1 Assortative mate preferences for height across short-term and long- 2 term relationship contexts in a cross-cultural sample

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26 **Abstract**

27 Height preferences reflecting positive assortative mating for height – wherein an individual’s own
28 height positively predicts the preferred height of their mate – have been observed in several distinct
29 human populations and are thought to increase reproductive fitness. However, the extent to which
30 assortative preferences for height differ strategically for short-term versus long-term relationship
31 partners, as they do for numerous other indices of mate quality, remains unclear. We explore this
32 possibility in a large representative sample of over 500 men and women aged 15-77 from Canada,
33 Cuba, Norway and the United States. Participants’ own heights were measured, and they indicated
34 their height preferences for a long-term and short-term mate using graphic stimuli containing metric
35 indices. Replicating the “male-taller norm”, participants on average preferred taller-than-average
36 male mates, and shorter-than-average female mates. Positive assortative preferences for height were
37 observed across sexes and samples, however the strength of these height preferences varied with
38 relationship context for men, and not for women. Taller men preferred relatively shorter women for
39 short-term relationships than for long-term relationships, indicating stronger assortative preferences
40 for height in a long-term context. These results provide preliminary evidence that, in addition to
41 mate preferences for other physical traits related to mate quality such as masculinity in the body,
42 face, and voice, assortative preferences for height do vary as a function of expected relationship
43 length, but this was surprisingly only observed for female height.

44

45 **1 Introduction**

46 One hundred and fifty years ago, Darwin published his now remarkably influential theory on sexual
47 selection, emphasizing the role of phenotypic qualities in mate choice decisions (Darwin, 1871).
48 Since then, a vast body of literature offers converging evidence that mate choice decisions are critical
49 for the reproductive success of humans and all other sexually reproducing organisms, and as such
50 mate preferences have been largely shaped by sexual selection to maximize fitness (Andersson, 1994;

51 Conroy-Beam et al., 2019a). Mate preferences in humans are intensively studied and shown to range
52 from preferences for specific character or personality traits, such as kindness and honesty, to
53 preferences for physical traits, such as age or physical attractiveness, that ostensibly function to target
54 mates of high genetic quality, resource holding potential, and/or reproductive potential (Shackelford
55 et al., 2005; Roberts and Little, 2008; Walter et al., 2020).

56 Mate preferences for physical height in humans are observed in both sexes and across diverse
57 cultures (Courtiol et al., 2010; Pisanski and Feinberg, 2013; Yancey and Emerson, 2014; Stulp et al.,
58 2017). This is perhaps not surprising given that height predicts a range of life-history and fitness-
59 related factors including health, socioeconomic status, dominance, and reproductive maturity
60 (Pisanski and Feinberg, 2013; Stulp and Barrett, 2016 for reviews). Body size in humans, like in
61 many other animals (Andersson, 1994), is a sexually dimorphic trait under natural and sexual
62 selection that is both highly heritable and susceptible to environmental influences. For instance, there
63 is evidence that taller men and women have, on average, a lower risk of mortality than do relatively
64 shorter individuals (Wormser et al., 2012). Shorter-than-average men in turn exhibit the lowest rates
65 of both social and reproductive success (Stulp and Barrett, 2016), particularly in industrialized or
66 western populations where stature predicts substantial variance in social status (Judge and Cable,
67 2004). Among women, a basic principle of allocation underscores a trade-off between skeletal
68 growth and reproduction, with shorter women typically reaching sexual menarche, and thus
69 reproductive maturity, sooner than taller women, and as a consequence giving birth to their first child
70 relatively earlier (Stearns, 2000; Stulp and Barrett, 2016). At the same time, short mothers experience
71 more complications during pregnancy and parturition (in part due to their small pelvis size) and
72 higher rates of child morbidity and mortality in both developing and industrialized countries (Stearns,
73 2000; Stulp and Barrett, 2016).

