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Abstract

A growing body of evidence has linked individual differences in facial structure—in particular, the facial width-to-height ratio (FWHR)—to social behaviors, including aggression, cheating, and nonreciprocation of trust. In the research reported here, we extended this work by demonstrating that the association between FWHR and aggression is moderated by subjective and objective measures of social status. In Study 1 (N = 237 college students), FWHR was positively correlated with aggressive behavior, but only among men reporting relatively low social status. In Study 2 (N = 891 professional hockey players), FWHR was positively correlated with penalty minutes, but only among players who earned relatively low salaries. Collectively, these studies provide compelling evidence for the role of social status in moderating the relationship between facial structure and aggression, indicating that FWHR is a robust predictor of aggressive behavior, but only in the context of relatively low social status.

Keywords

aggressive behavior, facial features, social behavior

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Physiognomy, which is rooted in the idea that one can accurately gauge another person's character on the basis of facial cues, has long been dismissed as pseudoscience. Nevertheless, a growing body of evidence suggests that people are indeed accurate when judging certain characteristics of others, such as sexual orientation (Rule, Ambady, Adams, & Macrae, 2008), trustworthiness (Stirrat & Perrett, 2010), physical strength (Sell et al., 2009), and aggressive behavior (Carré, McCormick, & Mondloch, 2009). The accuracy with which people make such judgments suggests that perceivers may be inferring these traits on the basis of static facial cues that are reliably linked to the corresponding traits. Indeed, one characteristic of the human face, the facial width-to-height ratio (FWHR; Weston, Friday, & Lio, 2007),[1] is positively correlated with aggressive behavior (Carré & McCormick, 2008), cheating (Haselhuhn & Wong, 2011), and nonreciprocation of trust (Stirrat & Perrett, 2010). It has been speculated that the relationship between within-sex variation in FWHR and aggressive behavior might reflect a common association to a third variable, such as organizational effects of testosterone, which influence both the development of physique and the central nervous system as part of sexual differentiation in adolescence (Carré & McCormick, 2008). Indeed, recent evidence has suggested that the FWHR is positively correlated with adult levels of testosterone in men (Lefevre, Lewis, Perrett, & Penke, 2013)

Despite these earlier findings, in recent work researchers have called into question whether this facial metric is a reliable correlate of aggression. In one study, only a marginal positive correlation was found between FWHR and aggression (p = .057) in a large sample of professional hockey players (Deaner, Goetz, Shattuck, & Schnotala, 2012); in another study, no association was found between variation in the FWHR and a self-report measure of aggression (Ozener, 2012). These inconsistencies may have been due to differences in methodology, or perhaps the initial findings were Type I errors. The latter possibility is unlikely

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given that independent laboratories have found associations between FWHR and other traits conceptually linked to aggression (e.g., reciprocity: Stirrat & Perrett, 2010; competitive behavior: Stirrat & Perrett, 2012; cheating: Haselhuhn & Wong, 2011; and prejudicial beliefs: Hehman, Leitner, Deegan, & Gaertner, 2013).

Another possibility is that the association between FWHR and social behavior may be moderated by social or contextual factors. Indeed, FWHRs of Fortune 500 chief executive officers are positively correlated with companies' financial performance, but only for companies with cognitively simple leadership styles (Wong, Ormiston, & Haselhuhn, 2011). One potential moderator of the relationship between FWHR and aggression is social status. Evidence suggests that homicides are overwhelmingly committed by men of relatively low social status (see Wilson, Daly, & Pound, 2009, for review). Compared with their high-status counterparts, low-status men may have relatively little to lose and much to gain from aggressive behavior (Wilson et al., 2009). We reasoned that this would be especially true of low-status men with relatively large FWHRs, who may be more likely to emerge victorious in direct physical altercations (see Stirrat, Stulp, & Pollet, 2012). In the current studies, we examined the extent to which one's relative social status, measured both subjectively (Study 1) and objectively (Study 2), would moderate the association between facial structure and aggressive behavior.

We hypothesized that the association between FWHR and aggression would be most robust among individuals scoring relatively low on subjective (Study 1) and objective (Study 2) measures of social status. Moreover, on the basis of previous evidence (Carré & McCormick, 2008), we predicted that status would moderate the association between FWHR and aggression in men but not women (Study 1).

Study 1

Method

Participants. The sample consisted of 237 students (48% men, 52% women; mean age = 21.75 years, *SD* = 4.64) from Wayne State University. Participants received a research-participant credit and a $10 honorarium in return for participating in the study. All procedures were approved by the Wayne State University Human Investigation Committee.

