

### Original Article

## Body Height Preferences and Actual Dimorphism in Stature between Partners in Two Non-Western Societies (Hadza and Tsimane')

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**Abstract:** Body height influences human mate preferences and choice. A typical finding in Western societies is that women prefer men who are taller than themselves and, equivalently, men prefer women who are shorter than themselves. However, recent reports in non-Western societies (e.g., the Himba in Namibia) challenge the view on the universality of such preferences. Here we report on male and female height preferences in two non-Western populations—the Hadza (Tanzania) and the Tsimane' (Bolivia)—and the relationships between body height preferences and the height of actual partners. In the Hadza, most individuals preferred a sexual dimorphism in stature (SDS) with the man being much taller than the woman. Preferences for SDS and actual partner SDS were positively and significantly correlated in both men and women, suggesting that people who preferred larger height differences also had larger height differences with their partners. In the Tsimane', the majority of men preferred an SDS with the man being taller than the woman, but women did not show such a preference. Unlike in the Hadza, SDS preference was not significantly correlated to actual partner SDS. We conclude that patterns of height preferences and choices in the Hadza and Tsimane' are different than those observed in Western societies, and discuss possible causes for the observed differences between non-Western and Western societies.

**Keywords:** body height, mate preference, sexual dimorphism in stature (SDS), sexual selection, Hadza, Tsimane'

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## **Introduction**

The significance of human body height in mate preferences has been a subject of many biological and social sciences investigations (e.g., Beigel, 1954; Brewer and Riley, 2009; Buunk, Pollet, Klavina, Figueredo, and Dijkstra, 2009; Cameron, Oskamp, and Sparks, 1977; Courtiol, Picq, Godelle, Raymond, and Ferdy, 2010; Fink, Neave, Brewer, and Pawlowski, 2007; Graziano, Brothen, and Berscheid, 1978; Seki, Ihara, and Aoki, 2012; Sorokowski and Butovskaya, 2012; Stulp, Buunk, Kurzban, and Verhulst, 2013; Stulp, Buunk, Pollet, Nettle, and Verhulst, 2013; Valentova, Stulp, Třebický, and Havlíček, 2014). Body height preferences have been assessed through experimental studies (Graziano et al., 1978; Shepperd and Strathman, 1989), investigations of lonely-hearts advertisements (Cameron et al., 1977; Lynn and Shurgot, 1984), and speed-dating settings (Kurzban and Weeden, 2005; Stulp, Buunk, and Pollet, 2013). The general result of these studies is that in Western societies men prefer women of average height and women prefer tall men as possible mating partners (Courtiol, Raymond, Godelle, and Ferdy, 2010; Stulp, Buunk, and Pollet, 2013a).

Rather than looking at absolute height, other studies have focused on preferences for height difference between an individual and his/her partner in a romantic relationship (i.e., sexual dimorphism in stature,  $SDS = \text{male height}/\text{female height}$ ). Although a positive assortative preference has been reported for height preferences in Western societies (i.e., taller individuals tend to prefer taller partners; Courtiol, Raymond, et al., 2010; Stulp, Buunk, Pollet, Nettle, et al., 2013), it has also been shown that both men and women have a preference for SDS such that a woman is shorter than a man (Fink et al., 2007; Pawlowski, 2003; Shepperd and Strathman, 1989; Stulp, Buunk, Pollet, Nettle, et al., 2013; Stulp, Buunk, Verhulst, and Pollet, 2013). Both men and women prefer moderate SDS with men being slightly taller than women, and a maximum acceptable SDS of about a 17% difference in height (Salska et al., 2008). Moreover, SDS preferences are dependent on height in that taller men and shorter women prefer larger height difference than do shorter men and taller women, possibly because this increases the pool of potential partners (Pawlowski, 2003).

Although these findings have been observed and replicated in a variety of Western populations (e.g., Courtiol, Raymond, et al., 2010; Stulp, Buunk, Pollet, Nettle, et al., 2013), giving some validity to the hypothesis that SDS preferences are consistent across Western societies, it is yet unclear if they can be generalized to non-Western societies. Recent studies on SDS preferences in non-Western societies argue against the universality of such an effect. For example, Sorokowski, Sorokowska, Fink, and Mberira (2012) report that in the Himba of northern Namibia, more than 30% of the individuals preferred an SDS where partners were of equal height. Moreover, more than 20% of men chose women taller than themselves. Another study in a non-Western society, the Yali of Papua, concluded that men and women did not rely on SDS when evaluating an opposite-sex individual as a potential mate (Sorokowski and Sorokowska, 2012). Finally, in Datoga of Tanzania, both men and women preferred “extreme” SDS; i.e., men and women preferred partners either much taller or much shorter than themselves (Sorokowski and Butovskaya, 2012).

