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Promiscuity is related to masculine and feminine body traits in both men and women: Evidence from Brazilian and Czech samples

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ABSTRACT

One of the possible explanations for human within-sex variation in promiscuity stems from conditional strategies dependent on the level of body sex-dimorphism. There is some evidence that masculine men and feminine women are more promiscuous than their sex-atypical counterparts, although mixed results persist. Moreover, another line of evidence shows that more promiscuous women are rather sex-atypical. We tested whether diverse sex-dimorphic body measures (2D:4D, WHR/WSR, handgrip strength, and height and weight) influence sociosexual desires, attitudes, promiscuous behavior, and age of first intercourse in a sex-typical or sex-atypical direction. Participants were 185 young adults, 51 men and 54 women from Brazil, and 40 men and 40 women from the Czech Republic. In men stronger handgrip and more feminine 2D:4D predicted higher sociosexual behaviors, desires, and lower age of the first sexual intercourse. While in women, sociosexual desires were predicted by lower handgrip strength and more feminine 2D:4D. It thus seems that it is rather a mixture of masculine and feminine traits in men, and feminine traits in women that increase their sociosexuality. Masculine traits (height) predicting female promiscuous behavior were specific for only one population. In conclusion, a mosaic combination of sex-typical but also sex-atypical independent body traits can lead to higher promiscuity, particularly in men. Limitations, implications, and future directions for research are considered.

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1. Introduction

Cross-culturally, men on average score higher on sociosexual orientation than women (Lippa, 2009; Penke and Asendorpf, 2008; Schmitt, 2005), which means they show a higher tendency for uncommitted sexual variety, usually referred to as a sexual unrestrictiveness or promiscuity. Despite that, there is substantial intrasexual variation in sociosexuality that still needs to be explained (Bailey et al., 2000; Gangestad and Simpson, 2000; Gross, 1996; Landolt et al., 1995). Individual variance in mating behavior can be seen as a result of each individual adjusting his/her mating tactics according to his/her physiological, morphological, cognitive, or psychological state (Gross, 1996; Oliveira et al., 2008).

One of the factors that can influence the intrasexual variation of mating tactics is the degree of overall individual masculinization. It has been suggested that higher androgen levels, in particular during the organizational period of individual ontogeny, influence the development of masculine traits in general, including psychological or cognitive traits, physical traits or sexuality (Mikach and Bailey, 1999). Consequently, irrespective of sex, individuals with higher androgen exposure during prenatal development are expected to show more masculine traits, including sexual strategies. In other words, similar mechanisms that influence average sex differences are supposed to also cause the intrasexual variation in such traits. Thus, more typical sexual behavior, such as higher sociosexuality, should be connected to other more masculine, for example somatic, traits in both men and women, pointing to their similar aetiological proximate mechanisms.

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On the other hand, it has been hypothesized that it is not the process of masculinization per se, but rather the degree of individual sex typicality that influences intrasexual variation in sociosexuality or sexual promiscuity in general. Sex-typical body traits (sizes and shapes) in both men and women are supposed to reflect optimal levels of sex hormones (current, pubertal or/and prenatal) and indicate sexual maturity, fertility, and genetic and developmental underlying heritable qualities of the organism ('good genes') (for reviews, see Gallup and Frederick, 2010; Grammer et al., 2003). Consequently, more sex-typical individuals might have increased mating opportunities and facilities to access mates, and thus higher sociosexuality. From the evolutionary perspective, sexual promiscuity can increase reproductive success in males more than in females (Gangestad and Simpson, 2000). However, women can also benefit from uncommitted sexual encounters through receiving both direct benefits (e.g., immediate resources, social status) and indirect benefits (e.g., 'good genes', 'sexy sons') (Gangestad and Simpson, 2000). Also, within-subject studies have shown that women during their fertile phase of the menstrual cycle, i.e. when they have higher estrogen levels, show higher tendencies to extrapair copulations, short-term matings, and preferences for more masculine men (e.g. Gangestad and Thornhill, 2008). Thus, more feminine women could benefit from a short-term sexual strategy, at least under certain conditions.

