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Judging a Man By the Width of His Face:
The Role of Facial Ratios and Dominance in Mate Choice at Speed-Dating Events

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ABSTRACT

Previous research shows that men with higher facial width-to-height ratios (fWHRs) have higher testosterone, are more aggressive, more powerful, and more financially successful, but are they more attractive to women in an ecologically valid mating context, speed-dating? Male fWHR was positively associated with perceptions of dominance, being chosen for a second date, and attractiveness to women for short-term, but not long-term relationships. Perceived dominance mediated (by itself and through physical attractiveness) the relationship between fWHR and women's interest in short-term relationships. Furthermore, men's perceptions of own dominance reflected patterns in mating desirability similar to those of fWHR. These results support the idea that fWHR is a physical marker of dominance. This is the first study to show that men with high fWHR are attractive to women for short-term relationships, and that male dominance is attractive in an interactive situation that could actually lead to dating and mating.

**Judging a Man By the Width of His Face:
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Several testosterone-linked traits have been proposed as indicators of genetic fitness (Gangestad & Simpson, 2000). For instance, fluctuating asymmetry of bilateral features such as fingers or eyes is thought to reflect developmental instabilities and genetic abnormalities, and thus may be a summary indicator of genetic quality in various species (Møller & Thornhill, 1998). In humans, men with more symmetrical and masculine faces are thought to have greater genetic resistance to pathogens during development despite having higher levels of testosterone, which has been argued to suppress immunocompetence (Gangestad & Simpson, 2000). Indeed, symmetrical and masculine men are most attractive to women around the time of ovulation, indicating that these men are preferred when women are most likely to conceive (Penton-Voak et al., 1999). In addition to aspects of physical appearance like symmetry and masculinity, behavioral traits like social dominance have also been discussed as indicators of genetic fitness (Gangestad & Simpson, 2000).

Dominance

Dominant men are sexually attractive to women (Sadalla, Kenrick, & Vershure, 1987) and are preferred as mates by women who are ovulating or considering short-term relationships (Gangestad, Garver-Apgar, Simpson, & Cousins, 2007; Gangestad, Simpson, Cousins, Garver-Apgar, & Christensen, 2004). Dominance can be ascertained by observing a man's social presence and intrasexual competitiveness (e.g., Gangestad et al., 2004; Sadalla et al., 1987); however, research suggests it can also be assessed simply by looking at a man's face. Mueller (1996) found that military officers with more dominant-looking faces achieved higher ranks throughout their careers. Facial masculinity, which is highly correlated with facial dominance (Perrett et al., 1998), is linked to perceptions of good health (Rhodes et al., 2007; cf. Boothroyd,

Jones, Burt, & Perrett, 2007) and, because masculine features require immune-system-compromising testosterone to maintain, is hypothesized to indicate good genes (Thornhill & Gangestad, 1999).

In addition to health benefits, facial dominance may be an honest signal of men's formidability as intrasexual competitors, which would be helpful in gaining access to mates and attracting women if stronger competitors were more likely to survive and reproduce (Puts, Jones, & DeBruine, 2012). Supporting these hypotheses, women are more likely to have copulatory orgasms with men who are more dominant (Puts, Welling, Burriss, & Dawood, 2012). Given that orgasms may help direct sperm towards the dominant follicle around ovulation, female copulatory orgasms with such men may be selecting for health and prowess in intrasexual competition (Puts et al., 2012).

As a not mutually exclusive alternative hypothesis, females might prefer dominance in men for direct benefits; for example, provision of physical protection (Snyder et al., 2011).