74 The mate height preferences of both sexes are likely to reflect adaptive mate choice decisions
75 (Kuijper et al., 2012; Buss and Schmitt, 2019), however it remains unclear exactly which aspects of
76 mate quality that are linked to height can explain the most variance in height preferences (Kowal et
77 al., 2021). Height preferences have been studied using a range of methodologies including numerical
78 self-report, judgments of figure drawings, and mate-choice relevant tasks (e.g., outcomes of speed
79 dates or dating advertisements)(see Courtiol et al., 2010 for review). These studies offer converging
80 evidence for a ‘male-taller-norm’ among young heterosexual western adults: women generally
81 indicate preferences for men taller than themselves, whereas men indicate preferences for relatively
82 shorter women (for reviews see Pisanski and Feinberg, 2013; Stulp and Barrett, 2016). A similar
83 pattern emerges in actual mated pairs at a rate much higher than expected by chance (Gillis and Avis,
84 1980; Stulp et al., 2013b). Western women generally prefer men who are taller than the average man
85 in their given population, for example, men that are around 180 cm tall (Beigel, 1954; Salska et al.,
86 2008; Courtiol et al., 2010). However, women’s preferences for above-average height in men appear
87 to asymptote within one or two standard deviations of the average (Beigel, 1954; Pawlowski, 2003;
88 Fink et al., 2007; Salska et al., 2008; Courtiol et al., 2010; Stulp et al., 2013a, 2013b) (i.e., the ‘male-
89 not-too-tall norm’). This aligns with evidence that, although taller men are generally healthier than
90 average-height or short men, very tall men have relatively higher rates of health complications (Stulp
91 et al., 2014; Stulp and Barrett, 2016).

92 Men’s preferences for women’s heights have consistently been shown to be weaker, less
93 consistent, and less robust than women’s preferences for men’s heights (Pierce, 1996; Salska et al.,
94 2008; Courtiol et al., 2010; Stulp et al., 2013a). This may reflect evolved and/or sociocultural sex
95 differences in mate preferences (Walter et al., 2020), wherein, for example, body size in men can
96 index dominance and resource holding potential – traits that are more likely to have been sexually
97 selected among men than women. Among women, indices of youth and fertility are more likely to

98 have been selected for, and indeed are reflected in the general mate preferences of men (Buss and
99 Schmitt, 1993; Shackelford et al., 2005; Walter et al., 2020). Nevertheless, female height can still
100 index health and fecundity to potential mates. The limited existing research on preferences for
101 women's heights suggests that western heterosexual men prefer average or shorter-than-average
102 women, however others report the opposite or no preference at all (Courtiol et al., 2010 for review).
103 Studies examining the preferences of men who identify as non-heterosexual also show mixed
104 findings, with support both for and against a general tendency to prefer a partner taller than oneself
105 (Valentova et al., 2014, 2016). In addition, such preferences appear to be moderated by a number of
106 factors, including the height of the rater (Valentova et al., 2014).

107 Indeed, an individual's own height is known to predict their preferred height in a mate.
108 Beyond absolute height preferences, several studies have found evidence for positive assortative
109 preferences for height, such that taller individuals tend to prefer taller mates and vice versa
110 (Pawlowski, 2003; Kurzban and Weeden, 2005; Fink et al., 2007; Courtiol et al., 2010; Stulp et al.,
111 2013b). Assortative mating in humans and other animals is most often positive, that is, occurs
112 between two individuals that share a given phenotypical quality (Thiessen and Gregg, 1980; Conroy-
113 Beam et al., 2019b). Such a preference can be adaptive if it increases genetic homology while
114 avoiding inbreeding (Thiessen and Gregg, 1980). Researchers have posited that positive assortative
115 preferences for height may increase the likelihood that height differences between mated pairs are not
116 extreme. Indeed, preferences for relative height typically do not exceed a difference of 25 cm
117 between heterosexual mates (Pawlowski, 2003; Fink et al., 2007; Salska et al., 2008). Positive
118 assortative preferences for height may thus function to increase one's pool of potential partners
119 (Pawlowski, 2003) or the quality of resultant offspring. Height is highly heritable ($h=0.80$)(Stulp
120 and Barrett, 2016), hence the offspring of two tall individuals will likely be tall as well. There is also

121 some evidence that extreme height differences between mated pairs predict a higher likelihood of
122 birth complications (Stulp et al., 2011).

123 While mate preferences can differ somewhat from actual mate choices due to conflicts of
124 interest between the sexes and numerous factors that limit the extent to which certain individuals can
125 attain a preferred or high-quality mate (Jiang et al., 2013; Stulp et al., 2013b), a recent meta-analysis
126 indicates weak positive assortative mating for height in heterosexual couples across forty-three
127 western ($r=.25$) and non-western ($r=.21$) countries (Stulp et al., 2017), with no cross-cultural
128 differences (Stulp et al., 2017). Notably, assortative preferences for height have not been consistently
129 replicated, for example, in non-traditional societies such as several tribes on the African continent
130 including the Hadza, Himba, Datoga and Tsimane' (Sear and Marlowe, 2009; Sorokowski et al.,
131 2011, 2015; Sorokowski and Butovskaya, 2012).