Interestingly, these two theories are in agreement when hypothesizing about the connection between male sociosexuality and the degree of masculine, or sex-typical, somatic traits: men higher on sociosexuality should show higher sociosexual behaviors and desires. Nevertheless, the hypotheses are in sharp contrast when it comes to women. Following the logic of the first approach we would expect rather masculine women adopt more promiscuous sexual strategies, while according to the second approach we would expect rather feminine women to show elevated sociosexuality.

There have been many studies looking at the relation between somatic masculinity and sexual promiscuity in both men and women (e.g., Boothroyd et al., 2008; Charles and Alexander, 2011; Hill et al., 2013; Hönekopp et al., 2006; Hughes et al., 2004; Manning and Fink, 2008; Puts et al., 2004; Rahman et al., 2005; Scarbrough and Johnston, 2005; Schwarz et al., 2011; Shoup and Gallup, 2008; Sim, 2013). The majority of these studies have investigated only one or a few sex-dimorphic body traits, usually in only one sex and within one population. The results of these studies have generally been ambiguous, so it is still not clear whether sociosexuality is connected with masculine or feminine body traits in either sex. Within-sex variation in promiscuity in both men and women thus deserves further testing using a more detailed approach.

1.1. The current study

In this study, we aimed to overcome many of the limitations of previous studies, by testing the relationship between a broader range of physical traits in both men and women (2D:4D, mean handgrip strength, height, weight, and WHR in women and WSR in men) from two ethnically diverse populations (Brazil and the Czech Republic) and proxies of sexual promiscuity (sociosexual desire, attitudes, promiscuous behavior, and age of the first intercourse). Such approach can shed more light on this research area, and increase the generality of the results.

The main focus of this study was to verify the direction and strength of the relationship between sex-dimorphic body measures and sexual promiscuity in both men and women. According to the first approach outlined above, individual level of somatic masculinity should be positively linked to sexual promiscuity in both men and women. The second approach predicts that sex-typical individuals should show elevated sexual promiscuity, so we should expect more masculine men but more feminine women would show higher tendencies to unrestricted sexual strategies. Concerning women, we thus have two alternative opposing hypotheses.

2. Materials and methods

2.1. Target sample

In total, 185 individuals participated in the study. Fifty-one men (age $M = 23.57$, SD = 3.89) and 54 women (age $M = 24.02$, SD = 4.86) were recruited at the University of São Paulo, Brazil, and 40 men (age $M = 22.65$, SD = 2.51) and 40 women (age $M = 22.43$, SD = 2.42) were recruited at the Charles University in Prague, Czech Republic. From subsequent analyses we removed participants who were 34 or older ($n = 3$), and individuals who indicated bisexual or predominantly or exclusively homosexual orientation (8 women and 10 men), since it has been shown that homosexual and heterosexual individuals can vary in traits such as body morphology (Valentova et al., 2014) and sociosexuality (Schmitt, 2006). The final sample consisted of 163 individuals (age $M = 22.99$, SD = 3.35), 83 women (44 Brazilians) and 80 men (41 Brazilians). Age did not vary according to sex or target country (all p-values > .05). The samples from both populations were comparable, because all participants were students from different undergraduate and graduate courses, from the largest cities and universities of each country.

2.2. Procedure

In both countries, the data were gathered under similar conditions to allow cross-cultural comparisons. Participants were informed about the basic aims of the study, and they came to the laboratory. Each participant who agreed to participate signed a consent form with detailed information about the study. The research was anonymous and voluntary – if anyone would not agree to participate, he or she could leave the study at any time without explanation. According to local law, Brazilian participants were not allowed to receive any financial reward. Czech participants were reimbursed with the equivalent of US$20. Nobody quit the research, but 2 individuals from the Brazilian sample refused to provide some data.

After signing the informed consent, each participant went through the whole procedure which took from 40 to 60 min. Altogether, each participant filled in a battery of questionnaires, and other procedures. The presented study is thus part of a larger project, and only information relevant to this particular study will be provided here in detail.