Facial Width-to-Height Ratio

Recently, researchers have examined a possible physical marker of dominance: the ratio of facial width to upper-facial height (distance between upper-lip and brow), which becomes larger in men after pubertal testosterone exposure (Verdonck, Gaethofs, Carels, & Zegher, 1999), and is linked to men's reactive testosterone levels (LeFevre, Lewis, Perrett, & Penke, 2013).¹ Previous research has suggested a link between facial width-to-height ratio (fWHR) and dominance, but has not explored this relationship directly (e.g. Carré & McCormick, 2008). Relatedly, fWHR may be associated with greater status and resources. For instance, fWHR predicts self-perceived power (Haselhuhn & Wong, 2012) and Chief Executive Officers' financial performance (Wong, Ormiston, & Haselhuhn, 2011). Furthermore, men with higher

fWHR are less likely to die from contact violence, suggesting they are either more formidable fighters or that their skulls are more resistant to blows (Stirrat, Stulp, & Pollet, 2012).

Although men with higher fWHRs may be healthier, more formidable, and are poised to achieve high status, there are downsides to choosing such men as mates. fWHR has been linked to aggressiveness in various contexts (Carré & McCormick, 2008; Carré, McCormick, & Mondloch, 2009). Moreover, men with high fWHRs are more deceptive (Haselhuhn & Wong, 2012) and less trustworthy (Stirrat & Perrett, 2010). Furthermore, dominant men are perceived as less faithful, and less investing as fathers (Johnston, Hagel, Franklin, Fink, & Grammer, 2001). Thus, it makes adaptive sense for women to extract genetic qualities from such men through short-term relationships, rather than entering long-term relationships, where aggression and defection costs are more relevant. Additionally, direct benefits of dominance like the provision of physical protection might outweigh low prospects of long-term investment sometimes, again supporting female mate choice for dominance in short-term relationships.

The Current Study

Although the roles of male dominance in human mating and fWHR in male status have been explored separately, they have not been examined together in a face-to-face dating context (though Hill et al., 2013 investigate dominance, facial shape, and attractiveness to females). It is unclear whether or not there are circumstances in which women find high fWHRs in men to be attractive. The present study aimed to provide a novel investigation of the role of men's fWHRs and dominance in actual mating evaluations and choices made in an ecologically valid, live-interactive context: speed-dating. In speed-dating events, people chat face-to-face with and assess a multitude of potential mates. In this initial mate selection context, we predicted that a

man's fWHR would lead to perceptions of his dominance, making him more desirable as a short-term, but not long-term mate.

Furthermore, given the importance of dominance in mate value and mating strategies, it may be adaptive for men to assess their own dominance accurately. Therefore, we expected self-perceived dominance in men to similarly predict women's interest in short-term, but not long-term relationships or friendship. We did not specifically predict that women would choose to see more dominant men again because such decisions likely reflect a mixture of long- and short-term mating interests.

METHOD

A younger subsample of the Berlin Speed Dating Study was used in order to match speed-daters' ages to facial raters' ages. Seventy-eight men and 81 women participated in one of seven speed-dating events (male age: 20-32 years, $M=26.5$; female age: 18-30 years, $M=25.4$). All were singles and received no other compensation for participating except the chance to find a real-life partner, suggesting the choices were primarily motivated by actual mating interests. In a pre-event questionnaire, participants indicated self-rated dominance via the assured-dominant and unassured-submissive (reverse scored) circumplex portions of the German Revised Interpersonal Adjective Scales (IAS-R; Ostendorf, 2001). They rated how accurately each adjective described them on a 5-point scale (1=*extremely inaccurate*, 5=*extremely accurate*; $\alpha=.81$). Standardized frontal facial photographs (neutral expression) were taken of each participant under uniform lighting conditions on a white background before each event (see Asendorpf, Penke & Back, 2011).

Speed-dates took place in semi-private booths, with each interaction lasting 3 minutes and a bell signalling the end of each date. Men rotated between booths while women remained

seated. Between dates, individuals recorded whether or not they wanted to go on another date with the person just seen and how interested they were (1=*not at all interested*, 5=*very interested*) in a potential short-term relationship, long-term relationship, and friendship. Within 24-hours of each event, participants mutually interested in seeing each other again received each other's contact details via email (Asendorpf et al., 2011). Following Weston et al.'s (2007) procedures, Psychomorph was used to calculate the ratio of the distance between the top of the lip and lower part of the brow (facial height) and the distance between the most lateral points of the face by the ears (bizygomatic width) for each male face. Bizygomatic width was divided by facial height to determine fWHR.

