Face shape and behavior: Implications of similarities in infants and adults

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Abstract

We investigated conceptual overlap between literature demonstrating links between adult facial width-to-height ratio (FWHR) and behavior and that demonstrating links between infant FWHR and temperament by investigating whether babyfaceness is associated with FWHR and behavior at both ages. Babyfaceness was positively correlated with FWHR in both infants and adults. Babyfaceness was also correlated with an infant temperament that is a precursor of bolder behavior in childhood and adulthood, just as a broader infant FWHR was previously shown to be. These results call into question existing explanations for relationships between facial appearance and adult assertive or aggressive behavior. Previously, behavioral correlates of adult FWHR have been attributed to influences of pubertal testosterone, and correlates of adult babyfaceness have been attributed to compensation for undesirable stereotypes. Our findings indicate that the pre-natal developmental influences required to explain appearance–temperament relationships in infancy also should be considered as explanations for appearance–behavior relationships in adulthood.

1. Introduction

1.1. Facial width-to-height ratio (FWHR) and behavior

A burgeoning body of research has highlighted the role of facial width-to-height ratio (FWHR) as an accurate predictor of assertive personality traits in men. Men with relatively broader faces scored higher on laboratory and real-world measures of aggressiveness (Carre, McCormick, & Mondloch, 2009; Carre & McCormick, 2008) and cheating (Jia, Van Lent, & Zeng, 2015; Haselhuhn & Wong, 2012; Stirrat & Perrett, 2010). Broader faces further predicted men’s dominance (Mileva, Cowan, Cobey, Knowles, & Little, 2014), US Presidents’ achievement drive (Lewis, Lefevre, & Bates, 2012), performance during negotiation tasks (Haselhuhn, Wong, Orniston, Inesi, & Galinsky, 2014), and CEOs’ corporate success (Wong, Orniston, & Haselhuhn, 2011).

1.2. Dominant explanation for FWHR effects

Most research on the link between FWHR and assertiveness attributes this relationship to the effect of pubertal testosterone to increase both facial masculinization and assertiveness. This explanation rests partly on evidence that pubertal sexual differentiation is associated with widening of the male jaw in many primate species, and human males show a larger FWHR than females (Weston, Friday, & Lio, 2007; but see Lefevre, Lewis, Bates, et al., 2012). Furthermore, testosterone is associated with assertive personality measures, such as physical aggression, reactive aggression, and social dominance (Mazur & Booth, 1998). Also supporting this link, FWHR is correlated with levels of circulating testosterone in men (Lefevre, Lewis, Perrett, & Penke, 2013). Based on the association between FWHR and increased testosterone and links between testosterone and aggressiveness, it is thought that FWHR may provide an honest signal of aggressiveness by indicating a man’s level of pubertal testosterone (Carre et al., 2015).

1.3. Other possible mechanisms for FWHR effects

The large body of research investigating links between FWHR and aggressive or assertive behavior has neglected two related lines of research that suggest mechanisms for the relationship other than pubertal testosterone: 1) men judged as more babyfaced show more assertive, aggressive behavior; and 2) infants with a broader FWHR show a less shy and inhibited temperament in childhood and adulthood.

1.3.1. Babyfaceness and assertive or aggressive behavior

Paralleling relationships between greater FWHR and more assertive or aggressive behavior is evidence that more babyfaced adolescent boys and young men show similar behavior. Babyfaced individuals are perceived as more naïve, honest, and warm than their more maturefaced peers (Zebrowitz & Montepare, 1995). However, babyfaced males do not fit these stereotypes. Babyfaced adolescent boys showed more academic achievement than their more maturefaced peers, an effect mediated by their higher motivation (Zebrowitz, Andreoletti, Collins, Lee, & Blumenthal, 1998), and more babyfaced men were more likely to earn military awards (Collins & Zebrowitz, 1995).
In addition, more babyfaced adolescents from lower socioeconomic status (SES) backgrounds, showed more criminal behaviors (Zebrowitz, Andreoletti, et al., 1998), and early measures of babyfaceness were associated with greater assertiveness and hostility at later ages in men, albeit not women (Zebrowitz, Collins, & Dutta, 1998). These effects parallel the behavioral correlates of higher FWHR discussed in Section 1.1. Moreover, the facial qualities correlated with rated babyfaceness include a rounder face, as defined by relatively equal breadth and length, which is likely to share variance with a broader FWHR (Zebrowitz & Montepare, 1992).