2.2.1. Questionnaires

Each participant filled in a questionnaire to provide self-reports of basic socio-demographic variables, and the Revised Sociosexual Orientation Inventory (SOI-R; Penke and Asendorpf, 2008), a well-established measure of sexual strategy, particularly propensity for sexual variety, uncommitted short-term sexual relationships. The questionnaire consists of 9 items, which are averaged into three sub-scales of sociosexual Behavior, Attitudes, and Desires. Higher scores known as unrestricted socio-sexual orientation indicate a stronger tendency toward short-term mating strategy (Cronbach's alpha = .750, males = .733, and females = .653). To assess other measures of mating allocation, we asked the participants to indicate the age of their first sexual intercourse (AFSI), and lifetime number of sexual partners (LNSP). The participants also indicated their sexual orientation on a 7-point Kinsey scale, where 0 = exclusively heterosexual, 3 = bisexual, and 6 = exclusively homosexual. Only individuals exclusively or predominantly heterosexual were included in the subsequent analyses.

2.2.2. Anthropometric measures

For each participant, we measured height (in cm) and weight (in kg). With a standard metric tape, we further measured the circumference of waist and hips in women, and waist and shoulders in men. From these measures, we computed waist-to-hip ratio (WHR) for women, by dividing waist circumference by hip circumference, and waist-to-shoulder ratio (WSR) for men, by dividing waist circumference by shoulder circumference. Also, the lengths of index and ring fingers were measured with a precise digital caliper. Each finger was measured twice on its ventral surface from the basal crease to their tip, and the average measured value was recorded. From these measures, we computed 2nd to 4th finger ratio (2D:4D). For the subsequent analyses we used only right 2D:4D, since previous research, consistent with our sample, has shown that right 2D:4D shows a bigger sex difference (Hönekopp and Watson, 2010) and is therefore a better measure of somatic masculinity–femininity. Finally, we measured maximum force trials of handgrip strength (in kilograms force, kgf) on two separate squeezes from each hand, alternating between right and left with different dynamometers for each population. Both the average strength for each hand and maximum handgrip showed virtually identical results, therefore we report analyses only for the average handgrip strength (HGS). Because participants could skip any self-report or body measurement of their choice, there are slightly different numbers of subjects for each analysis reflecting the subset of participants who have completed the particular procedure.

2.3. Analyses

First, we checked the normality of the data with Sapiro–Wilks's W test and since departure from normality in nearly all variables was detected, nonparametric tests were used where possible. We standardized all variables into z-scores. Since SOI-Behavior and LNSP correlated strongly in both men (Kendall's Tau = .743, $N = 78$, $p < .001$) and women (Kendall's Tau = .623, $N = 82$, $p < .001$), their averaged score, unrestricted behavior, was used in the subsequent analyses. Due to the relatively large number of comparisons performed, significances above a more conservative p of .01 should be treated with caution to avoid type I error, false positives. All data were analyzed using SPSS 21.0 (IBM Corp.).

3. Results

3.1. Differences between sexes and countries in physical measures, and sexual promiscuity

We ran a multivariate ANOVA, which is considered to be robust to violations of normality, to test for possible effects of sex, country, and sex*country on right 2D:4D, and height and weight. Between-subject effects showed significant effect of sex on 2D:4D ($p = .003$), height ($p < .001$), and weight ($p < .001$), significant effect of country on height ($p = .001$) and weight ($p < .001$), not on 2D:4D ($p = .586$), and there was no significant interaction between sex*country. According to these results, women showed higher 2D:4D (mean = .98, SD = .03) than men (mean = .97, SD = .03), women were on average shorter (mean height = 165.11 cm, SD = 6.10) than men (mean height = 177.43 cm, SD = 7.12), and women were lighter (mean weight = 59.01, SD = 10.53) than men (mean weight = 73.21, SD = 10.62). Both Brazilian men (mean height = 175.49 cm, SD = 6.77; mean weight = 70.05, SD = .10.82) and Brazilian women (mean height = 163.77, SD = 6.05; mean weight = 56.30, SD = 7.03) were shorter and lighter than Czech men (mean height = 179.53, SD = 6.98; mean weight = 76.63, SD = 9.39) and Czech women (mean height = 166.62, SD = 5.88; mean weight = 62.07, SD = 12.86). With an additional t-test we tested for sex differences in handgrip strength separately for the two populations, because in the two populations we used different measurement tools. In both populations, women showed significantly lower handgrip strength than men (both $p < .001$). Finally, to test for possible differences between the populations in WHR and WSR in women and men, respectively, we ran t-tests separately for each sex. In women there was no difference in WHR (mean WHR = .74, SD = .04) between the two populations ($t = 1.454$, df = 80, $p = .150$). In men, we found a significant difference between the two populations ($t = 2.714$, df = 78, $p = .008$) with Czech men having higher WSR (mean WSR = .74, SD = .05) than Brazilian men (mean WSR = .71, SD = .04).