Independent raters (11 male, 44 female, 1 unknown sex) aged 19-25 years ($M=19.6$), rated each male facial photo for dominance on a 7-point scale. Another set of independent raters (16 male, 15 female) aged 22-35 years ($M=26.39$) rated each male facial photo on aggressiveness ("How aggressive would this person be if provoked?"; from Carré et al., 2009; 1=*not at all aggressive*, 7=*very aggressive*). A third set of independent raters (7 male, 4 female) aged 20-40 years ($M=29.45$) rated each male face for facial adiposity (1=*very underweight*, 7=*very overweight*) (Coetzee, Perrett, & Stephen, 2009). A fourth set of 15 females aged 19-34 years ($M=22.67$) rated each male face for attractiveness on a 7-point scale (see Asendorpf et al., 2011). Inter-rater reliability was high for all four dimensions (α s=.96, .91, .95, .89).

RESULTS

Male fWHR

Facial width-to-height ratio is a measure based on bone structure shaped by testosterone at adolescence (Verdonck, et al., 1999). Because facial fat artificially inflates fWHR (Lefevre et al., 2013), we controlled for rated facial adiposity (perceived underweight/overweight) in all

analyses involving fWHR. Facial adiposity was correlated with fWHR, $r(78)=.58, p<.001$, but not with any dependent variables. fWHR correlated with perceived aggressiveness when controlling for facial adiposity, $r(75)=.23, p<0.05$. See Table 1 for zero-order correlations between fWHR and facial ratings. Women's interest for a short-term and long-term relationship, as well as the percentage of women who chose to see a man again were log-transformed to achieve normality.

Table 1. Zero-order Correlations Between fWHR and Facial Ratings

Variable	fWHR	Dominance	Aggressiveness	Facial adiposity
fWHR				
Dominance	.22			
Aggressiveness	.15	.78		
Facial adiposity	.58	-.03	-.06	
Physical attractiveness	-.18	.22	-.15	-.29

Note: $N = 78$ except for ratings of dominance where $N = 77$ because of a technical error in data collection. Significant correlations ($p < .05$) are in boldface; marginally significant correlations ($p < .10$) are in italics. fWHR: facial width-to-height ratio.

When examining the effect of fWHR on female interest in men, we controlled for male age and physical attractiveness because age has been found to contribute to perceptions of dominance and attractiveness in previous studies, and to eliminate physical attractiveness as a confounding factor (e.g. Boothroyd et al., 2007). Consistent with predictions, Table 2 shows that fWHR significantly predicted perceived dominance and being chosen more often. A repeated-measures general linear model was used to analyze men's attractiveness to women. Relationship type (short-term versus long-term; log-transformed) was as a within-subjects variable, and fWHR, age, attractiveness, and adiposity were entered as covariates to determine whether higher fWHR is more attractive to women for a short-term than long-term relationship. There was only

one significant within-subjects effect: an interaction between fWHR and relationship type, $F(1, 73) = 3.99, p < 0.05$. Together with the regression results, the interaction indicates that men with

Table 2. Multiple Linear Regressions Investigating the Effect of Facial Width-to-Height Ratio on Perception and Speed-Dating Outcomes Controlling for Rated Facial Adiposity, Attractiveness, and Age

