1 Preferences for sexually dimorphic body characteristics revealed in a large sample of speed
2 daters

3

4 Abstract

5 While hundreds of studies have investigated the indices that make up attractive body shapes,

6 these studies were based on preferences measured in the lab using pictorial stimuli. Whether

7 these preferences translate into real-time, face-to-face evaluations of potential partners is

8 unclear. Here 539 (275 female) participants in 75 lab-based sessions had their body

9 dimensions measured before engaging in round-robin speed dates. After each date they rated

10 each other's body, face, personality, and overall attractiveness, and noted whether they would

11 go on a date with the partner. Women with smaller waists and lower waist-to-hip ratios were

12 found most attractive, and men with broader shoulders and higher shoulder-to-waist (or hips)

13 ratios were found most attractive. Taller individuals were preferred by both sexes. Our results

14 show that body dimensions associated with greater health, fertility, and (in men)

15 formidability influence face-to-face evaluations of attractiveness, consistent with a role of

16 intersexual selection in shaping human bodies.

17 Keywords: Body shape; intersexual selection; mate preferences; speed-dating; physical

18 attractiveness

19

20　　Preferences for sexually dimorphic body characteristics revealed in a large sample of speed
21　　daters

22　　　　Bodies are centrally important to sexual attractiveness. A fundamental tenet in

23　theories of human mate choice is that romantic preferences have evolved to attend to traits

24　that were important in ancestral environments. The clearest examples of these traits are those

25　that reflect large sex differences in stature, muscularity, and body fat composition. For

26　example, in women, a lower waist-to-hip ratio and lower body mass index are associated with

27　greater reproductive value, i.e. youth (Lassek & Gaulin, 2018); in men, height and shoulder

28　width have been associated with greater physical strength (Archer & Thanzami, 2009) and

29　perceptions of both physical and social dominance (Dijkstra & Buunk, 2001; Stulp, Buunk,

30　Verhulst, & Pollet, 2015).

31　　　　Previous studies investigating the association of a body's shape with its appeal to a

32　viewer have shared one common feature: the models have always been inert stimuli presented

33　on screens or on paper. This raises several questions. To what extent do these preferences

34　translate into real-time, face-to-face evaluations of opposite-sex partners? Are there

35　preferences that are not captured by on-screen judgements? And, how much do bodily

36　features actually affect our attraction to real people, who have faces and personalities as well

37　as bodies?

38　**What makes a body attractive?**

39　　　　Singh's (1993) landmark study reported that men rated female stimuli of average

40　body weight with the lowest WHR (.70) as youngest, healthiest, and most attractive. These

41　findings were replicated in several Western populations (Koscinski, 2014; Thornhill &

42　Grammer, 1999), small-scale societies (Dixson, Dixson, Bishop, & Parish, 2010; Singh,

43　Dixson, Jessop, Morgan, & Dixson, 2010; but also see: Douglas & Shepard Jr, 1998;

44　Marlowe & Wetsman, 2001), and in research measuring men's visual attention and neural

45 reward responses (Dixson, Grimshaw, Linklater, & Dixson, 2011; Platek & Singh, 2010). In

46 men, height, shoulder width, and muscularity are positively associated with physical strength

47 and health (Archer & Thanzami, 2009; Lassek & Gaulin, 2009). Women also judge muscular

48 and v-shaped physiques as more attractive than over-lean or corpulent body types (Dixson,

49 Grimshaw, Ormsby, & Dixson, 2014; Frederick & Haselton, 2007; Mautz, Wong, Peters, &

50 Jennions, 2013). High body mass index (BMI) is associated with low attractiveness in both

51 sexes, but the association is complicated by the covariance of BMI with more specific body

52 measures such as muscle mass and waist circumference (Chinedu et al., 2013).

Artificial stimuli may be problematic

54 Though there is much research into the determinants of body attractiveness, the

55 studies to date have many limitations. The stimuli in the studies described above have ranged

56 from line drawings (e.g. Singh, 1993, 1995), to photographs (e.g. Koscinski, 2014), 3D

57 rotations of body scans (e.g. Brooks et al., 2010), videos of inert figures (e.g. Rilling,

58 Kaufman, Smith, Patel, & Worthman, 2009), and popular cartoon characters (Lassek &

59 Gaulin, 2016). The use of artificial stimuli in the studies investigating body attractiveness has

60 been criticised for conflating WHR and BMI (Tovee, Maisey, Emery, & Cornelissen, 1999),

61 and obscuring abdominal depth (Rilling et al., 2009). Importantly, the nature of the stimuli

62 has been shown to affect the manifestation of preferences (Koscinski, 2014), reinforcing the

63 importance of the match between stimuli and the mating situations of interest.

64 Of course, until recent times human mate evaluation did not rely on stimuli on a

65 computer screen but on face-to-face interactions. There are several reasons why in-person

66 evaluations might differ from ratings of stimuli on a computer screen. First, overall body size

67 (i.e. height) is impossible to properly appreciate from a small image on a screen; this is

68 especially relevant given the importance of body size in mate choice in animals (Bercovitch,

69   1989; Serrano-Meneses, Córdoba-Aguilar, Méndez, Layen, & Székely, 2007; Shine et al.,

70   2000) and apparently in humans too (Stulp & Barrett, 2016). Second, models used as stimuli

71   in previous studies investigating body attractiveness have worn form-fitting attire (e.g.

72   Koscinski, 2014) or been completely naked (Thornhill & Grammer, 1999), and in all cases

73   their faces were obscured. These procedures were designed to isolate the effects of body

74   variation, but in doing so they departed far from reality and made it impossible to determine

75   the importance of body variables to overall attractiveness when other relevant factors (e.g.

76   face, personality, clothing) are varying too, as is the case in real life mate evaluation (Lee,

77   Dubbs, Von Hippel, Brooks, & Zietsch, 2014). Third, real life interactions involve moving

78   bodies, which could be perceived quite differently from inert bodies (even if it is a 3D image

79   rotating so it can be seen from all angles). Natural movement can change the perception of

80   physical features – indeed several studies have shown modest or absent correlations between

81   attractiveness ratings of the same faces in static and dynamic conditions (Lander, 2008;

82   Penton-Voak & Chang, 2008; Rubenstein, 2005; but see Kościński, 2013). Fourth, attraction-

83   related cognitive processes elicited by in-person interactions are thought to be different from

84   those elicited by stated preferences (Todd, Penke, Fasolo, & Lenton, 2007). This difference

85   may relate to the cold-to-hot empathy gap (Eastwick & Finkel, 2008), which refers to the idea

86   that individuals who are not currently in a state of arousal (such as strong attraction) have

87   limited insight into the effect this arousal will have over their behaviour when it arises

88   (Loewenstein, 2005). Participants observing a picture or video of an inert body are unlikely to

89   experience the same arousal levels as when interacting in the physical presence of the person

90   they are evaluating, so the same principles may apply to these contexts. However, recently

91   the same pattern of results has been shown in friendship formation, which is less likely to

92   involve hot affect than relationship formation, suggesting that the problem may be more

93   complex (Huang, Ledgerwood, & Eastwick, in press).