Similarly to body measures, we tested the effect of sex, country and sex*country on sexuality measures. Since age turned out to be significantly associated with all sexuality measures except SOI-Desire (all $p > .02$), age was entered in the MANCOVA as a covariate. In line with previous studies, we found a main effect of sex on Promiscuous behavior ($p = .003$), SOI-Attitudes ($p < .001$), SOI-Desire ($p < .001$), and there was no effect on AFSI ($p = .293$). In all measures women scored lower than men. Further, there was a significant effect of country on SOI-Attitudes ($p = .003$), and SOI-Desire (0 = .018). In both measures, Brazilian participants scored higher then Czech participants. There was no significant sex*country interaction.

3.2. Relationship between sexual promiscuity (SOI-Desire, SOI-Attitudes, Promiscuous Behavior, AFSI) and physical measures (height, weight, WSR/WHR, handgrip strength, 2D:4D)

In order to test whether sexual promiscuity correlates with sex-dimorphic body measures, we ran explorative nonparametric Kendall 4×5 correlations between promiscuity measures and body measures, separately for each sex, first with participants from both countries together and then for each country separately. In the end, we performed multiple linear regressions, where sexual measures were entered as dependent variable, and body measures as predictors.

In men, the correlations clearly showed a positive relationship between several sexual measures and mean handgrip strength and 2D:4D. More specifically, men with stronger handgrip strength reported higher Promiscuous Behavior (Kendall's Tau = .222, $N = 80$, $p = .004$), and lower AFSI (Kendall's Tau = −.191, $N = 69$, $p = .028$). Similarly, men with higher (i.e. more feminine) 2D:4D reported higher Promiscuous Behavior (Kendall's Tau = .222, $N = 79$, $p = .004$), and also SOI-Desire (Kendall's Tau = .213, $N = 79$, $p = .007$). When controlling for SOI-Desire and SOI-Attitudes, only a significant positive relationship between Promiscuous behavior and 2D:4D remained ($r = .258$, $N = 75$, $p = .023$). When controlling for Promiscuous behavior, no correlation was significant. Linear stepwise regression repeated the basic results. In particular, 2D:4D and handgrip strength both positively predicted Promiscuous Behavior (R2 = .189, $F = 8.848$, $p < .001$), and 2D:4D predicted positively also SOI-Desire (R2 = .082, $F = 6.847$, $p = .011$), and negatively AFSI (R2 = .111, $F = 8.212$, $p = .006$). There were no effects of height, weight, neither WSR on sexual restrictiveness measures.

The results remained very similar for the Brazilian sample of men, with both 2D:4D and handgrip strength positively predicting Promiscuous Behavior (R2 = .319, $F = 8.893$, $p = .001$), SOI-Desire (R2 = .308, $F = 8.438$, $p = .001$), and SOI-Attitudes (R2 = .256, $F = 6.536$, $p = .004$). However, in Czech men, only 2D:4D negatively predicted AFSI (R2 = .147, $F = 5.670$, $p = .023$).

In women, handgrip strength correlated negatively with SOI-Desire (Kendall's Tau = −.207, $N = 69$, $p = .016$), and weight and height correlated positively with Promiscuous behavior (Kendall's Tau = .183, $N = 83$, $p = .016$; Kendall's Tau = .158, $N = 83$, $p = .039$, respectively). When controlling for SOI-Attitudes and SOI-Desire,

there was no correlation with Promiscuous behavior, while when controlling for Promiscuous behavior, handgrip strength negatively correlated with both SOI-Desire and SOI-Attitudes ($r = -.327$, $N = 65$, $p = .007$; $r = -.277$, $N = 65$, $p = .023$, respectively). Regression showed that SOI-Desire was negatively predicted by handgrip strength and positively by 2D:4D (R2 = .166, $F = 6.463$, $p = .003$).

In Brazilian women, it was only height which positively predicted Promiscuous Behavior (R2 = .167, $F = 5.409$, $p = .028$) and also negatively AFSI (R2 = .206, $F = 6.488$, $p = .017$). In Czech women, SOI-Desire was positively predicted by 2D:4D (R2 = .142, $F = 6.108$, $p = .018$).