In contrast to the argument that behavioral correlates of FWHR derive from pubertal testosterone levels, it has been suggested that the correlates of babyfaceness may reflect compensatory responses to the babyface stereotype. Indeed, more babyfaced young and middle-aged adults report more external constraints in their lives (i.e., external factors beyond their control that interfere with reaching goals; Andreoletti, Zebrowitz, & Lachman, 2001). One reason may be that babyfaced individuals are eschewed for jobs that value leadership and shrewdness, and favored for those that value the warm and submissive characteristics associated with the babyface stereotype and that are assigned more often to women than men as well as more often to babyfaced than maturefaced men (Zebrowitz, Tenenbaum, & Goldstein, 1991).

Since being viewed as warm and submissive conflicts with masculine ideals, it has been suggested that the more assertive and hostile behavior of more babyfaced men may reflect an effort to counter the babyface stereotype.

1.3.2. FWHR and infant temperament

Just as behavioral correlates of babyfaceness parallel correlates of FWHR in adulthood, so do temperament correlates of FWHR in infancy. Specifically, a landmark study by Arcus and Kagan (1995) found that low-reactive infants, who are developmentally prone to become more outgoing children, have higher FWHR than high-reactive infants, who are developmentally prone to be more shy and inhibited as children. Measures of infants’ FWHR at 14 months (calculated as the ratio of face width at zygion to head height rather than to mid-face height, as in the adult literature) correlated with infant temperament categories determined at 4 months of age. Moreover, this infant reactivity measure continues to predict reactivity in childhood, adolescence, and even into adulthood (e.g., Hardway, Kagan, Snidman, & PinCUS, 2013; 2012; Schwartz, Snidman, & Kagan, 1999; Schwartz et al., 2012).

In contrast to the suggestion that behavioral correlates of FWHR in adult men reflect the influence of pubertal testosterone or the suggestion that similar correlates of babyfaceness reflect a compensatory mechanism, another hormonal influence has been suggested to explain the behavioral correlates of infant FWHR. Specifically, Arcus and Kagan (1995) argued that this relationship may reflect increased prenatal exposure to glucocorticoids in infants with a smaller FWHR. Glucocorticoids are associated with inhibited growth of the palate in primate species (Hendrickx et al., 1975), which would lead to narrower faces and result in smaller FWHR. Further, overexposure to glucocorticoids in prenatal development leads to increased stress responses as well as higher levels of anxiety (Seckl & Meaney, 2004), which could yield less assertive and aggressive behavior.

1.4. Research aims

The present study investigated the conceptual overlap between the literature demonstrating links between adult FWHR and behavior and that demonstrating links between infant FWHR and temperament. More specifically, we investigated whether babyfaceness is associated with FWHR at both ages. As further evidence of conceptual overlap, we also investigated whether babyfaceness is associated with early infant temperament, as it has been shown to be with behavior in adulthood. If babyfaceness shares variance with FWHR in both infancy and adulthood, this would implicate early developmental contributors to the assertive and aggressive behavior shown by young men high in babyfaceness or FWHR, providing an alternative explanation to the influence of pubertal testosterone or compensatory motivation.

2. Method

2.1. Participants

Child participants were drawn from a longitudinal sample of middle-class Caucasian children studied by Kagan and associates. Data used in the present study included a) temperament assessed at 4-months (Kagan, Reznick, & Snidman, 1988), b) FWHR at 14-months (Arcus & Kagan, 1995), and c) facial ratings made in the present study from videotapes during a follow up study of the children at ages 6 to 8.5 years (Kagan, Snidman, Zentner, & Peterson, 1999). The current sample was restricted to the 120 participants videotaped in childhood who had temperament ratings. Of these, 73 also had FWHR measures, a much smaller sample than the number for whom measurements were originally taken (N = 284). Of those with babyface ratings, 41 had been classified in infancy as low reactive and 37 as high reactive, the two temperament categories contrasted by Kagan. Of those with measured FWHR, 25 had been classified as low reactive and 21 as high reactive.

2.2. Stimulus faces

2.2.1. Child participant faces

Thirty second clips of participants were taken from videotapes made during acclimation to the experimenter at the beginning of a long protocol of tests in the study by Kagan et al. (1999).