94   Speed-dating paradigms offer a way to test the importance of specific traits in mate

95   choice during ecologically valid face-to-face mating contexts (Finkel, Eastwick, & Matthews,

96   2007; Kurzban & Weeden, 2005, 2007; Lenton, Fasolo, & Todd, 2009; Lenton &

97   Francesconi, 2011). In speed-dating scenarios, people engage in brief interactions (3-5

98   minutes) with previously unknown people during which romantic interests can be gauged.

99   Despite their advantages, speed-dating paradigms have rarely been used to examine the

100   influence of objectively measured facial/bodily traits. In one study, male speed-daters with

101   wider faces, a cue to social dominance and aggressiveness (Geniole, Denson, Dixson, Carré,

102   & McCormick, 2015) were preferred as short-term mates (Valentine, Li, Penke, & Perrett,

103   2014). In other speed-dating studies, height was found attractive in men only (Asendorpf,

104   Penke, & Back, 2011), in both sexes (Stulp, Buunk, Kurzban, & Verhulst, 2013), or in neither

105   sex (Luo & Zhang, 2009). Additionally, there is some evidence that lower weight (Luo &

106   Zhang, 2009) and lower BMI (Asendorpf et al., 2011) are attractive in women only. These

107   results suggest that speed-dating is a valuable paradigm for physical attractiveness research;

108   however, selection for physical traits is undoubtedly multivariate, which places high value on

109   studies that include multiple objective measures of physical traits. Studies measuring

110   shoulders, waist, and hips are particularly valuable as they allow for analysis of body shape

111   rather than body size.

The present study

113   Existing research leaves the following questions unanswered: 1) How do body

114   dimensions influence judgements of body attractiveness in face-to-face interactions? 2) How

115   important is body attractiveness relative to face and personality attractiveness? 3) Do these

116   implicit preferences shape the explicit choices made by speed-daters? Answering these

117   questions is crucial to understanding how variation in bodies, and in particular body

118   dimensions, might affect mate selection in natural scenarios like those that have shaped our

119   evolution.

120   To address these questions we used a speed-dating paradigm in which opposite-sex

121   participants rated each other's body, face, personality, and overall attractiveness. The

122   participants' body dimensions were also measured, and using linear mixed effects modelling

123   we investigated the association of each body dimension, as well as several sexually

124   dimorphic ratios, with body attractiveness ratings. Similarly, we investigated the relative

125   importance of body, face, and personality attractiveness to overall attractiveness. We also

126   investigated the importance of these features in deciding whether to go on a date with their

127   partner. Lastly, to investigate whether these preferences are sex-differentiated, we tested for

128   moderation by sex in all analyses.

Material and methods

Participants

131   Participants were 539 (275 female) first year psychology students with ages ranging

132   from 16.67 to 46.08 (females: $M = 19.14$, $SD = 2.68$; males: $M = 19.83$, $SD = 3.11$).

133   Participants were recruited from the University of Queensland's first year research

134   participation scheme and were offered one credit for their participation in a study titled

135   'Speed-meeting study'. Requested volunteers were 1) heterosexual, 2) not in a committed

136   relationship, and 3) open to answering personal questions regarding their sexual history (for

137   questions not relating to the current study). Participants were assured of confidentiality as

138   well as being told at regular intervals that they may discontinue/omit answers without

139   forgoing credit. The participants included in this study are a subset (collected during 2012,

140   2013, 2014, and 2015) of an ongoing 'attraction study' (2010-present). The subset was

141   selected based on availability of all measures necessary for the present study. Sample size

142   was determined each year by how many participants could be tested in the available time

143   frame. All relevant data available at the start of preparing the paper were included. Statistical

144   power in a sample of this size (2161 interactions) is strong, but specific calculations are

145   difficult because of the complex multi-level, cross-classified design. From this subset,

146   participants who were classed as outliers (+/- 3.29 SD) on one or more body dimensions were

147   removed (8 males, 7 females).

148   **Materials**

149   Participants completed three questionnaires: *pre-questionnaire*, *speed-date*

150   *questionnaire*, and *post-questionnaire*. The *pre-questionnaire* contained self-report items

151   including participant height. The *speed-date questionnaire* contained ratings of partners'

152   body attractiveness, facial attractiveness, personality attractiveness, and overall

153   attractiveness. Each of the partner attractiveness (face, body, personality, overall) items were

154   asked in the format of 'I would rate their ____ attractiveness as…' These ratings were made

155   on a 7-point response scale ranging from 1 = Not at All Attractive to 7 = Extremely

156   Attractive. Additionally, participants were asked whether they would hypothetically go on a

157   date with the partner in the format of 'Would you go on a date with this person? (Y/N)'. The

158   *post-questionnaire* contained items unrelated to this study. We also collected body weight,

159   but it (and BMI) were not included in the main analyses because they are largely captured by

160   the girth variables and height – indeed, when included weight did not predict body

161   attractiveness above and beyond height, waist, hips, and shoulders (see supplementary

162   material, S1).

163   **Procedure**

164   Depending on attendance, speed-dating sessions consisted of two to five males and

165   two to five females. Prior to the speed-dates, participants were separated by sex and

166 completed the *pre-questionnaire*. Once finished, the group was brought together and

167 participants were assembled at five 'stations' within the laboratory. Each station had two

168 opposite-facing chairs for the partners. Participants were then told they would be given three

169 minutes to interact with an opposite sex partner. Participants spoke about any topic until they

170 heard a bell which indicated the date had ended. After hearing the bell, participants were then

171 instructed to begin completing the *speed-date questionnaire*. All participants were reminded

172 to hold their clipboards up to avoid their partner seeing their ratings. Experimenters

173 supervised the room to determine when all participants had finished completing ratings. The

174 process outlined above was then repeated until all opposite-sex dyads had interacted. If there

175 was an uneven ratio of males and females, the extra participant(s) were instructed to sit

176 quietly for three minutes during one or more rounds. Once all speed-dates and ratings had

177 been completed, participants began completing the *post-questionnaire*. During this time,

178 participants were taken aside one at a time by a female experimenter and their body

179 dimensions (shoulders, waist, hips) were measured using a tape measure. Waist and hips were

180 defined as the narrowest and widest points of the lower torso (including buttocks),

181 respectively. Shoulders were measured at the widest point of the shoulder area. All three

182 dimensions were measured as circumferences.

183 **Analysis**

184 The nature of the design (i.e. participants rating multiple partners) creates

185 dependencies in the data. The rating from each interaction between two people (Level 1) is

186 cross-classified within both the participant receiving the rating (Level 2), and the partner who

187 gave the rating (Level 2), all of which is nested within the session they both attended (Level

188 3). Therefore, it is necessary to use multilevel modeling (MLM) to account for the

189 hierarchical structure of the data. To check that MLM was appropriate, intraclass correlations

190 were examined at each level for both body and overall attractiveness (see Table 1).