132 The present study tests whether preferences for mate height differ for committed long-term
133 compared to uncommitted short-term relationships in a large cross-cultural sample of adults. While
134 most human societies practice marriage, short-term liaisons among single people or through serial
135 monogamy and extra-pair affairs are even more common in our species (Buss and Schmitt, 1993 for
136 review). Many studies have shown that mate preferences for traits linked to mate quality can differ
137 for short- versus long-term relationships (Buss and Schmitt, 1993, 2019). Much of this research has
138 focused on female preferences for male androgen-mediated traits, such as facial, vocal and bodily
139 masculinity. In general, women show relatively stronger preferences for androgen-mediated male
140 traits in the context of a short-term versus long-term relationship (Little et al., 2011), presumably
141 because the potential benefits of choosing a male mate with relatively high androgen levels (e.g.,
142 higher immunocompetence that may be passed to offspring) outweigh the potential costs (e.g., higher
143 risk of infidelity and decreased investment) in a short-term but not long-term relationship (Puts et al.,
144 2012 for review)(see e.g., Buss and Schmitt, 1993, 2019). However, mate preferences have also been

145 shown to vary by relationship context for traits that may not be directly linked to androgen-levels, but
146 that nevertheless predict characteristics relevant in a potential long-term versus short-term mate. This
147 may include, for example, relatively stronger preferences for intelligence and honesty in long-term
148 mates, and for sex drive or athleticism in short-term mates (Buss et al., 1990; Regan et al., 2000;
149 Muggleton and Fincher, 2017).

150 Despite being a sexually dimorphic trait in humans, height does not appear strongly and
151 consistently related to circulating testosterone levels in adult men (Kowal et al., 2021). Thus, while
152 female preferences for male height may not vary by relationship context as a function of variable
153 androgen-linked immunity benefits *per se*, as they do for androgen-mediated traits, other benefits
154 could be gained from such a preference when expressed by either sex. Indeed, this is because height
155 is linked more broadly to mate quality and health benefits in both sexes, and to fecundity in women.
156 To our knowledge, only one previous study examined height preferences for short-term versus long-
157 term mates, and that study focused only on heterosexual women's preferences for sexual dimorphism
158 in men's heights. Testing a sample of nearly 150 Polish women, Pawlowski & Jasienska (2005)
159 found that women preferred relatively taller male mates in a short-term than long-term mating
160 context. However, the effect of relationship length was small, as more than half of the women
161 showed the same height preference regardless of relationship context (Pawlowski and Jasienska,
162 2005). No previous study has tested whether preferences for women's heights differ by relationship
163 context.

164 Here, we test the prediction that positive assortative preferences for height will be observed
165 across four human populations and further explore whether these preferences differ by hypothetical
166 relationship context for both men's and women's heights. This exploratory study included a diverse
167 sample of over five-hundred male and female raters aged 15 to 77. To address the overabundance of
168 studies on the height preferences of predominantly western undergraduate students (Courtial et al.,

2010 for review; Pisanski and Feinberg, 2013), participants were recruited from both rural and urban regions in Canada, Cuba, Norway and the United States. While some researchers have suggested that population-level height differences may influence height preferences (Pawlowski, 2003; Stulp and Barrett, 2016), evidence is lacking for cross-cultural differences in assortative mating for height (Pawlowski, 2003; Fink et al., 2007; Stulp et al., 2017). Indeed, if height preferences reflect long-standing evolved mechanisms in our species, they are likely to be relatively stable across cultures (Shackelford et al., 2005). Moreover, differences in height among same-sex individuals *within* each of the sampled countries (up to 50 cm) far outweighed the average differences in height between countries (Cubans were on average 6 cm shorter than same-sexed Norwegians, with North Americans falling in between these two extremes). We thus had no *a priori* predictions that country would explain significant variance in assortative preferences for mate height above and beyond individual differences in height. As a result, we did not test for differences between countries, but instead modeled the variation in height preferences across these countries, using country as a random-intercept term. Our analyses hence focus on testing for an effect of relationship context on assortative preferences for height in both men and women.

2 Materials and Methods

2.1 Participants

Descriptive statistics for the ages, heights, and weights of men and women in each country are given in Table 1. Five-hundred and thirty-six participants took part (333 women, 203 men), aged 15-77 (mean age 25.8 ± 11.4 years). Participants were recruited from the general population (rural and urban) and from local universities in four countries: Canada ($n=143$), Cuba ($n=187$), Norway ($n=95$) and the United States ($n=111$), using a combination of recruitment methods ranging from online advertisements to word-of-mouth (self-reported nationalities are given in Table S1).