Together, these results suggest that SDS preferences in traditional societies are substantially different from those observed in Western societies (see Table 1). However, most of these studies have relied on preferred rather than actual SDS between partners, thus raising the question about the correspondence between these two. In other words, do people's preferences for body height in opposite-sex mating partners correlate with one another?

Gillis and Avis (1980) showed that in a Western society, husbands are more likely to be taller than their wives than would be expected by chance (see also Stulp, Buunk, Verhulst, et al., 2013), which is at least consistent with earlier mentioned height preferences. The evidence is, however, much more mixed when examining non-Western samples. In Gambia and among the Hadza, in approximately 10% of all marriages the wife was taller than the husband, which was not significantly different from chance, suggesting that height played less of a role in partner choice in these populations (Sear, 2006; Sear, Allal, and Mace, 2004; Sear and Marlowe, 2009). Thus, as was the case for the SDS preferences, patterns of actual SDS in married opposite-sex partners seen in Western populations are not necessarily observed in non-Western societies and cannot be regarded as universal (e.g., Sear and Marlowe, 2009).

The observed differences with respect to partner height preferences and mating patterns between Western and non-Western populations, and the variation between non-Western populations (e.g., Sorokowski et al., 2012; Sear and Marlowe, 2009), raises the question as to why these between-population differences exist. Before such a question can potentially be answered (see discussion for potential reasons), it is necessary to first document height preferences and mating patterns from many different non-Western populations. In the present study, we sought to investigate SDS preferences and patterns of partners' actual SDS in couples in two traditional societies: the Hadza of northern Tanzania and the Tsimane' of Bolivia. In addition to the investigation of possible differences between SDS preferences in these two societies compared to those reported in Western societies, we examined the relationship between SDS preferences and actual SDS between partners in order to determine how much preferred mate characteristics align with actual mate characteristics.

## **Materials and Methods**

### *Participants*

*The Hadza of Tanzania.* The Hadza are a hunter-gatherer society living in Tanzania. They number approximately 1,000–1,500 individuals and live in mobile camps, each comprising 30 people on average. This society has been extensively described in the literature (see Marlowe, 2010; Sear and Marlowe, 2009; Butovskaya, 2013). Women typically marry between 17 and 18 years of age, and men marry around the age of 20. Marriages are typically not arranged. Female choice seems to be the main factor leading to marriage because young single men appear willing to marry a wide range of women. Because divorce is common, serial monogamy is the best way to characterize the mating system (Sear and Marlowe, 2009; Butovskaya et al., 2012; Butovskaya, 2013). Although approximately 4% of men have two wives, polygynous marriages in Hadza are in most cases a transitory state. In most cases, such polygynous marriages are not stable.

**Table 1.** Actual and preferred SDS among indigenous societies

Study site	Subsistence strategy	Marriage patterns	General outline	Preferred / Actual SDS	Data source
Hadza (Tanzania)	Hunter-gatherers	Monogamy	Majority of men and women preferred and realized a sexual dimorphism in stature (SDS) with the man being taller than the woman; in approximately 10% of all marriages, the wife was taller than the husband.	Preferred + Actual	This study
			No evidence for the male-taller norm: In approximately 8% of all marriages, the wife was taller than the husband.	Actual	Sear and Marlowe, 2009
Tsimane' (Bolivia/Amazon)	Farmer-foragers	Monogamy, rare sororal polygyny	Majority of men preferred an SDS with the man being taller than the woman, but women did not show a specific preference for their partner's height. In less than 4% of all marriages, the wife was taller than the husband.	Preferred + Actual	This study
Datoga (Tanzania)	Pastoralists	Polygyny	Majority of men and women preferred extreme sexual dimorphism in stature (SDS) sets (i.e., men and women chose partners much taller or much shorter than themselves).	Preferred	Sorokowski and Butovskaya, 2012
Himba (Namibia)	Semi-nomadic pastoralists	Polygyny	Majority of men and women preferred an SDS with the man being taller than the woman, but a significant percentage of participants (over 30%) preferred partners' body height to be similar to their own; many Himba men preferred women taller than themselves.	Preferred	Sorokowski et al., 2012
Yali (Indonesia/Highlands of New Guinea)	Farmer-foragers	Polygyny	Men and women did not show any specific preference for their partner's height.	Preferred	Sorokowski and Sorokowska, 2012
Gambia		Polygyny	No evidence for the male-taller norm: In approximately 10% of all marriages, the wife was taller than the husband.	Actual	Sear, Allal, and Mace, 2004; Sear, 2006
Baka (Cameroon)	Hunter-gatherers	Monogamy	Partial evidence for the male-taller norm; interviews concerning height and mate choice suggested that the male-taller norm matches mating preferences.	Preferred + Actual	Becker et al., 2012