191   As all intraclass correlations were significant, indicating clustering at each level, we

192   proceeded with MLM analyses. We used the statistical software 'R', along with packages

193   'lme4' (Bates, Mächler, Bolker, & Walker, 2014) and 'lmerTest' (Kuznetsova, Brockhoff, &

194   Christensen, 2017), for these analyses.

195   Table 1

196   *Intra-class correlations for Bodily Attractiveness and Overall Attractiveness each level:*

197   *Participant (Level-1), Partner (Level-2), and Session (Level-3).*

Levels	Women Rating Men		Men Rating Women	
	Estimate (CI)	N	Estimate (CI)	N
Bodily Attractiveness				
Participant (Target)	.35 (.28-.41)	275	.30 (.24-.37)	290
Partner (Perceiver)	.31 (.25-.38)	287	.25 (.19-.32)	275
Session	.17 (.11-.24)	75	.11 (.07-.17)	75
Overall Attractiveness				
Participant (Target)	.28 (.21-.34)	275	.25 (.19-.32)	290
Partner (Perceiver)	.33 (.26-.39)	287	.22 (.16-.28)	275
Session	.13 (.09-.20)	75	.06 (.03-.11)	75

Note: The intra-class correlation represents the extent to which scores on the dependent variables 'cluster' within each level of aggregation. The intra-class correlation for *participant* represents the extent to which ratings received by a particular participant are more similar to each other than to ratings received by other participants. *Partner* indicates the extent to which ratings given by a particular partner are more similar to each other than ratings given by other participants. *Session* indicates the extent to which ratings received by participants in a particular session are more similar to each other than ratings received by participants in other sessions.

Results

199   Figure 1 shows scatterplots of the associations of height, and hip, shoulder, and waist

200   circumference with bodily attractiveness. MLM analyses with partner ratings of

201   attractiveness (body, facial, personality, overall) at Level-1, participant dimensions

202   (shoulders, waist, hips, height) at Level-2, and session group at Level-3 were used to evaluate

203   main effects and interactions. Unless otherwise specified, all models reported are maximal

204   models (Barr, Levy, Scheepers, & Tily, 2013). Prior to analysis, variables that were used as

205   denominators in ratios were converted to proportions for conceptual clarity (Kronmal, 1993).

206

Figure 1. Scatterplots depicting the relationship between body dimensions in centimetres (X) and average bodily attractiveness rating provided by speed-dating partners (Y) for each body dimension.

209   All variables were then mean centred using their sex-specific mean. The means and

210   standard deviations (prior to mean centring) for all Level-1 and Level-2 variables are reported

211   in Table 2.

212   Table 2

213   *Means and standard deviations for male and female targets on all Level-1 and Level-2*

214   *variables.*

Variables	Male Targets		Female Targets	
	Mean	SD	Mean	SD
Level-1 (Partner Ratings)				
Bodily Attractiveness	4.31	1.01	4.66	0.92
Facial Attractiveness	4.18	0.98	4.50	0.88
Personality Attractiveness	5.09	0.76	5.28	0.68
Overall Attractiveness	4.58	0.79	4.77	0.76
Level-2 (Participant)				
Shoulders	114.97	7.90	100.47	6.29
Waist	80.66	8.36	71.55	6.29
Hips	97.47	8.55	93.79	7.19
Height	180.18	7.27	165.82	7.06

Note: All attractiveness ratings were made on a 7-point Likert scale ranging from 1-7 (midpoint: 4). All body
dimensions were measured in centimetres.

215

What makes a male body attractive?

217   Previous research investigating male body attractiveness has emphasised the

218   importance of the shoulder-to-hip and shoulder-to-waist ratios. Interaction terms were

219   favoured over ratios because ratios can cause spurious relationships and produce

220   unacceptable collinearity with their constituent variables (Kronmal, 1993). These interaction

221   terms conceptually correspond to ratios, but with more appropriate statistical properties, and

222   will hereupon be referred to as ratios to simplify wording. All variables were standardised to

223   a mean of 0 and a standard deviation of 1 before being entered into equations, to ease

224   comparison of coefficients across body dimensions. The γ coefficients for both male models

225   are reported in Table 3.

226   Table 3

227   *Male MLM Models for Rated Bodily Attractiveness: Models are named for the variables they*
228   *include. The first row contains univariate models estimating main effects for each body*
229   *measurement. The second row contains multivariate models with interaction terms*
230   *representing well-known ratios as well as main effects for their constituent variables.*
231   *Multivariate models including all main effects can be found in supplementary materials (S2).*

232

	Main Effect Only Models											
	Shoulders			Waist			Hips			Height		
Predictors	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*
Shoulders	0.12	0.05	.007	-	-	-	-	-	-	-	-	-
Waist	-	-	-	.00	0.05	.992	-	-	-	-	-	-
Hips	-	-	-	-	-	-	-0.02	0.04	.615	-	-	-
Height	-	-	-	-	-	-	-	-	-	0.16	0.04	<.001
	Interaction Models											
	Shoulders by Hips			Shoulders by Waist			Waist by Hips			Waist by Height		
Predictors	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*
Shoulders	0.21	0.05	<.001	0.38	0.06	<.001	-	-	-	-	-	-
Waist	-	-	-	0.28	0.06	<.001	-0.01	0.06	.913	0.07	0.04	.100
Hips	0.07	0.05	.144	-	-	-	-0.07	0.06	.238	-	-	-
Height	-	-	-	-	-	-	-	-	-	0.2	0.04	<.001
Interaction	0.27	0.04	<.001	0.27	0.03	<.001	-0.25	0.04	<.001	0.09	0.05	.070

Note: Waist is inverted, with positive coefficients indicating that smaller values are preferred.

233   We found that taller men with broader shoulders were rated as having more attractive

234   bodies. Interaction terms in the shoulder-to-waist and shoulder-to-hips models were

235   significant, suggesting that a higher shoulder-to-waist or shoulder-to-hip ratio has a positive

236   effect on attractiveness beyond the individual effects of having broad shoulders or narrow

237   waist/hips. Additionally, the interaction term in the waist-by-hips model was significant,

238 suggesting that a lower waist-to-hips ratio has a positive effect on attractiveness beyond the

239 individual effect of having a narrow waist.

240 **What makes a female body attractive?**

241   Previous research investigating female body attractiveness has emphasised the

242 importance of the waist-to-hip and waist-to-height ratios. The γ coefficients for both female

243 models are reported in Table 4.

244 Table 4.

Female MLM Models for Rated Bodily Attractiveness: Models are named for the variables
they include. The first row contains univariate models estimating main effects for each body
measurement. The second row contains multivariate models with interaction terms
representing well-known ratios as well as main effects for their constituent variables.
Multivariate models including all main effects can be found in supplementary materials (S2).