2.2.2. Adult faces

Thirty six faces were selected from a publicly available database (Minear & Park, 2004), with equal numbers of younger and older men and women (9 per group). Each photograph was stretched in Photoshop by 3% in either height or width, resulting in 3 versions of each facial identity (Fig. 1), yielding 108 stimuli.

2.3. Raters

2.3.1. Child participant face raters

The videotape clips of the child participants were not publicly available. However, the first author and two graduate students with experience assessing babyfaceness from photographs were permitted to view them in Jerome Kagan’s lab in order to make babyfaceness and attractiveness ratings.

2.3.2. Adult faces raters

Thirty two adults (16 women) aged 18–81 (M = 47, SD = 27.86) rated babyfaceness and attractiveness of the adult faces. Students received course credit; others were paid $25.

3. Measures

3.1. FWHR of child participants

FWHR of participants at 14 months of age were taken from Arcus and Kagan (1995), who used calipers to measure the width between the left and right zygion and the height from the top of the head to the chin.

3.2. FWHR of adult faces

Two trained research assistants marked photographs of faces with 6 points (Fig. 2a) from which three distances were calculated (Fig. 2b). Using these distances, two measures of width to height ratio were
calculated: 1) Face FWHR — face width (distance between left and right zygion) divided by face height (distance between nasion and middle upper lip), the method used in the adult FWHR literature. 2) Head FWHR — face width divided by head height (distance between top of the head and bottom of the chin), calculated to see whether this would yield results better matching those found with the FWHR measure used for children. Inter-rater reliability was high for both ratios (rs = .946 and .989, respectively).

3.3. Babyface and attractive ratings

Ratings of babyfaceness and attractiveness of the child participants, shown in a random order, were made using 5-point scales with points labeled ‘very maturefaced (unattractive), somewhat maturefaced (unattractive), neither mature nor babyfaced (neither unattractive nor attractive), somewhat babyfaced (attractive), and very babyfaced (attractive)’. We used more specific scales than for ratings of the adult faces to increase reliability given the small number of raters that had access to the videotapes and the greater difficulty of the task, as the children moved around and were not always looking at the camera. Babyface ratings showed acceptable inter-rater reliability (alpha = .71) whereas attractiveness ratings showed lower reliability (alpha = .57). Because removing one judge’s ratings of attractiveness increased agreement to .70, the attractiveness results reported below only include the judgments of two raters.

Ratings of the babyfaceness and attractiveness of the adult faces were made on 7-point scales with endpoints labeled ‘Not at all’ and ‘Very’. Faces were blocked by age and sex, with the order counterbalanced across participants. All faces were rated on babyfaceness or attractiveness before any were rated on the other dimension. The order of the two ratings was counterbalanced across participants. Babyface ratings showed high reliability (alpha = .94) as did attractiveness ratings (alpha = .98).1

3.4. Temperament measures

Kagan and Snidman (1991) classified infants in the longitudinal study into one of four temperaments based on a battery of visual, auditory, and olfactory tests administered at 4 months of age: high reactive, low reactive, distressed, and aroused. Infants classified as high reactive showed a pattern of high distress and high motor activity; low reactive infants showed a pattern of low distress and low motor activity. Distressed infants were high in distress and low in motor activity whereas aroused infants were high in motor activity and low in distress.

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1 The faces also were rated on other traits in one of two orders: Aggressive, Manipulative, Trustworthy, Dominant, Angry, Masculine, Attractive, Babyfaced; or Dominant, Trustworthy, Manipulative, Aggressive, Masculine, Angry, Babyfaced, Attractive.
4. Results

4.1. Child participants

Infant FWHR was significantly correlated with childhood babynessness despite being measured at an interval of 5 to 7 years, \( r(71) = .48, p < .001 \). Infant FWHR was not correlated with childhood attractiveness \( r(71) = .03, p = .78 \). Both childhood babynessness and infant FWHR were associated with infant temperament. Low reactive infants were significantly more babyled in middle childhood (Mean = 3.21, SE = .14) than were high reactive infants (Mean = 2.78, SE = .21), \( t(70) = 2.22, p = .029, d = .53 \). Although the effect for FWHR was not significant when directly comparing high and low reactive children (low reactive: Mean = .56, SE = .008, high reactive: Mean = .54, SE = .013), \( t(44) = 1.59, p = .12, d = .52 \), this is likely due to lower power, as the means were very similar to those that differed significantly in the results reported by Arcus and Kagan (1995, Fig. 2) for the much larger sample of 284 infants assessed at 14 months. Also, the effect size for FWHR in the current smaller sample is similar to that for babyfacedness, which had a larger sample size.