Overall, 93.3% of participants reported the opposite-sex as their preferred sex for a romantic relationship, 3.4% reported a preference for the same-sex, 2.8% for either sex, and 0.6% did not report their sexual orientation. While height preferences can differ between heterosexual and non-heterosexual samples (Valentova et al., 2014, 2016), our sample size of non-heterosexual participants was not large enough to test for group differences. Thus, all participants regardless of their sexual orientation or age were included in the statistical analyses reported in this paper. However, models including only heterosexual participants who self-reported as preferring the opposite-sex, and models including only participants aged 17 to 40 (i.e., spanning the most reproductively relevant years of the human lifespan), can be found in the Supplementary Materials. Excluding participants on the basis of their sexual orientation and/or age from analyses did not change any significance levels. Participants provided written informed consent. Depending on the country sample, they received course credit for taking part (Canada, USA), or a small gift (Cuba, Norway). The study was conducted according to the Declaration of Helsinki on Biomedical Studies Involving Human Subjects.

2.2 Stimuli

Minimalistic graphic representations of back-facing male (Fig. 1A) and female (Fig. 1B) bodies were first generated by hand, scanned, and then digitally edited using Adobe Photoshop CS6. We controlled for body symmetry by inverse mirroring the left side of the body to the right (following Courtiol et al., 2010). In addition, aspect ratios between body width and height, and between the hips, shoulders and waist, were standardized across the scale. Bodies were positioned from shortest to tallest and labelled A to E, with heights given in both metric (cm) and imperial (feet, inches) units. The central figure marked “C” on the graphic represents average height for each sex, with adjacent bodies representing ± 5 cm and ± 10 cm deviations from the mean for a range of 20 cm. Scale values derive from population statistics obtained for North American adults (Shields et al., 2008; NCD Risk Factor Collaboration, 2016), as this approximates height distributions for Central and Northern global

216 populations (NCD Risk Factor Collaboration, 2016). Height scale values were selected so as to avoid
217 extremes at either end of the average distribution of heights, and the same standardized scale was
218 used for all participants in all four countries to allow for direct cross-cultural comparisons. Adding
219 numerical labels representing absolute heights to our scale, rather than using a wholly visual
220 representation of relative height differences between hypothetical pairs such as the sexual
221 dimorphism in stature (SDS) scale (Pawlowski, 2003; Fink et al., 2007; Sorokowski et al., 2011),
222 allowed for more precise numerical calculation of absolute height preferences and of the strength of
223 the relationship between own and preferred height, in real units.

224 **2.3 Procedure**

225 Participants were simultaneously presented with the graphic representations of men and women (Fig.
226 1A-B), on two separate laminated pages of A4 paper (Canada, Cuba, Norway) or as two digital
227 images scaled to the same size (USA). They were then asked to indicate their height preference for a
228 mate of their preferred sex in the context of a stable long-term relationship (for example, marriage)
229 and a short-term relationship (for example, a one-night stand) following previous work (Little et al.,
230 2002; Feinberg et al., 2012; O'Connor et al., 2014). The order in which long-term or short-term
231 preferences were tested was randomized. Participants were instructed that they could select more
232 than one preferred height only if they strongly felt that they equally prefer multiple height options.
233 However, multiple preferred heights were selected on only 2.6% of trials (28 of 1072) and were thus
234 averaged together to obtain a single preferred height value. Participants also reported their sex, age,
235 and sexual orientation. Canadian, Cuban, and Norwegian samples (80% of participants) completed
236 the study using pen and paper; their heights and weights were measured using metric tape and a
237 digital scale. American participants completed the study online using survey software (Research Core
238 2017, Qualtrics, Provo, Utah, USA); their heights and weights were self-reported.

239

3 Models and Results

For full statistical models, data, R code and output, and research stimuli see supplementary and online materials (Open Science Framework, <https://osf.io/ah97w/>).

We coded the response variable (Height Preference) in centimeters. Figure 1C shows the distribution of absolute height preferences for female and male mates in either relationship context. Table 2 reports absolute height preferences across countries. These absolute preference values (and their general distributions; Fig. 1C) are notably based on rater's raw responses and are largely given here for comparisons with previous studies. The values do not account for variance tied to individual raters or groups, including variance as a function of the rater's own height, as we explore in our linear mixed effects models.

To test our key hypothesis regarding assortative preferences for height by relationship context, we ran a series of linear mixed effects models using the R package lmerTest in R (Kuznetsova et al., 2017). In all models, we set REML to false, and fit with Maximum Likelihood to facilitate model comparison. We centered the response variable (Height Preference) on the sample mean (such that the intercept effects approximate a *t*-test, and the intercept itself is not 0 cm, an impossible value) and z-scored the Own Height variable. We then created models specifying random slopes and intercepts maximally with correlations between random effects and binary variables sum-to-zero coded (-0.5, 0.5) to reduce false positives and to create a full-factorial ANCOVA-like analysis (Barr, 2013). We entered all fixed-effects as random slopes at each participant's random intercept (i.e., all main effects and all 2-way and 3-way interactions among own height, sex, and relationship context). When grouping data by self-reported free-response nationality or by country, we nested each participant within their nationality or country. We also fit random intercepts for age as a control. Because we had no formal predictions regarding the age or country/nationality of raters,

263 we did not enter these as a fixed-effects terms and the factors are instead treated as nuisance
264 variables.