250

	Rated Bodily Attractiveness											
	Main Effect Only Models											
	Shoulders			Waist			Hips			Height		
Predictors	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*
Shoulders	-0.11	0.05	.015	-	-	-	-	-	-	-	-	-
Waist	-	-	-	0.19	0.05	<.001	-	-	-	-	-	-
Hips	-	-	-	-	-	-	-0.15	0.05	.002	-	-	-
Height	-	-	-	-	-	-	-	-	-	0.11	0.04	.011
	Interaction Models											
	Shoulders by Hips			Shoulders by Waist			Waist by Hips*			Waist by Height		
Predictors	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*
Shoulders	-0.05	0.05	.341	0.13	0.06	.033	-	-	-	-	-	-
Waist	-	-	-	0.33	0.06	<.001	0.21	0.05	<.001	0.25	0.04	<.001
Hips	-0.13	0.05	.009	-	-	-	0.00	0.05	.924	-	-	-
Height	-	-	-	-	-	-	-	-	-	0.14	0.04	<.001
Interaction	-0.01	0.04	.872	0.12	0.04	.005	0.10	0.03	.003	0.04	0.05	.453

Note: Waist and Hips are inverted, with positive coefficients indicating that smaller values are preferred.

* Maximal model did not converge, random intercept only model used.

251   We found that taller women with narrower waists, hips, and shoulders were rated as

252   having more attractive bodies. The interaction term in the Waist-to-hip model was significant,

253   suggesting a lower waist-to-hip ratio has a positive effect on attractiveness beyond the

254   individual effect of having a narrow waist. Additionally, the interaction term in the shoulders-

255   to-waist model was significant, suggesting that having a higher shoulder-to-waist ratio has a

256   positive effect on attractiveness beyond the individual effect of having a narrow waist.

257   Though the shoulders coefficient is negative in the univariate model, it is positive in the

258   shoulder-to-waist model where both waist and shoulder-to-waist ratio are controlled; this may

259   suggest that the negative coefficient observed in the univariate model is driven by collinearity

260   between shoulders and waist. Additional multivariate models for both women and men can be

261   seen in supplementary materials (S2).

262   **Are there truly sex differences in body preferences?**

263   As the pattern of results appeared to differ by sex, we combined the male and female

264   samples and tested for moderation of the effects by sex (see Table 5). Several sex differences

265   emerged: the attractiveness of broader shoulders and broader hips was greater in men,

266   whereas the attractiveness of narrower waists was greater in women. Unexpectedly, men and

267   women preferred taller partners to a similar degree. Additionally, the positive influence of

268   higher shoulder-to-waist or shoulder-to-hips ratios on attractiveness was greater in men.

269   Unexpectedly, the positive influence of lower waist-to-hip ratios was also greater in men.

270

271 Table 5.

272 *Unisex MLM Models for Rated Bodily Attractiveness: Models are named for the variables they include. The first row contains univariate models*
273 *estimating main effects for each body measurement. The second row contains multivariate models with interaction terms representing well-*
274 *known ratios as well as main effects for their constituent variables. Multivariate models including all main effects can be found in*
275 *supplementary materials (S2).*

	Main Effect Only Models											
	Shoulders			Waist			Hips			Height		
Predictors	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*
Shoulders	0.00	0.03	.885	-	-	-	-	-	-	-	-	-
Waist	-	-	-	0.10	0.03	.003	-	-	-	-	-	-
Hips	-	-	-	-	-	-	-0.07	0.03	.023	-	-	-
Height	-	-	-	-	-	-	-	-	-	0.13	0.03	<.001
Sex	0.13	0.03	<.001	0.13	0.03	<.001	0.14	0.03	<.001	0.14	0.03	<.001
Sex Interaction	-0.11	0.03	<.001	0.09	0.03	0.001	-0.08	0.03	.008	-0.03	0.03	.337

	Interaction Models											
	Shoulders by Hips			Shoulders by Waist			Waist by Hips			Waist by Height		
Predictors	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*
Shoulders	0.07	0.03	.044	0.26	0.04	<.001	-	-	-	-	-	-
Waist	-	-	-	0.31	0.04	<.001	0.11	0.04	.002	0.15	0.03	<.001
Hips	-0.09	0.03	.007	-	-	-	0.06	0.04	.140	-	-	-
Height	-	-	-	-	-	-	-	-	-	0.15	0.03	<.001
Sex	0.06	0.04	.087	0.05	0.04	.138	0.07	0.04	.048	0.13	0.03	<.001
Shoulders*Sex	-0.11	0.03	.001	-0.11	0.04	.013	-	-	-	-	-	-
Waist*Sex	-	-	-	0.01	0.04	.898	0.09	0.04	.017	0.08	0.03	.005
Hips*Sex	-0.04	0.03	.217	-	-	-	-0.05	0.04	.225	-	-	-
Height*Sex	-	-	-	-	-	-	-	-	-	-0.02	0.03	.430
Focal Interaction	-0.12	0.03	<.001	0.18	0.03	<.001	0.17	0.03	<.001	0.04	0.03	.140
Focal Interaction*Sex	0.11	0.03	<.001	-0.07	0.02	.008	-0.07	0.03	.012	-0.01	0.03	.607

276

277   **How important is body attractiveness?**

278   Table 6 shows that individuals' bodies were important to their overall attractiveness in

279   dynamic interactions with real people – something that had not been directly demonstrated

280   before. A model including a sex interaction term for each individual predictor (e.g. *Bodily*

281   *Attractiveness*Sex*) showed that body attractiveness ($p = .010$) and facial attractiveness ($p =$

282   .015) were more important to female attractiveness than to male attractiveness. On the other

283   hand, personality attractiveness was more important to male attractiveness than to female

284   attractiveness ($p < .001$). Full results of this analysis can be found in the supplementary

285   materials (S3).

286   Table 6.

287   *MLM γ coefficients for associations between body attractiveness and overall attractiveness.*

	Rated Overall Attractiveness (1-7)	
Predictors	γ (SE)	
	Male Targets	**Female Targets**
Bodily Attractiveness	0.26 (0.02)***	0.32 (0.02)***
Facial Attractiveness	0.32 (0.02)***	0.40 (0.02)***
Personality Attractiveness	0.44 (0.02)***	0.32 (0.02)***

Note: ***p < .001; **p < .01; *p < .05.

288   **Do these preferences shape speed-date choices?**

289   To determine whether the pattern of results identified for the bodily attractiveness and

290   overall attractiveness variables was consistent with their speed-dating choices, the same

291   analyses were repeated with the Date variable. For male targets, all associations were

292   consistent with previous analyses (see Table 7).

293

Table 7.

Male MLM Models for Date (Y/N): Models are named for the variables they include. The first row contains univariate models estimating main effects for each body measurement. The second row contains multivariate models with interaction terms representing well-known ratios as well as main effects for their constituent variables.