Predictor	Perceived dominance			Female interest in long-term relationship (log)			Female interest in short-term relationship (log)			Female interest in friendship			Percentage times being chosen (log)		
	<i>b</i>	<i>SE b</i>	β	<i>b</i>	<i>SE b</i>	β	<i>b</i>	<i>SE b</i>	β	<i>b</i>	<i>SE b</i>	β	<i>b</i>	<i>SE b</i>	β
Age	0.03	0.04	.09	0.02	0.01	.32**	0.01	0.01	.21*	0.07	0.03	.23*	0.01	0.00	.26**
Attractiveness	0.22	0.11	.23*	0.09	0.02	.51**	0.08	0.02	.44**	0.39	0.09	.45**	0.05	0.01	.47**
Adiposity	-0.19	0.14	-.19	-0.02	0.02	-.12	-0.05	0.02	-.25†	-0.12	0.12	-.13	-0.03	0.01	-.23†
fWHR	1.92	0.69	.38**	0.14	0.10	.15	0.29	0.11	.31**	0.81	0.56	.18	0.16	0.06	.30**
<i>R</i> ²	.15			.38			.31			.28			.36		
<i>F</i>	3.05*			11.30**			8.23**			7.23**			10.20**		

** $p < .01$; * $p < .05$; † $p < .10$,
 Note: fWHR: facial width-to-height ratio.

higher fWHRs are not more attractive for long-term relationships, but are more attractive for short-term relationships, as predicted.

Mediator Models

We propose a model wherein fWHR leads to perceptions of dominance, causing women to find men physically attractive, resulting in women’s interest in men for short-term relationships. Bias-corrected bootstrapped confidence intervals with 1,000 iterations were calculated using Hayes’ (2013) Process macro for SPSS. When physical attractiveness is not entered into the model, perceived dominance mediates the relationship between fWHR and women’s interest in a short-term relationship, $R^2 = .20, ab = .10$ (95% CI [.02-.24]), $p < .05$. Physical attractiveness does not mediate the relationship between fWHR and women’s interest in a short-term relationship, but it does mediate the relationship between perceived dominance and women’s interest in a short-term relationship. As shown in Figure 1, the indirect effect of fWHR on women’s interest in a short-term relationship through perceived dominance and physical

attractiveness was significant, $ab=.03$ (95% CI [.01-.11]), $p<.05$.² The remaining direct effect of fWHR on women’s interest in a short-term relationship was also significant, $t=2.04$, $p<.05$. The direct and indirect effects of fWHR combined explain 34% of the variance in women’s interest in short-term relationships. Thus, results support our model that a higher male fWHR leads to perceptions of greater dominance, which increases physical attractiveness, which in turn makes men attractive for short-term relationships.