To increase power, infants who were classified as distressed (high distress—low motor activity) were added to the high reactive group (high distress—high motor activity), creating a set of infants who were high in distress (N = 67). Those classified as aroused (low distress—high motor activity) were added to the low reactive group (low distress—low motor activity), creating a set of infants who were low in distress (N = 53). Analyses combining these combined groups revealed that infants low in distress at 4 months of age had higher FWHR at 14 months, (low distress: Mean = .56, SE = .008, high distress: Mean = .54, SE = .007) \( t(72) = 2.07, p = .042, d = .57 \), and also were significantly more babyled in middle childhood, (low distress: Mean = 3.20, SE = .097, high distress: Mean = 2.83, SE = .013), \( t(117) = 2.43, p = .017, d = .44 \). *2

4.2. Adult faces

As shown in Table 1, the manipulation of FWHR was successful whether it was assessed as the ratio between face width and distance between top of head and chin (Head FWHR) or between face width and distance between the nasion and top of upper lip (Face FWHR). As predicted, FWHR was positively related to adult babyfaceness, just as it was for children. First, the unmanipulated male faces showed a positive relationship between babynessness and Face FWHR, \( r(16) = .685, p = .002 \), and this effect remained significant with face age controlled, \( r(15) = .593, p = .012 \). These correlations were not significant for Head FWHR or for unmanipulated female faces, \( ps > .20 \). Second, a 2(face sex) \( \times \) 2(face age) \( \times \) 3(FWHR) ANOVA yielded a significant main effect for manipulated FWHR, \( F(2,64) = 3.29, p = .044, \eta^2 = .093 \), that was not moderated by face age or face sex, all \( ps > .250 \). Planned comparisons revealed that higher FWHR faces (Mean = 3.30, SE = .12) were judged significantly more babyled than the unmanipulated faces (Mean = 3.18, SE = .13), \( p < .001 \), and the lower FWHR faces (Mean = 3.14, SE = .11), \( p = .043 \), which did not differ from the unmanipulated ones, \( ps > .250 \). The FWHR manipulation had no significant effect on attractiveness, \( F(2,64) = .185, p > .250, \eta^2 = .006 \), and this null effect was not moderated by face age or sex, \( ps > .250 \).

5. Discussion

This study is the first to examine conceptual overlap between the literature demonstrating links between adult FWHR and behavior and that demonstrating links between infant FWHR and temperament. Evidence that these literatures are tapping the same construct is provided by significant correlations between babyfacedness and both infant and adult FWHR as well as between babynessness and infant temperament. The fact that infant temperament shows stability through adolescence and into early adulthood bolsters the argument that the prediction of a bolder temperament from a larger FWHR in infancy captures the same phenomenon as the prediction of assertive and aggressive behavior from a larger FWHR or babyfacedness in adult men.

Additional support for the overlap between the babyface and FWHR literatures was provided by positive correlations between babyfacedness and adult FWHR only when the latter was computed using Face FWHR, as is conventional in adult FWHR research. Although one might suggest that Head FWHR is more comparable to the measure used with infants, the fact that 14 month old infants have not yet shown pubertal growth of the jawbone that is independent of the skull renders the Arcus and Kagan (1995) infant measure more equivalent to adult Face FWHR. The finding that the correlation between adult babyfacedness and Face FWHR in the unmanipulated faces was limited to male faces is consistent with evidence that the documented effects of each of these facial qualities on behavior is largely limited to men. This sex difference also is consistent with the fact that other childlike features also contribute to babyfacedness, and some of these differ for female and male faces. For example, Zebrowitz and Montepare (1992) found that nose bridge size was a significant predictor of the babyfacedness of female, but not male faces.