	Main Effect Only Models											
	Shoulders			Waist			Hips			Height		
Predictors	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*
Shoulders	0.24	0.10	.022	-	-	-	-	-	-	-	-	-
Waist	-	-	-	0.00	0.11	.968	-	-	-	-	-	-
Hips	-	-	-	-	-	-	0.05	0.11	.630	-	-	-
Height	-	-	-	-	-	-	-	-	-	0.38	0.10	<.001
	Interaction Models											
	Shoulders by Hips			Shoulders by Waist			Waist by Hips			Waist by Height		
Predictors	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*
Shoulders	0.40	0.12	.001	0.75	0.17	<.001	-	-	-	-	-	-
Waist	-	-	-	0.55	0.17	.001	-0.04	0.15	.783	0.10	0.11	.353
Hips	0.20	0.12	.104	-	-	-	0.01	0.15	.930	-	-	-
Height	-	-	-	-	-	-	-	-	-	0.42	0.11	<.001
Interaction	0.42	0.13	.002	0.54	0.15	<.001	-0.38	0.13	.003	-0.12	0.1	.226

Note: Waist is inverted, with positive coefficients indicating that smaller values are preferred.

For female targets, main effects were consistent with the exception of the positive effect for narrower hips, which was no longer significant. Additionally, the positive influence of lower waist-to-hip ratios and higher shoulder-to-hips ratios were no longer significant (see Table 8).

304   Table 8

305   *Female MLM Models for Date (Y/N): Models are named for the variables they include. The*
306   *first row contains univariate models estimating main effects for each body measurement. The*
307   *second row contains multivariate models with interaction terms representing well-known*
308   *ratios as well as main effects for their constituent variables.*

309

							Date Yes/No						
					Main Effect Only Models								
	Shoulders			Waist			Hips			Height		
Predictors	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*
Shoulders	-0.17	0.12	.148	-	-	-	-	-	-	-	-	-
Waist	-	-	-	0.29	0.12	.018	-	-	-	-	-	-
Hips	-	-	-	-	-	-	-0.17	0.13	.208	-	-	-
Height	-	-	-	-	-	-	-	-	-	0.22	0.11	.041
					Interaction Models								
	Shoulders by Hips			Shoulders by Waist			Waist by Hips			Waist by Height		
Predictors	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*
Shoulders	-0.17	0.14	.207	0.07	0.17	.679	-	-	-	-	-	-
Waist	-	-	-	0.41	0.16	.013	0.37	0.15	.011	0.39	0.12	.001
Hips	-0.09	0.13	.498	-	-	-	0.12	0.14	.413	-	-	-
Height	-	-	-	-	-	-	-	-	-	0.29	0.12	.013
Interaction	0.18	0.12	.125	0.05	0.13	.688	0.15	0.12	.197	0.14	0.11	.210

Note: Waist and Hips are inverted, with positive coefficients indicating that smaller values are preferred.

* Maximal model did not converge, random intercept only model used.

310

311   In terms of sex differences, the effect of broader shoulders was still greater in men;

312   however, there was no longer a sex difference for narrower waists. Additionally, the positive

313   influence of higher shoulder-to-waist or shoulder-to-hips ratios was still greater in men;

314   however, there was no longer a sex difference for lower waist-to-hip ratios (see Table 9).

315 Table 9

316 *Unisex MLM Models for Date (Y/N): Models are named for the variables they include. The first row contains univariate models estimating main*
317 *effects for each body measurement. The second row contains multivariate models with interaction terms representing well-known ratios as well*
318 *as main effects for their constituent variables.*

	Main Effect Only Models											
	Shoulders			Waist			Hips			Height		
Predictors	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*
Shoulders	0.01	0.08	.904	-	-	-	-	-	-	-	-	-
Waist	-	-	-	0.16	0.08	0.046	-	-	-	-	-	-
Hips	-	-	-	-	-	-	-0.10	0.08	.203	-	-	-
Height	-	-	-	-	-	-	-	-	-	0.30	0.09	<.001
Sex	0.36	0.09	<.001	0.37	0.09	<.001	0.37	0.09	<.001	0.38	0.09	<.001
Sex Interaction	-0.20	0.08	.010	0.13	0.08	.089	-0.05	0.08	.476	-0.08	0.07	.246

	Interaction Models											
	Shoulders by Hips			Shoulders by Waist			Waist by Hips			Waist by Height		
Predictors	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*	γ	SE	*p*
Shoulders	0.10	0.09	.307	0.41	0.12	.001	-	-	-	-	-	-
Waist	-	-	-	0.49	0.12	<.001	0.16	0.10	.111	0.24	0.08	.002
Hips	-0.15	0.09	.094	-	-	-	0.07	0.10	.478	-	-	-
Height	-	-	-	-	-	-	-	-	-	-	-	-
Sex	0.23	0.10	.018	0.19	0.10	.056	0.29	0.10	.005	0.40	0.09	<.001
Shoulders*Sex	-0.28	0.09	.002	-0.31	0.12	.010	-	-	-	-	-	-
Waist*Sex	-	-	-	-0.11	0.12	.329	0.19	0.10	.067	0.12	0.08	.113
Hips*Sex	0.05	0.09	.586	-	-	-	0.05	0.10	.629	-	-	-
Height*Sex	-	-	-	-	-	-	-	-	-	-0.08	0.08	.300
Focal Interaction	-0.07	0.09	.418	0.26	0.09	.004	0.25	0.08	.001	0.01	0.07	.892
Focal Interaction*Sex	0.29	0.09	.002	-0.22	0.09	.009	-0.09	0.08	.251	0.13	0.07	.083

Note: Waist is inverted, with positive coefficients indicating that smaller values are preferred.

319

320   Individuals' bodies were still predictive of their likelihood of receiving a date, as were

321   their faces and personalities; however, there were no longer any sex differences (ps > .16),

322   see Table 10.

323   Table 10.

324   *MLM γ coefficients for associations between body attractiveness and date (Y/N).*

	Date (Y/N)	
Predictors	*γ* (SE)	
	Male Targets	**Female Targets**
Bodily Attractiveness	0.13 (0.04)**	0.17 (0.04)***
Facial Attractiveness	0.32 (0.04)***	0.36 (0.04)***
Personality Attractiveness	0.25 (0.03)***	0.19 (0.03)***

Note: ***p < .001; **p < .01; *p < .05.

325

326   **Discussion**

327   Previous research into the visual determinants of bodily attractiveness has used

328   images of inert, faceless bodies on a computer screen or sheet of paper. Here, using 75 lab-

329   based speed-dating sessions, we estimated attractiveness of various body dimensions based

330   on ratings in 2161 live, face-to-face interactions. In line with previous findings, our more

331   ecologically valid study showed that women with smaller waists and lower WHRs were

332   found more attractive, and taller men with broader shoulders and lower shoulder-to-hips (or

333   waist) ratios were found more attractive. Contrary to recent studies that suggested WHR does

334   not contribute to attractiveness above and beyond a narrow waist (Brooks, Shelly, Jordan, &

335   Dixson, 2015; Lassek & Gaulin, 2016), our results indicate that WHR does make a

336   significant unique contribution to female attractiveness, though its effect is much smaller than

337   absolute waist circumference. By contrast, the male shoulder-to-waist (or shoulder-to-hip)

338   ratio has a strong influence on male attractiveness, with an interaction term much larger than

339   the female WHR.