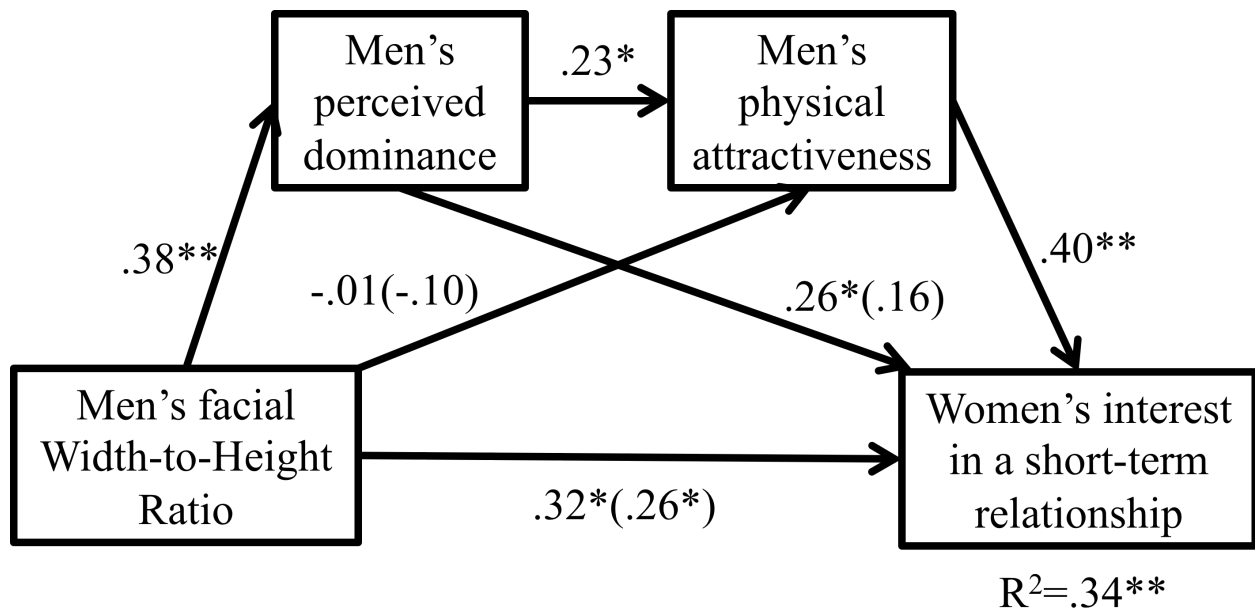


Figure 1. Standardized regression coefficients for the relationship between facial width-to-height ratio (fWHR) and women’s interest in short-term relationships as mediated by perceived dominance and physical attractiveness, controlling for facial adiposity and age. The standardized regression coefficients controlling for the relevant mediator(s) are in parentheses.

*: $p < .05$; **: $p < .01$

Self-rated dominance

Self-rated dominance was positively correlated with other-perceived dominance at a marginally significant level, $r(76)=.20$, $p=.09$. There was no correlation between self-rated dominance and fWHR (controlling for adiposity), $r(74)=-0.05$, *ns*. However, as predicted, self-rated male dominance was significantly more related to women’s interest for short-term, $r(77)=.24$, $p=.04$, than long-term relationships, $r(77)=.01$, $p=.91$, as indicated by a significant interaction between relationship type and self-rated dominance, controlling for adiposity, age,

and attractiveness, $F(1,72)=12.46, p<.01$. There was no relationship between self-perceived dominance and friendship interest, $r(77)=-.13, p=.25$ or times being chosen, $r(77)=-0.02, p=0.89$. Thus, results tentatively indicated that men's ratings of own dominance tracked other-perceived dominance, and reflected similar patterns in mating desirability to fWHR.

DISCUSSION

The results support our proposed model whereby fWHR is a physical marker of male dominance, and men with high fWHRs are attractive to women for short-term, but not long-term relationships. More generally, the findings support the hypothesis that dominance is a sexually selected trait indicating genetic quality (Thornhill & Gangestad, 1999). The results are also consistent with the non-mutually exclusive explanation that women may be favoring dominant-looking men to gain protection in a short-term context at the expense of having long-term investment. Moreover, sexually dimorphic traits in men, particularly their faces, may have been shaped by intrasexual selection, and then became attractive to women secondarily (Puts et al., 2012). This study is significant because it is the first to show that high fWHR is associated with attractiveness to women for short-term, but not long-term, relationships, and the first to examine the role of both dominance and fWHR in an ecologically valid mate selection context.

While fWHR and other-perceived dominance were related, fWHR and IAS-R self-rated dominance were not. This may be because fWHR indicates physical dominance (e.g., men with high fWHR are less likely to die from contact violence than men with low fWHR; Stirrat et al., 2012), while the IAS-R measures social dominance (Ostendorf, 2001). fWHR and other-perceived dominance were significantly correlated with other-perceived aggressiveness, while self-rated dominance was not. Similarly, Carré and McCormick (2008) found that fWHR predicted aggressive behaviour, but trait dominance as measured by the International Personality

Item Pool scales did not. Further research could investigate the independence and accuracy in self-assessment of distinct types of dominance.