At the time of the study, the participants lived in the Lake Eyasi region. The height of all participants was measured by one of the authors (MB) using a portable anthropometer. Age was self-reported, although some participants did not know exactly how old they were.

*The Tsimane' from Bolivia.* The Tsimane' are a native Amazonian society of farmer-foragers. Their population of around 8,000 is distributed throughout approximately 100 villages, most of which are in the area of Beni in northern Bolivia. This tribe has been extensively described in the literature (e.g., Godoy et al., 2005; Huanca, 2008; Ringhofer, 2010).

The participants inhabited the region near the Maniqui River and lived in the villages of Maracas, Puerto Yucumo, Campo Bello, Catumare, and Anachere. Each participant's height was measured using a portable anthropometer. All measurements were taken by the principal investigators (PS, AS). Some of the participants did not take part in all stages of the study (e.g., for some individuals we lack information about the height of the partner, because that partner was not present in the village at the time of the study). Age was self-reported.

The marital customs in the Tsimane' have been described in detail (e.g., Winking, Gurven, and Kaplan, 2011). Similar to other native Amazonian societies, the Tsimane' still practice cross-cousin marriage. Traditionally, marriage is arranged by parents. However, in our sample only 29% of participants declared that their marriage was arranged. Nevertheless, these measures should be used with some caution as partners did not always agree on this, and respondents were not always entirely sure, given the long time it took them to answer. Rest assured, in this population, the parental influence on marriage is strong (Gurven, Winking, Kaplan, von Rueden, and McAllister, 2009).

### *Procedure*

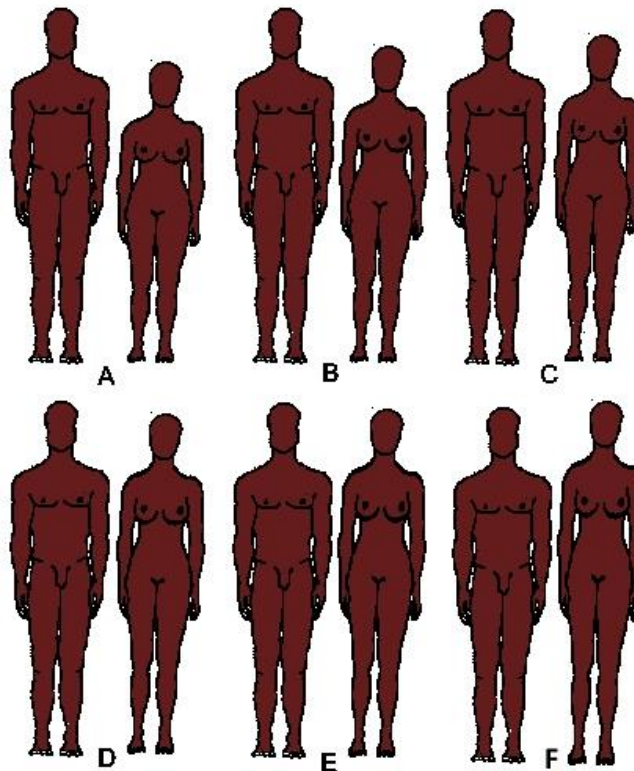
The data were collected through individual interviews conducted by the authors (MB among Hadza; AS and PS among Tsimane') with the help of a Tsimane' translator who was fluent in Spanish and a Hadza translator fluent in English. We used stimuli described in Sorokowski and Butovskaya (2012), which were slightly modified versions of silhouettes used by Pawlowski (2003). Although the stimuli are not ideal, they were used in previous studies both in Western (Fink et al., 2007; Pawlowski, 2003; Valentova et al., 2014) and non-Western societies (Sorokowski and Butovskaya, 2012; Sorokowski and Sorokowska, 2012; Sorokowski et al., 2012), and they ensure direct comparability with previous work.