340   We found that broad shoulders and a high shoulder-to-waist or shoulder-to-hips ratio

341   were more attractive in men than in women, consistent with intersexual selection contributing

342   to the large sex difference in these features. We also found a sex difference in the degree to

343   which men and women prefer low WHRs; however, this was in the opposite direction to what

344   we would have expected a priori, with women preferring lower WHRs to a stronger degree.

345   Importantly, this does not indicate that women prefer waist-to-hip ratios more extreme in men

346   than men prefer in women, but rather that women prefer a lower waist-to-hip ratio relative to

347   the male specific norm than men do relative to the female specific norm. Though previous

348   research in this area has placed greater emphasis on the theoretical reasons for preferring low

349   WHRs in women, higher WHRs have been associated with erectile dysfunction in men

350   (Giugliano et al., 2004; Heidler et al., 2007; Zambon et al., 2010). We also did not find the

351   predicted sex difference in height preferences. Women's height has generally not been

352   associated with attractiveness in previous studies using on-screen models (but see Brooks et

353   al., 2015; Rilling et al., 2009), and sex differences in height preference have been found in

354   many other self-reported preference studies, which generally find that women prefer above-

355   average to tall men while men prefer average-height women (reviewed by Courtiol,

356   Raymond, Godelle, & Ferdy, 2010). Further, women self-report valuing height more than do

357   men (Buss & Barnes, 1986). However, because body height cannot be properly appreciated

358   on a screen or sheet of paper, previous findings may have reflected participants' stereotypes

359   about what is attractive in men and women more than their actual preferences (Ledgerwood,

360   Eastwick, & Smith, 2018). Also, awareness of preferences could be limited if it is a correlate

361   of height – such as long legs (Brooks et al., 2015) – that is attractive in women rather than

362   height *per se*. As well as indicating formidability, which is thought to be beneficial mainly to

363   men (Puts, 2010), tallness might be preferred as an indicator of general condition (Perkins,

364   Subramanian, Davey Smith, & Özaltin, 2016), which is beneficial to both sexes.

365   For the first time, we demonstrated the importance of body attractiveness when

366   judging potential partners in real-time. We showed that body attractiveness is important to the

367   overall attractiveness of both sexes, even when other cues such as facial and personality

368   attractiveness vary. Also, our results demonstrated that body and facial attractiveness are

369   more important to men than to women, whereas personality attractiveness is more important

370   to women than to men. These findings are consistent with Sexual Strategies Theory (Buss &

371   Schmitt, 1993) and cross-cultural self-report findings (Buss, 1989) that physical features rank

372   higher in men's preferences than in women's. Nonetheless, our study has several limitations.

373   First, participants were university students who opted into a speed-dating study. It is therefore

374   possible that our sample contained men and women who were more confident in dating

375   scenarios and thus potentially more physically attractive than the general population.

376   However, both sexes used the full body attractiveness scale, suggesting that – in the eyes of

377   participants – their partners spanned the full range of body attractiveness. Second,

378   participants' evaluations were based on three minute interactions with opposite sex partners.

379   It is possible that personality ratings, relative to body and facial ratings, would have been

380   more influential if participants had greater knowledge of participants' personalities. In this

381   way, our estimate regarding proportion of overall attractiveness attributed to body

382   attractiveness may be specific to short interactions. Additionally, as our attractiveness ratings

383   were general (i.e. not specified as short- or long-term contexts) it is not possible to determine

384   the context participants had in mind when rating partners. Third, our sample contained only

385   young, Western undergraduate students, and so we do not make claims about the universality

386   of these results. Fourth, this study used linear modeling. While it is highly likely that these

387   relationships are non-linear when extreme values are included (e.g. malnourished and obese

388   individuals), they did not significantly depart from linearity within the range of body types of

389   participants in our study. Correlation tables for all included variables can also been seen in

390   Supplementary material S4. Fifth, the speed-dating paradigm necessitates that one sex is

391   seated while the other sex 'rotates' from partner to partner. When seated, it is difficult to

392   appreciate height. To test whether this influenced our results, we counterbalanced the rotating

393   sex and ran *height by rotating sex* interactions (see supplementary material S5). No

394   interaction term was significant, thereby suggesting that the time participants spent unseated

395   (e.g. milling outside and walking into the room) was sufficient, or that height can be

396   adequately perceived in the sitting position. Last, though using interaction terms in place of

397   ratios is statistically more sound, this prevented us from using known comparison points that

398   are specific to ratios (e.g. WHR .70). To address this, we have provided supplementary

399   figures (S6) that show body attractiveness as a function of all of the included ratios. For

400   WHR, we also include comparison points for the ideal ratios for both men (.90) and women

401   (.70)

402   Future research examining body attractiveness should evaluate both sexes regardless

403   of whether their hypotheses are sex-specific. Although examining the attractiveness of

404   women's dimensions and men's dimensions in separate studies can be informative, the

405   numerous differences in study design and sampling make between-sex comparisons difficult.

406   Without between-sex comparisons, it is not possible to conclude that a trait is preferred by

407   one sex in particular; as illustrated with our height example, the case may be that it is

408   preferred by both sexes similarly. Evolutionary explanations are often shaped by ideas about

409   traits being preferred more strongly (or exclusively) by one or the other sex, so it is important

410   to routinely include both sexes in studies testing evolutionary hypotheses. Furthermore,

411   though our findings largely support findings from studies using inert stimuli, we encourage

412   more mate-preference research involving face-to-face human interactions to ensure that

413   conclusions from computer-based studies apply in more ecologically valid situations.

414

References

415

416 Archer, J., & Thanzami, V. (2009). The relation between mate value, entitlement, physical aggression,

417   size and strength among a sample of young Indian men. *Evolution and Human Behavior,*

418   *30*(5), 315-321. doi:10.1016/j.evolhumbehav.2009.03.003

419 Asendorpf, J. B., Penke, L., & Back, M. D. (2011). From dating to mating and relating: Predictors of

420   initial and long-term outcomes of speed-dating in a community sample. *European Journal of*

421   *Personality, 25*(1), 16-30.

422 Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory

423   hypothesis testing: Keep it maximal. *Journal of memory and language, 68*(3), 255-278.

424 Bates, D., Mächler, M., Bolker, B., & Walker, S. (2014). Fitting linear mixed-effects models using

425   lme4. *arXiv preprint arXiv:1406.5823*.

426 Bercovitch, F. B. (1989). Body size, sperm competition, and determinants of reproductive success in

427   male savanna baboons. *Evolution, 43*(7), 1507-1521.