4. Discussion

We have tested whether body measures, which on average differ between men and women and can thus be considered as sex-(a)typical traits within each sex, predict sexual strategies, which are also highly sex-specific. If more promiscuous sexual strategies are one of the masculine traits, developing at least in part under the influence of prenatal or pubertal androgens, individuals with more masculine body traits, irrespective of sex, should show also higher sexual promiscuity, while the opposite should be truth for rather feminine individuals. On the other hand, if optimal levels of sex hormones underpin sex-typicality, men with more masculine and women with more feminine traits might show rather higher sexual unrestrictiveness, for example because they have more opportunities. From this point of view, it is always masculine characteristics in men that are connected to sexual promiscuity, while both feminine and masculine characteristics in women can be related to sexual strategies.

We have actually shown that these two concepts do not need to be in opposition, because in our sample women with both masculine traits (height, weight) and feminine traits (higher 2D:4D, lower handgrip strength) reported higher promiscuous strategies. Interestingly, masculine traits predicted promiscuous behavior, including age of first intercourse, while more feminine characteristics predicted sociosexual desire. Thus, our data support one of the outlined approaches, showing that women with rather masculine body traits also tend to have a higher number of sexual partners and start earlier with sexual activities, and have thus more unrestricted sexual behavior (Clark, 2004; Mikach and Bailey, 1999). On the other hand, we also supported the other possibility (Manning and Fink, 2008; Rahman et al., 2005), by showing that rather more feminine women have higher sociosexual desires. Sociosexual desires do not need to reflect behaviors (Penke and Asendorpf, 2008), but they can increase, for example, flirting behavior with men who are willing to provide immediate resources or status. Since it is the woman who chooses with whom she will actually have a consensual sexual encounter, women with higher desires can manipulate men in order to get what they want, without needing to have actual sex with them.

However, our data raised a serious question concerning men, since men with one masculine (hand-grip), and one feminine trait (higher 2D:4D) reported higher sociosexuality. In Brazilian men it was this combination of masculine and feminine traits, which predicted all measures of sexual unrestrictiveness, while in Czech men only a more feminine 2D:4D predicted age of the first sexual intercourse. Thus, we have partly supported previous literature that showed that US men with higher handgrip strength reported relatively earlier sexual experience and a greater number of sex partners (Gallup et al., 2007; Shoup and Gallup, 2008). However, our results are independently in agreement with a study showing the opposite pattern, e.g. association between feminine 2D:4D in men and promiscuity (Puts et al., 2004). In a similar vein, Ostovich and Sabini (2004) reported that men with more feminine gender identity also had higher sex drive than more masculine men. Surprisingly, none of the authors interpreted these results, one of them clearly stating that they "are unable to suggest why a more feminine gender identity might be correlated with a higher sex drive in adulthood for men" (Ostovich and Sabini, 2004, p. 1261).

An implicit presumption of both lines of reasoning is that a testosterone signaling mechanism and body traits have evolved as a unit. However it has already been pointed out that they might be independent to some degree (Hau, 2007). From a proximate viewpoint, it is thus possible that heterogenous timing of masculinization and/or defeminization events (prenatal and pubertal), associated with heterogenous distribution of androgen receptors throughout development of different body modules during ontogeny (Bastir, 2008; Bastir et al., 2013; Bastir and Rosas, 2009) can account for seemingly contradictory findings.

Because individual women have different preferences, we suggest that by possessing a mosaic of independent masculine and feminine quality indicators (facial, bodily, behavioral, and psychological) men can potentially increase their reproductive fitness by broadening the pool of potential sexual partners. In fact, it has been shown that very attractive males possess a combination of both masculine (maturity and status) and feminine (neotenic and expressive) facial features, in line with the multiple motives hypothesis (Cunningham et al., 1990). In addition, in monogamous relationships the majority of women ideally secure from the same man both 'good genes' indicators, frequently associated with masculine traits, and direct benefits, such as good partner and parenting qualities, associated with rather feminine traits. Indeed, it has been shown that women, particularly when higher on attractiveness, put greater emphasis on securing the best combination of all preferred qualities from the same man: indicators of good genes, good investment abilities, good parenting abilities, and good partner traits (Buss and Shackelford, 2008). Thus, possessing androgynous features, both masculine and feminine, might lead to higher sexual opportunities in men, including relationships with high quality women, and potentially to higher reproductive success.