Additional mediators of the relationship between fWHR and women's interest in men for short-term relationships could be explored as dominance and physical attractiveness did not fully mediate this relationship. Are men with wider faces healthier? Do they seem like good protectors or providers? Men with wide faces are not more physically attractive to women, but are preferred for short-term relationships and future dates. Further research should further explore these issues. Future studies could also investigate how ovulation affects women's interest in dominance cues in more interactive contexts. Gangestad et al. (2004) began this process by videotaping men answering questions posed by a woman allegedly considering them for a lunch date, and indicating why the men would be a better date than their competitors. Men high in social presence and direct intrasexual competitiveness were preferred more for short-term than long-term relationships, particularly when women were ovulating. Thus far, however, no live-interactive studies have examined whether perceived dominance or high fWHR is preferred by women during ovulation. More research is needed to ensure that the extensive lab-based findings regarding dominance and ovulation extend to real-world scenarios.

Conclusion

Women perceived men with wide faces as dominant and were attracted to them for short-term relationships. The results complement and extend the large body of work on facialmetrics and attraction, as well as recent work on mate choice in live-interactive mate selection contexts, and highlight the importance of deducing why dominant men are alluring to women.

Authorship: K.A.V. and D.I.P. developed the study concept. All authors contributed to the study design. Testing and data collection were performed by K.A.V. and L.P. K.A.V. performed the

data analysis under the supervision of D.I.P., L.P. and N.P.L. K.A.V. drafted the paper and N.P.L., D.P. and L.P. provided critical revisions. All authors approved the final version of the paper for submission.

NOTES

1. fWHR measured from skulls is not sexually dimorphic, but is associated with sex-differences in contact violence mortality (Stirrat et al., 2012).
2. Coefficients differ from Table 1 and $N=77$ because one man did not receive dominance ratings due to a technical error and Hayes' Process excludes missing data.

REFERENCES

- Asendorpf, J. B., Penke, L., & Back, M. D. (2011). From dating to mating and relating: Predictors of initial and long-term outcomes of speed-dating in a community sample. *European Journal of Personality, 25*, 16-30.
- Boothroyd, L. G., Jones, B. C., Burt, M., & Perrett, D. I. (2007). Partner characteristics associated with masculinity, health, and maturity in male faces. *Personality and Individual Differences, 43*, 1161-1173.
- Carré, J. M., & McCormick, C. M. (2008). In your face: facial metrics predict aggressive behaviour in the laboratory and in varsity and professional hockey players. *Proceedings of the Royal Society B: Biological Sciences, 275*, 2651-2656.
- Carré, J. M., McCormick, C. M., & Mondloch, C. J. (2009). Facial structure is a reliable cue of aggressive behavior. *Psychological Science, 20*, 1194-1198.
- Coetsee, V., Perrett, D. I., & Stephen, I. D. (2009). Facial adiposity: A cue to health?. *Perception, 38*, 1700-1711.
- Gangestad, S. W., Garver-Apgar, C. E., Simpson, J.A., & Cousins, A. J. (2007). Changes in women's mate preferences across the ovulatory cycle. *Journal of Personality and Social Psychology, 92*, 151-163

- Gangestad, S. W., & Simpson, J. A. (2000). The evolution of human mating: Trade-offs and strategic pluralism. *Behavioral and Brain Sciences*, *23*, 573-587.
- Gangestad, S. W., Simpson, J. A., Cousins, A. J., Garver-Apgar, C. E., & Christensen, P. N. (2004). Women's preferences for male behavioural displays change across the menstrual cycle. *Psychological Science*, *15*, 203-207.
- Haselhuhn, M. P. & Wong, E. M. (2012). Bad to the bone: Facial structure predicts unethical behaviour. *Proceedings of the Royal Society B*, *279*, 571-576.
- Hayes, A. F. (2013). *An introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: Guilford Press. <http://www.guilford.com>
- Hill, A. K., Hunt, J., Welling, L. L. M., Cárdenas, R. A., Rotella, M. A., Wheatley, J. R., et al. (2013). Quantifying the strength and form of sexual selection on men's traits. *Evolution and Human Behavior*, *34*, 334-341.
- Johnston, V. S., Hagel, R., Franklin, M., Fink, B., & Grammer, K. (2001). Male facial attractiveness: Evidence for hormone-mediated adaptive design. *Evolution and Human Behavior*, *22*, 251-267.
- Lefevre, C. E., Lewis, G. J., Perrett, D. I., & Penke, L. (2013). Telling facial metrics: Facial width-to-height ratio is associated with testosterone levels in men. *Evolution and Human Behavior*, *34*, 273-279.
- Møller, A. P., & Thornhill, R. (1998). Bilateral symmetry and sexual selection: A meta-analysis. *The American Naturalist*, *151*, 174-192.
- Mueller, U. (1996). Facial dominance of West Point cadets as a predictor of later military rank. *Social Forces*, *74*, 823-850.
- Ostendorf, F. (2001). Measuring interpersonal behavior with the German Interpersonal Adjective Scales. In R. Riemann, F. M. Spinath & F. Ostendorf (Eds.), *Personality and temperament. Genetics, evolution, and structure* (pp. 232-260). Lengerich: Pabst.