428 Brooks, R. C., Scott, I. M., Maklakov, A. A., Kasumovic, M. M., Clark, A. P., & Penton-Voak, I. S.

429   (2010). National income inequality predicts women's preferences for masculinized faces

430   better than health does. *Proceedings of the Royal Society of London B: Biological Sciences*,

431   rspb20100964.

432 Brooks, R. C., Shelly, J. P., Jordan, L. A., & Dixson, B. J. (2015). The multivariate evolution of

433   female body shape in an artificial digital ecosystem. *Evolution and Human Behavior, 36*(5),

434   351-358. doi:10.1016/j.evolhumbehav.2015.02.001

435 Buss, D. M. (1989). Sex-differences in human mate preferences - evolutionary hypothesis tested in 37

436   cultures. *Behavioral and Brain Sciences, 12*(1), 1-14.

437 Buss, D. M., & Barnes, M. (1986). Preferences in human mate selection. *Journal of Personality and*

438   *Social Psychology, 50*(3), 559-570. doi:10.1037/0022-3514.50.3.559

439 Buss, D. M., & Schmitt, D. P. (1993). Sexual strategies theory: an evolutionary perspective on human

440   mating. *Psychological review, 100*(2), 204.

441   Chinedu, S. N., Ogunlana, O. O., Azuh, D. E., Iweala, E. E. J., Afolabi, I. S., Uhuegbu, C. C., . . .

442   Osamor, V. C. (2013). Correlation between body mass index and waist circumference in

443   nigerian adults: implication as indicators of health status. *Journal of public health research,*

444   *2*(2), e16-e16. doi:10.4081/jphr.2013.e16

445   Courtiol, A., Raymond, M., Godelle, B., & Ferdy, J. B. (2010). Mate choice and human stature:

446   homogamy as a unified framework for understanding mating preferences. *Evolution, 64*(8),

447   2189-2203. doi:10.1111/j.1558-5646.2010.00985.x

448   Dijkstra, P., & Buunk, B. P. (2001). Sex differences in the jealousy-evoking nature of a rival's body

449   build. *Evolution and Human Behavior, 22*(5), 335-341. doi:10.1016/s1090-5138(01)00070-8

450   Dixson, B. J., Dixson, A. F., Bishop, P. J., & Parish, A. (2010). Human physique and sexual

451   attractiveness in men and women: A New Zealand–US comparative study. *Archives of Sexual*

452   *Behavior, 39*(3), 798-806.

453   Dixson, B. J., Grimshaw, G. M., Linklater, W. L., & Dixson, A. F. (2011). Eye-tracking of men's

454   preferences for waist-to-hip ratio and breast size of women. *Archives of Sexual Behavior,*

455   *40*(1), 43-50.

456   Dixson, B. J., Grimshaw, G. M., Ormsby, D. K., & Dixson, A. F. (2014). Eye-tracking women's

457   preferences for men's somatotypes. *Evolution and Human Behavior, 35*(2), 73-79.

458   Douglas, W. Y., & Shepard Jr, G. H. (1998). Is beauty in the eye of the beholder? *Nature, 396*(6709),

459   321.

460   Eastwick, P. W., & Finkel, E. J. (2008). Sex differences in mate preferences revisited: Do people

461   know what they initially desire in a romantic partner? *Journal of Personality and Social*

462   *Psychology, 94*(2), 245.

463   Finkel, E. J., Eastwick, P. W., & Matthews, J. (2007). Speed-dating as an invaluable tool for studying

464   romantic attraction: A methodological primer. *Personal Relationships, 14*(1), 149-166.

465   Frederick, D. A., & Haselton, M. G. (2007). Why is muscularity sexy? Tests of the fitness indicator

466   hypothesis. *Personality and Social Psychology Bulletin, 33*(8), 1167-1183.

467   Geniole, S. N., Denson, T. F., Dixson, B. J., Carré, J. M., & McCormick, C. M. (2015). Evidence

468   from meta-analyses of the facial width-to-height ratio as an evolved cue of threat. *PLoS ONE,*

469   *10*(7), e0132726.

470   Giugliano, F., Esposito, K., Di Palo, C., Ciotola, M., Giugliano, G., Marfella, R., . . . Giugliano, D.

471   (2004). Erectile dysfunction associates with endothelial dysfunction and raised

472   proinflammatory cytokine levels in obese men. *Journal of Endocrinological Investigation,*

473   *27*(7), 665-669. doi:10.1007/BF03347500

474   Heidler, S., Temml, C., Broessner, C., Mock, K., Rauchenwald, M., Madersbacher, S., & Ponholzer,

475   A. (2007). Is the Metabolic Syndrome an Independent Risk Factor for Erectile Dysfunction?

476   *The Journal of Urology, 177*(2), 651-654. doi:https://doi.org/10.1016/j.juro.2006.09.043

477   Huang, S. A., Ledgerwood, A., & Eastwick, P. W. (in press). How Do Ideal Friend Preferences and

478   Interaction Context Affect Friendship Formation? Evidence for a Domain- General

479   Relationship Initiation Process. *Social Psychological and Personality Science, 0*(0),

480   1948550619845925. doi:10.1177/1948550619845925

481   Koscinski, K. (2014). Assessment of Waist-to-Hip Ratio Attractiveness in Women: An

482   Anthropometric Analysis of Digital Silhouettes. *Archives of Sexual Behavior, 43*(5), 989-997.

483   doi:10.1007/s10508-013-0166-1

484   Kościński, K. (2013). Perception of facial attractiveness from static and dynamic stimuli. *Perception,*

485   *42*(2), 163-175.

486   Kronmal, R. A. (1993). Spurious correlation and the fallacy of the ratio standard revisited. *Journal of*

487   *the Royal Statistical Society. Series A (Statistics in Society)*, 379-392.

488   Kurzban, R., & Weeden, J. (2005). HurryDate: Mate preferences in action. *Evolution and Human*

489   *Behavior, 26*(3), 227-244. doi:10.1016/j.evolhumbehav.2004.08.012

490   Kurzban, R., & Weeden, J. (2007). Do advertised preferences predict the behavior of speed daters?

491   *Personal Relationships, 14*(4), 623-632. doi:10.1111/j.1475-6811.2007.00175.x

492   Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest package: tests in linear

493   mixed effects models. *Journal of Statistical Software, 82*(13).

494   Lander, K. (2008). Relating visual and vocal attractiveness for moving and static faces. *Animal*

495   *Behaviour, 75*(3), 817-822. doi:https://doi.org/10.1016/j.anbehav.2007.07.001

496   Lassek, W. D., & Gaulin, S. J. C. (2009). Costs and benefits of fat-free muscle mass in men:

497   relationship to mating success, dietary requirements, and native immunity. *Evolution and*

498   *Human Behavior, 30*(5), 322-328. doi:10.1016/j.evolhumbehav.2009.04.002

499   Lassek, W. D., & Gaulin, S. J. C. (2016). What Makes Jessica Rabbit Sexy? Contrasting Roles of

500   Waist and Hip Size. *Evolutionary Psychology, 14*(2), 16. doi:10.1177/1474704916643459

501   Lassek, W. D., & Gaulin, S. J. C. (2018). Do the Low WHRs and BMIs Judged Most Attractive

502   Indicate Higher Fertility? *Evolutionary Psychology, 16*(4), 1474704918800063.

503   Ledgerwood, A., Eastwick, P. W., & Smith, L. K. (2018). Toward an integrative framework for

504   studying human evaluation: Attitudes toward objects and attributes. *Personality and Social*

505   *Psychology Review, 22*(4), 378-398.