Our results indicate that relationships between behavior and the facial qualities of FWHR and babyfacedness occur earlier in development than is suggested by research investigating behavioral correlates of these facial qualities in adolescents and adults. This casts doubt on attributions of the relationships to variations in pubertal testosterone levels or compensation for stereotypes. Since Arcus and Kagan (1995) assessed temperament at 4 months and FWHR at 14 months, their results suggest an influence of prenatal hormone exposure or other prenatal factors on future behavior. As suggested by those authors, glucocorticoid exposure provides one possible mechanism linking FWHR (and, by extension, babyfacedness) to temperament in infancy. The same mechanism could also account for the evidence for relationships between facial morphology and behavior in adults, since longitudinal research has shown that infant temperament predicts behavior in adolescence and adulthood (e.g., Hardway et al., 2013; Schwartz et al., 1999, 2012).

Another possible mechanism is prenatal testosterone exposure. However, a meta-analysis showed no evidence for a relationship between adult aggressiveness and the 2D to 4D finger ratio, a proxy for prenatal testosterone exposure (Hönekopp & Watson, 2011). Also, studies investigating whether the 2D:4D finger ratio is associated with facial masculinity have yielded mixed results (Burriss, Little, & Nelson, 2007; Fink et al., 2005; Koehler, Simmons, & Rhodes, 2004; Meindl, Windhager, Wallner, & Schaefer, 2012), and none has specifically assessed FWHR. The implications of these results are unclear, since a meta-analysis found no relationship between finger ratios and androgen receptors, as assessed by genetic polymorphisms (Voracek, 2014). Thus, the 2D:4D ratio may not be a good proxy for prenatal testosterone.

### Table 1

<table>
<thead>
<tr>
<th>Face</th>
<th>Mean</th>
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<tr>
<td>Long, Unmanip</td>
<td>0.57</td>
<td>0.03</td>
<td>1.82</td>
<td>0.12</td>
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<tr>
<td>Wider</td>
<td>0.61</td>
<td>0.03</td>
<td>1.94</td>
<td>0.14</td>
</tr>
</tbody>
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Note: All means within both Head FWHR and Face FWHR were significantly different from each other, \( ps < .001 \). * Facial width divided by head height. *2 Facial width divided by mid-face height.
exposure, reflecting the balance of prenatal testosterone and estrogen rather than testosterone alone (Manning, 2011). A more valid index of prenatal testosterone exposure may well provide evidence that it contributes to the associations between face shape and assertive or aggressive behavior.

Whatever factors in early development contribute to relationships between face shape and assertive or aggressive behavior, various moderators of these effects suggest that developmental influences in addition to prenatal hormone influences are at play. In particular, higher SES, IQ and height decrease the likelihood that babyfaced boys will show more anti-social behavior, like delinquency, and increase the like-lihood that they will show more assertive behavior, like high achieve-ment motivation (Zebrowitz, Andreoletti, et al., 1998; Zebrowitz, Collins, et al., 1998). Similarly, research reveals that the positive relation-ship between FWHR and aggression is moderated by objective and subjective measures of social status, with a significant relationship only for men with relatively low status (Goetz et al., 2013). There is also evidence that self-fulfilling prophecy effects may contribute to less pro-social behavior in men with a higher FWHR (Haselhuhn, Wong, & Ornston, 2013). Furthermore, sex-role socialization may con-trIBUTE to the fact that, with one exception (Lefevre, Etichells, Howell, Clark, & Penton-Voak, 2014), a relationship between FWHR or babyfaceness and aggressive or assertive behavior is more reliable for men than women (Carre & McCormick, 2008; Geniole, Keyes, Carré, & McCormick, 2014; Mileva et al., 2014; Zebrowitz, Andreoletti, et al., 1998; Zebrowitz, Collins, et al., 1998), with these results leading many researchers to study only men. Among the children born with a predis-position toward assertive or aggressive behavior, girls may experience stronger social pressure to subdue this tendency. It is also possible that the babyfaced appearance of boys with greater FWHR may moti-vate them to counter the infantilizing stereotypes, augmenting their early tendencies toward assertive, aggressive behavior. The influence of testosterone at puberty may also augment these tendencies in boys more than girls.

6. Conclusions

Our results suggest that not only is there an early developmental cause for the relationship between infant FWHR and temperament, as Kagan and his associates previously demonstrated, but also that this causal variable is likely to contribute to the documented relationships between FWHR or babyfaceness and assertive or aggressive behavior in adolescence and adulthood. Such early developmental influences warrant additional consideration in research examining the relation-ship between facial breadth and behavior.

Ethics

The protocol was approved by an institutional review board and carried out in accordance with the provisions of the World Medical Association Declaration of Helsinki.

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References