One should keep in mind that in the study of human individual variation it is very difficult to provide experimental evidence. Therefore most of the evidence we provide is correlational and cross-sectional as in the majority of the previous literature. Another, rather technical, limitation of this study is the fact that we used different dynamometers to measure handgrip strength in the two investigated populations, which compromises confidence in cross-cultural comparisons. However, the reported sex-differences within each culture in this trait were in the expected direction.

Further, participants from the two different populations studied, in both countries, have been recruited from the middle-class university student population in the biggest cities of both countries, and thus are not properly cross-culturally diverse (for discussion see, Henrich et al., 2010). More cross-cultural comparisons are thus needed for testing the universality of the effects described. Interestingly, despite the high similarity of the samples studied and the methods used, we have found some specific differences pointing to the unique character of each studied population. Employing more than one limited sample can allow researchers to overcome simplistic interpretations of results valid only for a specific population. For example, the result that neither masculinity nor femininity alone mediate human sociosexuality can vary in different populations, and in a cross-cultural sample, a more realistic picture can emerge, such as a mosaic of independent factors modulating the studied variation. Indeed, we have found some specific differences between the two studied populations. In fact, in Czech men and women it was only a more feminine digit ratio that predicted their age of first sex and sociosexual desire, respectively. In contrast, in Brazilian women only greater height predicted sociosexual

behavior, while in Brazilian men the mixture of feminine and masculine traits was connected to almost all sociosexuality measures.

5. Conclusions

Up to one quarter of the within-sex variation in sexual promiscuity has been shown to be related to masculine and feminine independent body traits in both men and women. A mosaic combination of both sex-typical and sex-atypical independent traits can lead to higher promiscuity in both men and women. In men, body traits are related to the behavioral domain of sexual irrestrictiveness, while in women body traits are related to the domain of desire, and partly also behavior. Since masculine and feminine traits in men reflect different kinds of desired mating qualities (good genes, resources, parenting, and good partner qualities) having both types of traits can increase their pool of potential partners. Remarkably, we have shown that different body traits independently covary with promiscuity in distinct ways. For instance, handgrip is always sex-typically associated with promiscuity in both men and women (i.e., stronger men and weaker women are more promiscuous). In contrast, a feminine 2D:4D is associated with promiscuity in both males and females.

This study has gone some way toward enhancing our understanding of how opposite lines of explanation can be actually intertwined and how unique relationships between each body trait and promiscuity can be actually disentangled. This has important implications for more nuanced theorizing in advancing the field of intrasexual variation in sexual strategies. For instance, predictions about which balance between sex-typical and sex-atypical body traits covaries with promiscuity in each sex could be integrated with the balance between masculine and feminine mental abilities influencing promiscuity. The way body sex-dimorphism leads to promiscuity should be connected with the way both sex-dimorphism and promiscuity are perceived and appreciated by opposite and same-sex individuals. Direct genetic links between body sex-dimorphism and promiscuity should be considered together with possible indirect psychological mediators of such a link, such as self-esteem or mate-value. The evo-devo models of body growth and sex-dimorphism (Hochberg, 2011) could be integrated with the literature on alternative reproductive tactics and signaling in animals (Oliveira et al., 2008).

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References

Bailey, J.M., Dunne, M.P., Martin, N.G., Kirk, K.M., Zhu, G., 2000. Do individual differences in sociosexuality represent genetic or environmentally contingent strategies? Evidence from the Australian twin registry. J. Pers. Soc. Psychol. 78, 537–545, http://dx.doi.org/10.1037/0022-3514.78.3.537.

Bastir, M., 2008. A systems-model for the morphological analysis of integration and modularity in human craniofacial evolution. J. Anthropol. Sci. 86, 37–58.

Bastir, M., Martinez, D.G., Recheis, W., Barash, A., Coquerelle, M., Rios, L., Peña-Melián, A., Rio, F.G., O'Higgins, P., 2013. Differential growth and development of the upper and lower human thorax. PLOS ONE 8, e75128, http://dx.doi.org/10.1371/journal.pone.0075128.

Bastir, M., Rosas, A., 2009. Mosaic evolution of the basicranium in *Homo* and its relation to modular development. Evol. Biol. 36, 57–70, http://dx.doi.org/10.1007/s11692-008-9037-4.