265 Twenty-two participants chose not to indicate a height preference for either a long-term or
266 short-term relationship partner, and their data were thus excluded from these models. For analyses we
267 thus included the short-term and long-term preferences of 514 participants, totaling 1028
268 observations, however this varies slightly depending on the analysis as some participants did not
269 complete all demographic questions. The number of observations per analysis are noted in the
270 Supplementary Materials in each model's output.

271 The R code for Model 1 nesting participants by country is:

272 `lmer(height_preference ~ height_z_scored * Sex * Relationship_context + (1 + height_z_scored *
273 Sex * Relationship_context || ID_NUMBER:Country) + (1 | Age), data=data, REML=FALSE).`

274 To facilitate interpretation of results, we subsequently split the data by sex of rater and re-ran the
275 models. Table 3 displays fixed effects for the country-level model, for both sexes combined and for
276 each sex separately. Full model results including random effects are given in Table S2 in the
277 Supplementary Materials; Models excluding participants on the basis of their reported sexual
278 orientation and/or age are given in Tables S3 and S4, and show the same pattern of results.

279 The results of Model 1 show that, in general, men preferred shorter women whereas women
280 preferred taller men, relative to their own body heights (Table 3). Examining these effects for each
281 sex separately while controlling for country-level variance shows that, on average, women prefer
282 men 2.3 cm (or almost 1 inch) taller than the average men in their country, and men prefer women
283 2.5 cm (or about 1 inch) shorter than the average women in their country. Own height therefore
284 positively predicted preferences for mate height, confirming positive assortative preferences for

height in both sexes and across countries (Fig. 2). However, this was qualified by relationship context in preferences for women's heights. Indeed, taller men preferred relatively shorter women for short-term relationships than they did for long-term relationships (Table 3; Fig. 2).

We then tested the same model again, replacing country with the self-reported free-response nationality ($k=39$) of each participant, rather than their country of residence (see Table S1 for a break-down of reported nationalities).

The R code for Model 2 nesting participants by nationality is:

```
lmer(height_preference ~ height_z_scored * Sex * Relationship_context + (1 + height_z_scored * Sex * Relationship_context || ID_NUMBER:Nationality_selfreport:Country) + (1 | Age), data=data, REML=FALSE).
```

Table 4 displays fixed-effects for the nationality-level model, comparing men and women together and separately. Full model results including random effects are given in Table S5 in the Supplementary Materials. Models excluding participants on the basis of their reported sexual orientation and/or age are given in Tables S6 and S7, and show the same pattern of results.

In Model 2, own height again significantly and positively predicted preferences for height. As found in the country-level model, there was a main effect of relationship context, specific to male raters. This was qualified by an interaction with the rater's own height, revealing again that for short-term relationships taller men preferred relatively shorter women than they did for long-term relationships (Table 4; Fig. 2).

4 Discussion

Our results partially corroborate previous findings, namely that women generally prefer taller men, and men generally prefer shorter women, relative to their own heights (Beigel, 1954; Salska et al.,

2008; Courtiol et al., 2010; Stulp et al., 2013a). This result extends the “male taller norm” to four industrialized countries. Our results further corroborate a positive relationship between participants’ own heights and their mate height preferences, that is, positive assortative preferences for height (Stulp et al., 2017). However, assortative height preferences were qualified by relationship-context. Surprisingly, and in contrast to research on individual differences in preferences for facial and vocal masculinity in the context of a short-term versus long-term relationship (Little et al., 2011), our effects were specific to preferences for women’s heights. Men preferred relatively shorter women for short-term relationships than for long-term relationships.