Procedure. Participants were photographed while they were sitting down and assuming an emotionally neutral expression. Next, participants completed a self-report measure of subjective social status (Adler, Epel, Castellazzo, & Ickovics, 2000). For this, participants were shown a ladder and given the following instructions:

> Think of this ladder as representing where people stand in the United States. At the top are the people who are the best off—those who have the most money, the most education and the most respected jobs. At the bottom are the people who are the worst off—who have the least money, the least education, and the least respected jobs or no job. The higher up you are on this ladder, the closer you are to the people at the very top; the lower you are, the closer you are to the people at the very bottom.

As part of a broader protocol, participants then played one of several video games on an Xbox Kinect (Microsoft, Redmond, WA; data not reported here). Next, participants were escorted to an individual testing room where they completed the point-subtraction aggression paradigm (PSAP), a well-validated behavioral measure of reactive aggression (see Cherek, Tcheremissine, & Lane, 2006, for review). Participants were told they were playing the game with another same-sex participant (actually a computer program) and that the goal of the task was to earn as many points as possible, which could later be exchanged for money. Participants had three response options: Button 1 earned points after 100 consecutive presses, Button 2 stole points from the other person after 10 consecutive presses, and Button 3 protected the participants' points for a variable amount of time after 10 consecutive presses. Throughout the task, points were "stolen" from participants, and this was attributed to their partner, who allegedly got to keep all these stolen points. Participants could steal points back, but they were told they had been randomly assigned to an experimental condition in which they could not keep the stolen points. The PSAP consisted of three blocks, each lasting 7 min.

FWHR measurement. Two trained raters measured FWHR using the National Institutes of Health open-access ImageJ software (http://rsbweb.nih.gov/ij/). Both raters were blind to the primary hypothesis (i.e., that social status would moderate the association between FWHR and aggression). Interrater reliabilities were high for facial width, facial height, and FWHR (rs > .90).

Statistical analyses. Subjective social-status data were missing for 7 participants (2 men and 5 women), and aggression data for 11 participants (6 men and 5 women) were lost because of a computer malfunction. Multiple regression analyses were computed with average aggressive behavior (Button 2 presses) during the PSAP as the dependent variable and the following variables entered as predictors—Step 1: sex, FWHR, and subjective social status (main effects); Step 2: Sex × FWHR, Sex × Subjective Social Status, and FWHR × Subjective Social Status

(two-way interactions); and Step 3: Sex × FWHR × Subjective Social Status (three-way interaction). We mean-centered FWHR and subjective social status prior to computing interaction terms.

Results and discussion

Subjective social status was negatively correlated with aggressive behavior (b = −10.03, SE = 4.89), $t(215)$ = −2.05, p = .042. The Sex × FWHR × Subjective Social Status interaction was significant (b = −97.55, SE = 36.14), $t(211)$ = −2.699, p = .008. This three-way interaction emerged because the FWHR × Subjective Social Status interaction was significant for men (b = −153.51, SE = 61.76), $t(211)$ = −2.486, p = .014,[2] but not for women (b = 41.59, SE = 37.57), $t(211)$ = 1.107, p = .269. Simple-slopes analyses indicated that FWHR predicted aggression in men reporting low subjective social status (b = 392.511, SE = 125.94), $t(211)$ = 3.117, p = .002, Cohen's d = 0.43, but not in men reporting high subjective social status (b = −71.425, SE = 127.43), $t(211)$ = −0.561, p = .576, Cohen's d = 0.08. See Figure 1 and Table S1 in the Supplemental Material available online for the results from the full regression model.

In summary, we replicated earlier research indicating that individual differences in FWHR are positively (albeit marginally) correlated with aggression in men (Carré & McCormick, 2008). Importantly, we went beyond replication by demonstrating that subjective social status moderates the effect of FWHR on aggressive behavior. Specifically, FWHR was positively correlated with aggression, but only in men reporting low subjective social status.

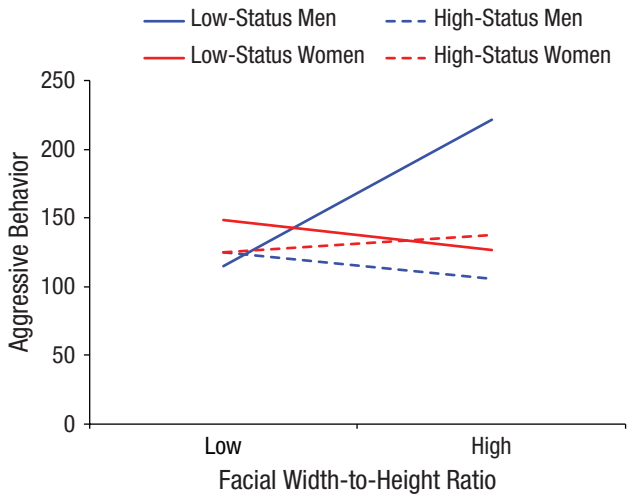

Fig. 1. Results from Study 1: aggressive behavior as a function of facial width-to-height ratio (FWHR), gender, and social status. Low and high facial width-to-height ratios were plotted at 1 standard deviation below and above the mean, respectively, and low and high subjective-social-status scores were plotted at 1 standard deviation below and above the mean, respectively.