Boothroyd, L.G., Jones, B.C., Burt, D.M., DeBruine, L.M., Perrett, D.I., 2008. Facial correlates of sociosexuality. Evol. Hum. Behav. 29, 211–218, http://dx.doi.org/10.1016/j.evolhumbehav.2007.12.009.

Buss, D.M., Shackelford, T.K., 2008. Attractive women want it all: good genes, economic investment, parenting proclivities, and emotional commitment. Evol. Psychol. 6, 134–146.

Charles, N.E., Alexander, G.M., 2011. The association between 2D:4D ratios and sociosexuality: a failure to replicate. Arch. Sex. Behav. 40, 587–595, http://dx.doi.org/10.1007/s10508-010-9715-z.

Clark, A.P., 2004. Self-perceived attractiveness and masculinization predict women's sociosexuality. Evol. Hum. Behav. 25, 113–124, http://dx.doi.org/10.1016/S1090-5138(03)00085-0.

Cunningham, M.R., Barbee, A.P., Pike, C.L., 1990. What do women want? Facialmetric assessment of multiple motives in the perception of male facial physical attractiveness. J. Pers. Soc. Psychol. 59, 61–72, http://dx.doi.org/10.1037/0022-3514.59.1.61.

Gallup, A.C., White, D.D., Gallup Jr., G.G., 2007. Handgrip strength predicts sexual behavior, body morphology, and aggression in male college students. Evol. Hum. Behav. 28, 423–429, http://dx.doi.org/10.1016/j.evolhumbehav.2007.07.001.

Gallup, G.G.J., Frederick, D.A., 2010. The science of sex appeal: an evolutionary perspective. Rev. Gen. Psychol. 14, 240–250, http://dx.doi.org/10.1037/a0020451.

Gangestad, S.W., Simpson, J.A., 2000. The evolution of human mating: trade-offs and strategic pluralism. Behav. Brain Sci. 23, 573–644, http://dx.doi.org/10.1017/S0140525X0000337X.

Gangestad, S.W., Thornhill, R., 2008. Human oestrus. Proc. R. Soc. Lond. Biol. 275 (1638), 991–1000, http://dx.doi.org/10.1098/rspb.2007.1425.

Grammer, K., Fink, B., Moller, A.P., Thornhill, R., 2003. Darwinian aesthetics: sexual selection and the biology of beauty. Biol. Rev. 78, 385–407, http://dx.doi.org/10.1017/S1464793102006085.

Gross, M.R., 1996. Alternative reproductive strategies and tactics: diversity within sexes. Trends Ecol. Evol. 11, 92–98, http://dx.doi.org/10.1016/0169-5347(96)81050-0.

Hau, M., 2007. Regulation of male traits by testosterone: implications for the evolution of vertebrate life histories. BioEssays 29 (2), 133–144, http://dx.doi.org/10.1002/bies.20524.

Henrich, J., Heine, S.J., Norenzayan, A., 2010. The weirdest people in the world. Behav. Brain Sci. 33, 61–83, http://dx.doi.org/10.1017/S0140525X0999152X.

Hill, A.K., Hunt, J., Welling, L.L., Cárdenas, R.A., Rotella, M.A., Wheatley, J.R., Puts, D.A., 2013. Quantifying the strength and form of sexual selection on men's traits. Evol. Hum. Behav. 34 (5), 334–341, http://dx.doi.org/10.1016/j.evolhumbehav.2013.05.004.

Hochberg, Z., 2011. Evo-devo of Child Growth: Treatise on Child Growth and Human Evolution. John Wiley & Sons, Hoboken, NJ.

Hönekopp, J., Voracek, M., Manning, J.T., 2006. 2nd to 4th digit ratio (2D:4D) and number of sex partners: evidence for effects of prenatal testosterone in men. Psychoneuroendocrinology 31, 30–37, http://dx.doi.org/10.1016/j.psyneuen.2005.05.009.

Hönekopp, J., Watson, S., 2010. Meta-analysis of digit ratio 2D:4D shows greater sex difference in the right hand. Am. J. Hum. Biol. 22 (5), 619–630, http://dx.doi.org/10.1002/ajhb.21054.