Few studies have examined men’s preferences for women’s heights, and those studies have typically produced smaller effects sizes and less consistent results than have studies examining women’s preferences for men’s heights (Pierce, 1996; Salska et al., 2008; Courtiol et al., 2010; Stulp et al., 2013a). In addition, no previous study, to the authors knowledge, has tested for differences in men’s preferences for women’s heights across relationship contexts, despite the important trade-off between female height and reproduction (Stearns, 2000; Stulp and Barrett, 2016). However, our finding that women’s preferences for men’s heights did not differ (while men’s did) is unexpected, as predictions regarding context-specific mating strategies have traditionally focused on variation in women’s preferences (Buss and Schmitt, 1993, 2019). Moreover, one previous study found that women do prefer a larger sexual dimorphism in stature (SDS) for hypothetical short-term than long-term relationships (i.e., they prefer silhouette drawings representing a relatively larger difference in height between a male-female pair) (Pawlowski and Jasienska, 2005). However, that study used the SDS scale (Pawlowski, 2003), aimed at measuring preferences for relative height between heterosexual pairs, that is not directly comparable to our scales. While our sample size of female raters was more than double that of Pawlowski & Jasienska (2005), suggesting that a lack of statistical power in our study is unlikely to explain the contrasting results, their study controlled for

331 phase of menstrual cycle in their female raters whereas our study did not. Regrettably, neither study
332 examined the potential influence of the current relationship status of participants on height
333 preferences. More research is clearly needed to understand context-specific mating strategies in
334 height preferences, particularly for women's heights, using comparable methods to discern the
335 robustness of these effects.

336 The absolute height preferences of each sex observed here support a general tendency for
337 raters to prefer taller-than-average men and shorter-than-average women and, most consistently, to
338 dis-prefer mates of either sex that exhibit a very short or very tall stature (Courtiol et al., 2010; Stulp
339 and Barrett, 2016 for reviews). These observed absolute preferences corroborate studies suggesting
340 that the costs of shortness outweigh the benefits of tallness, particularly for men (Stulp et al., 2014),
341 wherein both men and women of average to somewhat above-average height appear to enjoy the
342 highest reproductive success, at least in western societies, though this relationship varies widely
343 across studies (Stulp and Barrett, 2016).

344 Despite modest cross-cultural differences in the population-level height distributions of
345 Cubans, North Americans, and Norwegians, raters from all countries sampled in this study showed a
346 similar pattern of height preferences. A recent meta-analysis comparing the heights of actual mated
347 heterosexual couples also found no significant cultural differences (Stulp et al., 2017), suggesting
348 that individual height differences may trump population-level height differences, as the variation in
349 heights within countries is typically several times greater than between countries. Fink et al. (Fink et
350 al., 2007) also found no cross-cultural differences in preferences for sexual dimorphism in stature
351 among participants from Austria, Germany and the United Kingdom, and no differences when
352 comparing these samples to a Polish sample (Pawlowski, 2003).

353 While previous studies have shown relatively stronger preferences for various physical traits
354 in hypothetical short-term compared to long-term relationship contexts, particularly for androgen-
355 mediated masculinity in the face, body and voice (Little et al., 2011; Puts et al., 2012), our results
356 suggest that this ostensibly adaptive mechanism may not robustly or consistently generalize to
357 women's preferences for all sexually dimorphic male traits, including physical height. However,
358 while height is not closely linked to androgen levels in men (Kowal et al., 2021), preferences for
359 indices of mate quality that are not directly hormonally mediated (such as height) may nevertheless
360 differ for short-term versus long-term mates (Buss et al., 1990; Regan et al., 2000; Muggleton and
361 Fincher, 2017). We did not find evidence of this for preferences of men's heights.

362 Like the SDS scale (Pawlowski, 2003; Pawlowski and Jasienska, 2005), the scale used in the
363 present study represented a normal distribution of heights for the sampled populations, omitting
364 extremes, and importantly, did not elicit floor or ceiling effects. However, a limitation of such a scale
365 is that it constrains the extent to which very short or very tall respondents can choose partners who
366 are much shorter or taller than themselves. Thus, a broader representation of heights would allow for
367 a correspondingly broader range of preference responses, and potentially a stronger mapping between
368 own and preferred height. Incorporating a broader range of height preference options would also
369 allow researchers to more readily use a single standardised height preference scale when comparing
370 responses across human populations whose height distributions vary considerably from one another.
371 Another potential limitation of the scale employed here is that visual representations of bodies were
372 given alongside a numeric metric representing each figure's height. While this allowed us to quantify
373 height preferences in objective units, it prevents conclusions about whether participants were basing
374 their judgments on the illustration, the metric, or both. The commonly used SDS scale does not
375 contain metrics (Pawlowski and Jasienska, 2005; Fink et al., 2007; Sorokowski et al., 2011;
376 Valentova et al., 2014), and that approach may indeed increase the implicit nature of the preference

377 task and reduce conscious cognitive biases. Finally, while physical height and weight measurements
378 were taken from our Canadian, Cuban and Norwegian participants (80% of our study sample),
379 American respondents self-reported their body size. Self-reports of height can be biased, particularly
380 among men (Merrill and Richardson, 2009), and thus have the potential to weaken the true
381 association between own and preferred height, as may have been the case for our sample of American
382 men.