Study 2

In this study, we examined the extent to which the effects observed in Study 1 extended beyond the laboratory setting in a large sample of National Hockey League (NHL) players. *Aggression* was defined as the number of penalty minutes obtained per game played during the 2010–2011 season. Player salary was used as an objective measure of social status.

Method

Facial measurements were made as in Deaner et al. (2012). Photographs of NHL players were obtained from the Sports Illustrated Web site (sportsillustrated.cnn.com) between December 16, 2011, and October 31, 2012. Goalkeepers were excluded given the low base rate of penalties that they receive. Unlike Deaner et al., we included penalty minutes for only one season to make comparisons between salary and penalty minutes for that specific year. Photographs of players not measured by Deaner and colleagues (2012) were obtained from the Sports Illustrated Web site and measured using ImageJ software by two trained raters blind to the primary hypothesis. Interrater reliabilities were high for facial width, height, and the FWHR (rs > .90).

The final sample consisted of 891 players. Player salaries were obtained from www.blackhawkzone.com and www.capgeek.com. Notably, players who are 25 years of age or younger receive entry-level contracts that are capped at $900,000 per year, which is quite small compared with the standard 2010–2011 contract of the top-paid player in the NHL ($10,000,000). Given that salaries for younger players are restricted by the terms of the collective bargaining agreement, we included type of contract (entry-level vs. standard level) as a covariate in our analyses.

Results and discussion

Salary data were missing for 11 players. Also, 12 players were removed from the analyses because their aggression scores were more than 3.5 standard deviations from the mean. Nine of these players played fewer than 12 games during the 2010–2011 season. A regression analysis was performed with penalties per game used as the dependent variable and the following variables entered as predictors—Step 1: type of contract (0 = standard-level contract, 1 = entry-level contract), salary, and FWHR; Step 2: Salary × FWHR interaction. We mean-centered all variables prior to computing the interaction term.

Step 1 of the model showed that type of contract, salary, and FWHR were significant predictors of penalties per game ($p < .001$), with type of contract and salary negatively associated with penalty minutes ($b = -0.25$, $SE = 0.05$, $p < .001$, and $b = -0.003$, $SE = 0.001$, $p < .01$, respectively) and FWHR positively associated with penalty minutes ($b = 0.38$, $SE = 0.15$, $p < .01$).[3] Step 2, including the FWHR × Salary interaction, was also significant ($b = -0.02$, $SE = .008$), $t(863) = -2.642$, $p = .008$.[4] Simple-slopes analyses indicated that FWHR was positively correlated with penalty minutes for players with relatively low salaries ($b = 0.779$, $SE = 0.21$), $t(863) = 3.722$, $p < .001$, Cohen's $d = 0.25$. To put these findings into perspective, players with large FWHRs and low salaries obtained 34% more penalty minutes than players with small FWHRs and low salaries during the 2010–2011 season. In contrast, there was no relationship between FWHR and penalty minutes for players with relatively high salaries ($b = 0.037$, $SE = 0.20$), $t(863) = 0.19$, $p = .85$, Cohen's $d = 0.01$. See Figure 2 and Table S2 in the Supplemental Material for the results from the full regression model. Analyses performed separately for players with entry-level ($n = 206$) and standard-level ($n = 662$) contracts revealed similar FWHR × Salary interactions (ps = .06 and .01, respectively), with FWHR being positively correlated with penalty minutes for players with relatively low salaries (ps < .008) but not high salaries (ps > .81).

These results show that FWHR was positively associated with penalty minutes only when players earned relatively low salaries. These findings indicate that the moderating effect of social status on the link between FWHR and aggression extends beyond the laboratory and can be found using an objective measure of social status.

