASE129*.

Hope, D., Bates, T., Penke, L., Gow, A. J., Starr, J. M., and Deary, I. J. (2013). Symmetry of the face in old age reflects childhood social status. *Economics and Human Biology, 11*, 236–244.

Huber, S., and Fieder, M. (2014). Advanced paternal age is associated with lower facial attractiveness. *Evolution and Human Behavior, 35*, 298-301.

Jokela, M. (2009). Physical attractiveness and reproductive success in humans: Evidence from the late 20th century United States. *Evolution and Human Behavior, 30*, 342–350.

Kestilä, L., Koskinen, S., Martelin, T., Rahkonen, O., Pensola, T., Aro, H., and Aromaa, A. (2005). Determinants of health in early adulthood: What is the role of parental education, childhood adversities and own education? *European Journal of Public Health, 16*, 305–314.

Kuh, D., Hardy, R., Langenberg, C., Richards, M., and Wadsworth, M. E. J. (2002). Mortality in adults aged 26–54 years related to socioeconomic conditions in childhood and adulthood: Post war birth cohort study. *British Medical Journal, 325*, 1076–80.

Makela, P. (1999). Alcohol-related mortality as a function of socio-economic status. *Addiction, 94*, 867-886.

Marmot, M., Shipley, M., Brunner, E., and Hemingway, H. (2001). Relative contribution of early life and adult socioeconomic factors to adult morbidity in the Whitehall II study. *Journal of Epidemiology and Community Health, 55*, 301–307.

McGovern, R. J., Neale, M. C., and Kendler, K. S. (1996). The independence of physical attractiveness and symptoms of depression in a female twin population. *The Journal of Psychology, 130*, 209–219.

Pflüger, L. S., Oberzaucher, E, Katina, S., Holzleitner, I. J., and Grammer, K. (2012). Cues to fertility: Perceived attractiveness and facial shape predict reproductive success. *Evolution and Human Behavior, 33*, 708–714.

Power, C., Matthews, S., and Manor, O. (1998). Inequalities in self-rated health: Explanations from different stages of life. *The Lancet, 351*, 1009–1014.

R Core Team (2013). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Available: [http://www.R-project.org/](http://www.R-project.org/).

Rahkonen, O., Arber, S., and Lahelma, E. (1995). Health inequalities in early adulthood: A comparison of young men and women in Britain and Finland. *Social Science and Medicine, 41*, 163–171.

Rowe, D. C., Clapp, M., and Wallis, J. (1987). Physical attractiveness and the personality resemblance of identical twins. *Behavior Genetics, 17*, 191–201.

Shah, C. P., Kahan, M., and Krauser, J. (1987). The health of children of low-income families. *CMAJ: Canadian Medical Association Journal, 137*, 485–490.

Silva, L. M., van Rossem, L., Jansen, P. W., Hokken-Koelega, A. C. S, Moll, H. A., Hofman, A., . . . Raat, H. (2012). Children of low socioeconomic status show...
accelerated linear growth in early childhood: Results from the Generation R Study. *PLOS ONE*, 7, e37356.

Thornhill, R., and Gangestad, S. W. (1999). Facial attractiveness. *Trends in Cognitive Sciences*, 3, 453–460.

Udry, J. R., and Eckland, B. K. (1984). Benefits of being attractive: Differential payoffs for men and women. *Psychological Reports*, 54, 47–56.

Umberson, D., and Hughes, M. (1987). The impact of physical attractiveness on achievement and psychological well-being. *Social Psychology Quarterly*, 50, 227–236.

Vagero, D., and Leon, D. (1994). Effect of social class in childhood and adulthood on adult mortality. *The Lancet*, 343, 1224–1225.

Wilkinson, R. G., and Marmot, M. G. (Eds.) (2003). *Social determinants of health: The solid facts*. Copenhagen, Denmark: World Health Organization.
Appendix

Table A1. GLM of the subject’s father’s highest education, parental income in 1957, as well as subject’s sex, year of birth, and father’s age at subject’s birth, regressing on the subject’s facial attractiveness: full model including all two-way interactions with subjects’ sex as well as the interactions between the indicators of parental SES

|                                | $\beta$  | SE    | $t$   | $p$     |
|--------------------------------|----------|-------|-------|---------|
| Intercept                      | 0.0317   | 0.0477| 0.67  | 0.506   |
| Sex female (ref. male)         | -0.2192  | 0.0620| -3.53 | < 0.001 |
| Father’s age at subject’s birth| -0.0692  | 0.0295| -2.34 | 0.019   |
| Year of birth (1937-1940)      | -0.0017  | 0.0276| -0.06 | 0.952   |
| Father’s highest education (ref. = 1): |          |       |       |         |
| 2                              | 0.1458   | 0.0821| 1.78  | 0.076   |
| 3                              | 0.1329   | 0.0791| 1.68  | 0.093   |
| 4                              | -0.0244  | 0.1085| -0.23 | 0.822   |
| 5                              | 0.0378   | 0.1173| 0.32  | 0.748   |
| 6                              | 0.2637   | 0.1189| 2.22  | 0.027   |
| 7                              | -0.0262  | 0.1917| -0.14 | 0.891   |
| Parental income in 1957        | 0.0550   | 0.0480| 1.15  | 0.252   |
| Sex female: father's age at subject's birth |          |       |       |         |
| Sex female: year of birth      | 0.0822   | 0.0396| 2.07  | 0.038   |
| Sex female: father's highest education (ref. = 1): |          |       |       |         |
| 2                              | 0.1593   | 0.1090| 1.46  | 0.144   |
| 3                              | 0.1423   | 0.1062| 1.34  | 0.180   |
| 4                              | 0.1917   | 0.1418| 1.35  | 0.176   |
| 5                              | 0.4164   | 0.1567| 2.66  | 0.008   |
| 6                              | 0.0457   | 0.1607| 0.28  | 0.776   |
| 7                              | 0.4661   | 0.2650| 1.76  | 0.079   |
| Sex female: parental income    | 0.1036   | 0.0418| 2.48  | 0.013   |
| Parental income: father’s highest educ. (ref. = 1): |          |       |       |         |
| 2                              | -0.0573  | 0.0599| -0.96 | 0.340   |
| 3                              | -0.0660  | 0.0723| -0.91 | 0.362   |
| 4                              | 0.0963   | 0.0853| 1.13  | 0.259   |
| 5                              | -0.0099  | 0.0894| -0.11 | 0.912   |
| 6                              | -0.0379  | 0.0573| -0.66 | 0.508   |
| 7                              | -0.1566  | 0.0685| -2.29 | 0.022   |

Note. residual standard error = 1.211 on 4240 df (6051 cases are missing in any variable and thus excluded); multiple $R^2 = 0.029$; $R^2$ adj. = 0.024; $F(25, 4240) = 5.12$; $p < 1.58e-15$