383 Despite the cross-cultural nature of this study, the countries sampled here all score high on the
384 World Health Organization's Global Health Statistics, with comparably low rates of disease and
385 childhood mortality (WHO Health Statistics and Information Systems, 2016). It is possible that cross-
386 cultural differences in mate height preferences across relationship contexts may differ in countries
387 with a high versus low health index. For example, selection may favour earlier sexual maturation
388 (and thus shorter stature) in countries with high childhood mortality and low life expectancy (Sear,
389 2010). Indeed, assortative preferences for height have not been consistently replicated in non-
390 traditional African societies namely among the Hadza, Himba, Datoga and Tsimane' tribes (Sear and
391 Marlowe, 2009; Sorokowski et al., 2011, 2015; Sorokowski and Butovskaya, 2012). Replication
392 studies may therefore include participants from countries representing a wider range of ecological
393 conditions. In future work, researchers may also test whether the preferences observed here translate
394 into real-life mate choices, that is, whether or not stronger assortative mating in height is observed in
395 actual committed (e.g., married) couples compared to shorter-term (casual) partnerships. Finally, it is
396 important to emphasize that human relationships are complex and that mating contexts extend
397 beyond a binary division of short-term and long-term partners. Integrating this complexity in study
398 designs will undoubtedly help to illuminate and advance our understanding of human mate
399 preferences.

400

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530

531 **6 Conflict of Interest**

532 The authors declare that the research was conducted in the absence of any commercial or financial
533 relationships that could be construed as a potential conflict of interest.

534 **7 Author Contributions**

535 K.P. and D.R.F. designed the research; K.P., M.F., N.D., A.O., A.S., and R.P. collected data. K.P.,
536 A.O., and R.P. coded and analyzed data. D.R.F performed statistical modelling; K.P. created stimuli

537 and figures. K.P., A.O. and D.R.F. wrote the paper. K.P., N.E., E.C.M., C.L., and D.R.F. supervised
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545 Academics (#626/STYP/12/2017).

546 **9 Data Availability Statement**

547 The datasets analyzed for this study, full statistical models, R code and output, and research stimuli
548 can be found in the Open Science Framework (<https://osf.io/ah97w/>).

549 **10 Figure Captions**

550 **Figure 1.** (A-B) Stimulus image set featuring back-facing silhouettes of men (panel A) and women
551 (panel B) used to measure mate height preferences. See *Stimuli* for detailed descriptions of stimulus
552 and creation and parameters. (C) Distributions of raw absolute height preferences for female heights
553 (top row) and male heights (bottom row) in short-term versus long-term relationship contexts.

554 **Figure 2.** Assortative preferences for the heights of potential female mates (top row) and male
555 mates (bottom row) in all four countries. The heights of raters positively predict how much taller-
556 than-average or shorter-than-average they prefer their mates to be, with similar effects observed
557 across countries. Men's preferences for women's heights are relatively stronger for a long-term (solid

558 lines and green coloration) than short-term (dashed lines and orange coloration) relationship context.

559 95% confidence intervals are represented by shaded regions surrounding each regression line.

560

561

562 **11 Tables**563 **Table 1.** Descriptive statistics for age, height, and weight of each sample by sex and country

Sex of Rater	Country		<i>N</i>	Mean	SD	Min	Max
Men	All	Age	203	26	11.3	15.0	75.0
		Height (cm)		178.3	7.8	152.4	200.7
		Weight (kg)		76.5	16.9	47.8	149.7
	Canada	Age	46	18.5	1.7	17.0	28.0
		Height (cm)		179.2	7.2	160.1	190.5
		Weight (kg)		71.4	12.2	47.8	99.8
	Cuba	Age	86	23.1	3.2	19.0	32.0
		Height (cm)		176.0	6.9	160.0	190.0
		Weight (kg)		69.9	11.6	50.0	110.0
	Norway	Age	42	33.8	14.8	15.0	75.0
		Height (cm)		181.2	7.2	165.0	200.0
		Weight (kg)		85.6	18.1	54.0	125.0
	USA	Age	29	35.4	16.4	19.0	70.0
		Height (cm)		179.8	10.0	152.4	200.7
		Weight (kg)		90	21	61.2	149.7
Women	All	Age	333	25.7	11.4	15.0	77.0
		Height (cm)		164.9	7.5	130.0	190.5
		Weight (kg)		62.9	15.4	28.6	149.7
	Canada	Age	97	19.1	2.3	17.0	29.0
		Height (cm)		165.1	7.9	149.9	190.5
		Weight (kg)		60.6	12	38.6	98.9
	Cuba	Age	101	21.2	3.4	18.0	32.0
		Height (cm)		163	7.7	130.0	180.0
		Weight (kg)		56.4	8.2	40.0	84.0
	Norway	Age	53	28.9	13.5	15.0	67.0
		Height (cm)		167.6	5.7	154.0	177.0
		Weight (kg)		63.8	12.1	46.0	100.0
	USA	Age	82	37.1	13.5	20.0	77.0
		Height (cm)		165	7.3	144.8	188.0
		Weight (kg)		72.9	21.2	28.6	149.7

Table 2. Absolute (raw) height preferences by sex, country, and relationship context. These raw values do not account for variance due to individual or sample differences.