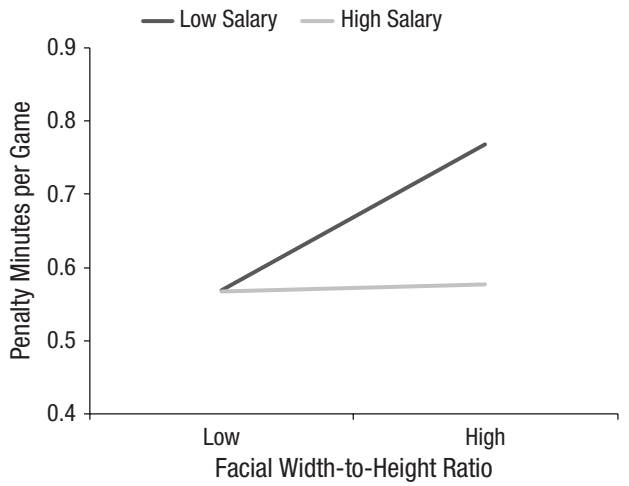

Fig. 2. Results from Study 2: ice-hockey players' penalty minutes per game played as a function of facial width-to-height ratio and salary level. Low and high facial width-to-height ratios were plotted at 1 standard deviation below and above the mean, respectively, and low and high salaries were plotted at 1 standard deviation below and above the mean, respectively.

General Discussion

The results of both studies indicate that the FWHR is a reliable indicator of aggression when relative social status is considered. The current findings indicate that bivariate associations between FWHR and aggressive behavior, although significant, are relatively small in magnitude. Notably, only when individual differences in subjective social status are taken into account does the relationship between FWHR and aggressive behavior clearly emerge. Specifically, only under relatively poor social circumstances (i.e., low subjective or objective social status) does variability in FWHR predict individual differences in aggressive behavior.

Our findings raise the question of why FWHR does not predict aggression in high-status men. We suggest that a consideration of the relative costs and benefits of aggression may shed light on this question. Specifically, the costs and benefits of aggression are inequitably distributed across social strata (Wilson et al., 2009). For high-status men, the costs of aggression (e.g., potential for a decrease in social status and risk of physical injury) may outweigh the potential benefits; thus, high-status men may have much to lose from aggressive behavior and relatively little to gain. For low-status men, the relative benefits of aggression may outweigh the costs. For instance, success in an aggressive interaction may not only protect one's reputation (Wilson et al., 2009) but also increase one's access to valued resources (e.g., social status and mating opportunities). Increased access to such resources may ultimately increase one's reproductive fitness.

Importantly, we have extended this body of work by demonstrating that not all low-status men will engage in aggressive behavior. Specifically, aggressive behavior among low-status men appears to occur primarily among men with relatively large FWHRs. Recent evidence has suggested that men with relatively large FWHRs are more likely to be successful in male-to-male physical confrontations (e.g., Stirratt et al., 2012). Thus, for low-status men, the costs of aggression may be attenuated, and, hence, net benefits may be greater for men with larger FWHRs, who presumably are more likely to be successful in competitive or aggressive interactions than low-status men with smaller FWHRs.

The relationship between FWHR and penalty minutes for men with low salaries, although significant, was relatively small in magnitude (Cohen's $d = 0.25$). Notably, however, these results were obtained from a highly select population earning between $500,000 and $10,000,000

per year. Thus, we may have underestimated the true effect of status on the relationship between FWHR and aggressive behavior by focusing on a group of extremely wealthy individuals. Future researchers will need to capture a broader range of variability in other measures of objective status (e.g., socioeconomic status).

In summary, the current findings add to the body of evidence suggesting that variability in facial structure maps onto individual differences in human aggression. Crucially, however, these findings indicate that wide-faced men are not destined for aggressive behavior—it is only in the context of relatively low social status that wide-faced men may be particularly prone to engage in aggressive behavior. More generally, our findings are consistent with a growing body of evidence indicating the importance of considering social risk factors when examining associations between biological variables and individual differences in complex human behavioral traits (for review, see Caspi, Hariri, Holmes, Uher, & Moffitt, 2010).

Author Contributions

J. M. Carré, J. A. Campbell, E. Lozoya, and S. M. M. Goetz designed the study. J. A. Campbell and S. M. M. Goetz collected the data. J. M. Carré, S. M. M. Goetz, and K. S. Shattuck analyzed the data. E. Lozoya and R. M. Miller measured participants' faces. S. M. M. Goetz and J. M. Carré wrote the manuscript, and K. S. Shattuck and G. E. Weisfeld provided critical edits. All authors approved the manuscript.

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Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

Supplemental Material

Additional supporting information may be found at http://pss.sagepub.com/content/by/supplemental-data

Notes

1. FWHR is calculated by dividing the distance between the left and right zygion (facial width) by that between the brow and upper lip (facial height).
2. For men, there was a positive correlation between FWHR and aggression (r = .187, p = .053) and a negative correlation between subjective social status and aggression (r = −.221, p = .023). No such associations were found for women (all ps > .56).
3. There was a bivariate correlation between penalty minutes and FWHR (r = .08, p = .02) but not between penalty minutes and salary (r = −.02, p = .48).
4. When body weight was entered as a covariate, the main effects of type of contract, FWHR, and salary and the FWHR × Salary interaction remained statistically significant (p = .043).

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