506   Lee, A. J., Dubbs, S. L., Von Hippel, W., Brooks, R. C., & Zietsch, B. P. (2014). A multivariate

507   approach to human mate preferences. *Evolution and Human Behavior, 35*(3), 193-203.

508   doi:10.1016/j.evolhumbehav.2014.01.003

509   Lenton, A. P., Fasolo, B., & Todd, P. M. (2009). The relationship between number of potential mates

510   and mating skew in humans. *Animal Behaviour, 77*(1), 55-60.

511   Lenton, A. P., & Francesconi, M. (2011). Too much of a good thing? Variety is confusing in mate

512   choice. *Biology Letters, 7*(4), 528-531.

513   Loewenstein, G. (2005). Hot-cold empathy gaps and medical decision making. *Health Psychology,*

514   *24*(4), S49-S56. doi:10.1037/0278-6133.24.4.s49

515   Luo, S., & Zhang, G. (2009). What Leads to Romantic Attraction: Similarity, Reciprocity, Security, or

516   Beauty? Evidence From a Speed-Dating Study. *Journal of Personality, 77*(4), 933-964.

517   doi:doi:10.1111/j.1467-6494.2009.00570.x

518   Marlowe, F., & Wetsman, A. (2001). Preferred waist-to-hip ratio and ecology. *Personality and*

519   *Individual Differences, 30*(3), 481-489.

520   Mautz, B. S., Wong, B. B., Peters, R. A., & Jennions, M. D. (2013). Penis size interacts with body

521   shape and height to influence male attractiveness. *Proceedings of the National Academy of*

522   *Sciences, 110*(17), 6925-6930.

523   Penton-Voak, I. S., & Chang, H. Y. (2008). Attractiveness judgements of individuals vary across

524   emotional expression and movement conditions. *Journal of Evolutionary Psychology, 6*(2),

525   89-100.

526   Perkins, J. M., Subramanian, S., Davey Smith, G., & Özaltin, E. (2016). Adult height, nutrition, and

527   population health. *Nutrition reviews, 74*(3), 149-165.

528   Platek, S. M., & Singh, D. (2010). Optimal waist-to-hip ratios in women activate neural reward

529   centers in men. *PLoS ONE, 5*(2), e9042.

530   Puts, D. A. (2010). Beauty and the beast: Mechanisms of sexual selection in humans. *Evolution and*

531   *Human Behavior, 31*(3), 157-175.

532   Rilling, J. K., Kaufman, T. L., Smith, E. O., Patel, R., & Worthman, C. M. (2009). Abdominal depth

533   and waist circumference as influential determinants of human female attractiveness. *Evolution*

534   *and Human Behavior, 30*(1), 21-31. doi:10.1016/j.evolhumbehav.2008.08.007

535   Rubenstein, A. J. (2005). Variation in perceived attractiveness: Differences between dynamic and

536   static faces. *Psychological Science, 16*(10), 759-762.

537   Serrano-Meneses, M., Córdoba-Aguilar, A., Méndez, V., Layen, S., & Székely, T. (2007). Sexual size

538   dimorphism in the American rubyspot: male body size predicts male competition and mating

539   success. *Animal Behaviour, 73*(6), 987-997.

540   Shine, R., Olsson, M., Moore, I., LeMaster, M., Greene, M., & Mason, R. (2000). Body size enhances

541   mating success in male garter snakes. *Animal Behaviour, 59*(3), F4-F11.

542   Singh, D. (1993). Adaptive significance of female physical attractiveness: Role of waist-to-hip ratio.

543   *Journal of Personality and Social Psychology, 65*(2), 293-307. doi:10.1037/0022-

544   3514.65.2.293

545   Singh, D. (1995). Female judgment of male attractiveness and desirability for relationships: Role of

546   waist-to-hip ratio and financial status. *Journal of Personality and Social Psychology, 69*(6),

547   1089-1101. doi:10.1037/0022-3514.69.6.1089

548   Singh, D., Dixson, B. J., Jessop, T. S., Morgan, B., & Dixson, A. F. (2010). Cross-cultural consensus

549   for waist–hip ratio and women's attractiveness. *Evolution and Human Behavior, 31*(3), 176-

550   181.

551   Stulp, G., & Barrett, L. (2016). Evolutionary perspectives on human height variation. *Biological*

552   *Reviews, 91*(1), 206-234. doi:10.1111/brv.12165

553   Stulp, G., Buunk, A. P., Kurzban, R., & Verhulst, S. (2013). The height of choosiness: mutual mate

554   choice for stature results in suboptimal pair formation for both sexes. *Animal Behaviour,*

555   *86*(1), 37-46. doi:10.1016/j.anbehav.2013.03.038

556   Stulp, G., Buunk, A. P., Verhulst, S., & Pollet, T. V. (2015). Human Height Is Positively Related to

557   Interpersonal Dominance in Dyadic Interactions. *PLoS ONE, 10*(2), 18.

558   doi:10.1371/journal.pone.0117860

559   Thornhill, R., & Grammer, K. (1999). The body and face of woman: One ornament that signals

560   quality? *Evolution and Human Behavior, 20*(2), 105-120. doi:10.1016/s1090-5138(98)00044-

561   0

562   Todd, P. M., Penke, L., Fasolo, B., & Lenton, A. P. (2007). Different cognitive processes underlie

563   human mate choices and mate preferences. *Proceedings of the National Academy of Sciences,*

564   *104*(38), 15011.

565   Tovee, M. J., Maisey, D. S., Emery, J. L., & Cornelissen, P. L. (1999). Visual cues to female physical

566   attractiveness. *Proceedings of the Royal Society B-Biological Sciences, 266*(1415), 211-218.

567   Valentine, K. A., Li, N. P., Penke, L., & Perrett, D. I. (2014). Judging a man by the width of his face:

568   The role of facial ratios and dominance in mate choice at speed-dating events. *Psychological*

569   *Science, 25*(3), 806-811.

570   Zambon, J. P., Mendonça, R. R. d., Wroclawski, M. L., Karam Junior, A., Santos, R. D., Carvalho, J.

571   A. M. d., & Wroclawski, E. R. (2010). Cardiovascular and metabolic syndrome risk among

572   men with and without erectile dysfunction: case-control study. *Sao Paulo Medical Journal,*

573   *128*, 137-140.

574