	Country	Relationship Context	Preferred Height (cm)	
			<u>Mean</u>	<u>SEM</u>
Preferred Heights for Women	Canada	Long-term	167.178	.8792
		Short-term	165.565	.9177
	Cuba	Long-term	164.802	.6294
		Short-term	164.018	.6824
	Norway	Long-term	165.976	.7536
		Short-term	166.077	.8289
	USA	Long-term	165.552	1.2353
		Short-term	164.517	1.3230
Preferred Heights for Men	Canada	Long-term	180.402	.5046
		Short-term	179.629	.5550
	Cuba	Long-term	179.208	.4532
		Short-term	178.943	.4470
	Norway	Long-term	179.971	.7674
		Short-term	180.181	.7814
	USA	Long-term	179.691	.6629
		Short-term	179.962	.6979

SEM = standard error of the mean

570 **Table 3.** Model 1: Linear mixed effects model testing for differences in assortative preferences for
 571 mate height as a function of a short-term versus long-term relationship context, nesting participants
 572 by country. See Table S2 for full model with random effects.

	Women and Men	Women only	Men only
(Intercept)	-0.103 [-0.678, 0.472]	1.167 *** [0.612, 1.722]	-1.244 * [-2.318, -0.169]
Own height (of rater, z-scored)	1.892 *** [1.304, 2.479]	2.461 *** [1.700, 3.222]	1.453 ** [0.519, 2.388]
Sex (of rater)	-2.374 *** [-3.524, -1.224]		
Relationship context	0.112 [-0.462, 0.686]	0.392 [-0.169, 0.953]	-0.140 [-1.249, 0.969]
Own height * Sex	-0.681 [-1.856, 0.494]		
Own height * Relationship context	0.735 * [0.172, 1.299]	0.381 [-0.265, 1.027]	1.076 * [0.114, 2.038]
Sex * Relationship context	-0.558 [-1.707, 0.590]		
Own height * Sex * Relationship context	0.690 [-0.437, 1.816]		

Own height of rater is coded in models as “height_z_scored”; Sex of rater is coded as “Sex”; Relationship context has two levels: short-term, long-term.

[Lower 95% CI, Upper 95% CI]; *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

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574

575 **Table 4.** Model 2: Linear mixed effects model testing for differences in assortative preferences for
 576 mate height as a function of a short-term versus long-term relationship context, nesting participants
 577 by self-reported nationality. See Table S5 for full model with random effects.

	Women and Men	Women only	Men only
(Intercept)	-0.020 [-0.571, 0.530]	1.041 *** [0.498, 1.584]	-1.015 [-2.046, 0.015]
Own height (of rater, z-scored)	1.649 *** [1.095, 2.202]	2.207 *** [1.502, 2.912]	1.189 * [0.293, 2.086]
Sex (of rater)	-2.033 *** [-3.133, -0.932]		
Relationship context	0.111 [-0.463, 0.685]	0.386 [-0.176, 0.947]	-0.138 [-1.247, 0.970]
Own height * Sex	-0.815 [-1.921, 0.291]		
Own height * Relationship context	0.743 * [0.180, 1.305]	0.390 [-0.256, 1.035]	1.076 * [0.115, 2.038]
Sex * Relationship context	-0.551 [-1.699, 0.597]		
Own height * Sex * Relationship context	0.675 [-0.451, 1.800]		

Own height of rater is coded as “height_z_scored”; Sex of rater is coded as “Sex”; Relationship context has two levels: short-term, long-term.

[Lower 95% CI, Upper 95% CI]; *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

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579

(A) Male image set

(B) Female image set

(C)

Canada

Cuba

Norway

United States of America

Preferences for women's heights

Long- term

Short- term

Preference for height of mate relative to average (cm)

Preferences for men's heights

Own height of rater (cm)

20
10
0
-10
-2020
10
0
-10
-20

130 140 150 160 170 180 190 200

130 140 150 160 170 180 190 200

130 140 150 160 170 180 190 200

130 140 150 160 170 180 190 200