Hughes, S.M., Dispenza, F., Gallup, G.G., 2004. Ratings of voice attractiveness predict sexual behavior and body configuration. Evol. Hum. Behav. 25, 295–304, http://dx.doi.org/10.1016/j.evolhumbehav.2004.06.001.

Landolt, M.A., Lalumiere, M.L., Quinsey, V.L., 1995. Sex differences in intra-sex variations in human mating tactics: an evolutionary approach. Ethol. Sociobiol. 16, 3–23, http://dx.doi.org/10.1016/0162-3095(94)00012-V.

Lippa, R.A., 2009. Sex differences in sex drive, sociosexuality, and height across 53 nations: testing evolutionary and social structural theories. Arch. Sex. Behav. 38, 631–651, http://dx.doi.org/10.1007/s10508-007-9242-8.

Manning, J.T., Fink, B., 2008. Digit ratio (2D:4D), dominance, reproductive success, asymmetry, and sociosexuality in the BBC internet study. Am. J. Hum. Biol. 20, 451–461, http://dx.doi.org/10.1002/ajhb.20767.

Mikach, S.M., Bailey, J.M., 1999. What distinguishes women with unusually high numbers of sex partners? Evol. Hum. Behav. 20, 141–150, http://dx.doi.org/10.1016/S1090-5138(98)00045-2.

Oliveira, R.F., Taborsky, M., Brockmann, H.J., 2008. Alternative Reproductive Tactics: An Integrative Approach. Cambridge University Press, New York.

Ostovich, J.M., Sabini, J., 2004. How are sociosexuality, sex drive, and lifetime number of sexual partners related? Pers. Soc. Psychol. B 30, 1255–1266, http://dx.doi.org/10.1177/0146167204264754.

Penke, L., Asendorpf, J.B., 2008. Beyond global sociosexual orientations: a more differentiated look at sociosexuality and its effects on courtship and romantic relationships. J. Pers. Soc. Psychol. 95, 1113–1135, http://dx.doi.org/10.1037/0022-3514.95.5.1113.

Puts, D.A., Gaulin, S.J., Sporter, R.J., McBurney, D.H., 2004. Sex hormones and finger length: what does 2D:4D indicate? Evol. Hum. Behav. 25, 182–199, http://dx.doi.org/10.1016/j.evolhumbehav.2004.03.005.

Rahman, Q., Korhonen, M., Aslam, A., 2005. Sexually dimorphic 2D:4D ratio, height, weight, and their relation to number of sexual partners. Pers. Individ. Differ. 39, 83–92, http://dx.doi.org/10.1016/j.paid.2004.12.007.

Scarbrough, P.S., Johnston, V.S., 2005. Individual differences in women's facial preferences as a function of digit ratio and mental rotation ability. Evol. Hum. Behav. 26, 509–526, http://dx.doi.org/10.1016/j.evolhumbehav.2005.03.002.

Schmitt, D.P., 2005. Sociosexuality from Argentina to Zimbabwe: a 48-nation study of sex, culture, and strategies of human mating. Behav. Brain Sci. 28, 247–275, http://dx.doi.org/10.1017/S0140525X05000051.

Schmitt, D.P., 2006. Sexual strategies across sexual orientations: how personality traits and culture relate to sociosexuality among gays,

lesbians, bisexuals, and heterosexuals. J. Psychol. Hum. Sex. 18, 183–214, http://dx.doi.org/10.1300/J056v18n02_06.
Schwarz, S., Mustafić, M., Hassebrauck, M., Jörg, J., 2011. Short- and long-term relationship orientation and 2D:4D finger-length ratio. Arch. Sex. Behav. 40, 565–574, http://dx.doi.org/10.1007/s10508-010-9698-9.
Shoup, M.L., Gallup Jr., G.G., 2008. Men's faces convey information about their bodies and their behavior: what you see is what you get. Evol. Psychol. 6, 469–479.
Sim, K., 2013. The relationship between sex-typical body shape and quality indicators. J. Soc. Evol. Cult. Psychol. 7, 97–120, http://dx.doi.org/10.1037/h0099207.
Valentova, J.V., Kleisner, K., Havlicek, J., 2014. Shape differences between the faces of heterosexual and homosexual men. Arch. Sex. Behav. 43, 353–361, http://dx.doi.org/10.1007/s10508-013-0194-x.