- Penton-Voak, I. S., Perrett, D. I., Castles, D. L., Kobayashi, T., Burt, D. M., Murray, L. K., & Minamisawa, R. (1999). Menstrual cycle alters face preference. *Nature*, *399*, 741-742.
- Perrett, D. I., Lee, K. J., Penton-Voak, I. S., Rowland, D., Yoshikawa, S., Burt, D. M., Henzi, S. P., Castles, D. L., & Akamatsu, S. (1998). Effects of sexual dimorphism on facial attractiveness. *Nature*, *394*, 884-887.
- Puts, D. A., Jones, B. C., & DeBruine, L. M. (2012). Sexual selection on human faces and voices. *Journal of Sex Research*, *49*, 227-243.
- Puts, D. A., Welling, L. L. M., Burriss, R. P., Dawood, K. (2012). Men's masculinity and attractiveness predict their female partners' reported orgasm frequency and timing. *Evolution and Human Behavior*, *33*, 1-9.
- Rhodes, G., Yoshikawa, Y., Polermo, R., Simmons, L.W., Peters, M. Lee, K., Halberstadt, J. & Crawford, J. R. (2007) Perceived health contributes to the attractiveness of facial symmetry, averageness, and sexual dimorphism. *Perception*, *36*, 1244-1252.
- Sadalla, E. K., Kenrick, D. T., & Vershure, B. (1987). Dominance and heterosexual attraction. *Journal of Personality and Social Psychology*, *52*, 730-738.
- Snyder, J. K., Fessler, D. M. T., Teokhin, L., Frederick, D. A., Lee, S. W., & Navarette, C. D. (2011). Tradeoffs in a dangerous world: Women's fear of crime predicts preferences for aggressive and formidable mates. *Evolution and Human Behavior*, *32*, 127-137.
- Stieger, J. H. (1980). Tests for comparing elements of a correlation matrix. *Psychological Bulletin*, *87*, 245-251.
- Stirrat, M., & Perrett, D. I. (2010). Valid facial cues to cooperation and trust: Male facial width and trustworthiness. *Psychological Science*, *21*, 349-354.
- Stirrat, M., Stulp, G., & Pollet, T. V. (2012). Male facial width is associated with death by contact violence: narrow-faced males are more likely to die from contact violence. *Evolution and Human Behavior*, *33*, 551-556.
- Thornhill R., & Gangestad S.W. (1999). Facial attractiveness. *Trends in Cognitive Science*, *3*, 452-460.

- Verdonk, A., Gaethofs, M., Carels, C. & de Zegher, F. (1999). Effect of low-dose testosterone treatment on craniofacial growth in boys with delayed puberty. *European Journal of Orthodontics*, 21, 137-143.
- Weston, E. M., Friday, A. E. & Liò, P. (2007) Biometric evidence that sexual selection has shaped the hominin face. *PloS ONE*, 2, 1-8.
- Wong, E. M., Ormiston, M. E., & Haselhuhn, M. P. (2011). A face only an investor could love: CEOs' facial structure predicts their firms' financial performance. *Psychological Science*, 22, 1478-1483.