The participants were shown six pairs of silhouettes, each pair with a different SDS (see Figure 1; participants were shown the version without the letters). For every pair, the size of the image of the man remained unchanged, but the body of the woman from the original pair ( $SDS = 1.09$ ) was shortened or elongated (without manipulating her width) to obtain SDS ratios ranging from 1.19 (i.e., the man being much taller than the woman) to 0.96 (i.e., the woman being slightly taller than the man). The ratios decreased in increments of about .05. In all silhouettes, the size of the head remained unchanged.

Participants were told that each pair represented partners in a romantic relationship and that the pairs of partners differed in their body heights. They were asked to choose the pair they would prefer in their own relationship (preferred SDS). Participants were then requested to provide information on their partner's height (actual SDS). In the Hadza sample, participants chose the pair from SDS stimuli set which depicted their current relationship; in the Tsimane' sample, we measured the actual height of the partner. Additionally, to examine the general validity of the SDS stimuli that we used in both studies, we also collected the data on

perception of the actual SDS for a subsample of Tsimane' men and women (similarly as described for the Hadza). We correlated the participants' perception of their actual SDS (six categories; see Figure 1) with the measured SDS between the partners (raw, uncategorized data), resulting in a strong and significant correlation,  $r(105) = .66, p < .0001$  (Spearman's rank correlation was identical). This suggests that judgments of a couple's actual SDS on the basis of our stimuli were reliable (note that because participants necessarily had to approximate their SDS given the limited range of categories to choose from, and the categories presented do not cover all possible SDSs, there is a degree of unavoidable measurement error in these assessments. This means that we should not expect a perfect correlation between perceived and actual SDS). In the few polygynous marriages (three men had two wives, who in all cases were sisters), we collected information about both partners. In general, the Hadza and Tsimane' were able to comprehend the questions easily.

**Figure 1.** Six pairs of human outlines with different levels of sexual dimorphism in size



Note: A = 1.19, B = 1.14, C = 1.09, D = 1.04, E = 1.0, F = 0.96

### *Analyses*

We performed separate analyses for each sex and each population. We did so because: 1) we wished to facilitate comparison with previous studies that followed a similar analysis strategy; 2) we could not use parametric analysis methods because of the distribution of our variables; and 3) the methods used differed slightly between our study populations.

Chi-squared tests were used to assess the findings based on the stimuli due to their categorical nature. Sex differences were analyzed using Mann-Whitney *U* tests, and Spearman rank correlations ( $r_s$ ) were used to test for association between two variables.

## Results

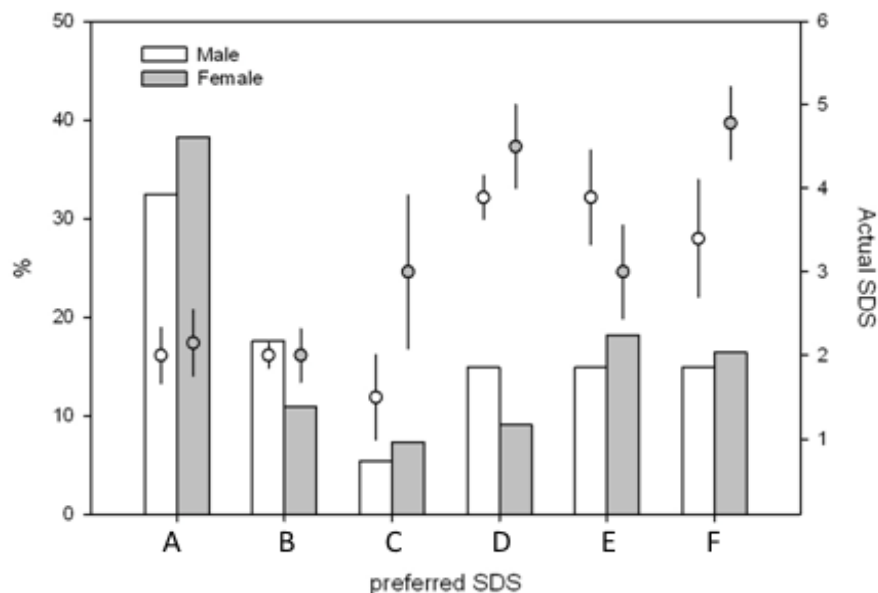
### *Hadza preferences for SDS*

Our Hadza sample comprised 55 women between 18 and 70 years of age ( $M = 37.78$ ,  $SD = 14.16$ ) and 74 men (for one man, age was missing) between the ages of 17 and 80 ( $M = 38.89$ ,  $SD = 16.07$ ). The height of male participants ranged from 142.6 cm to 178.3 cm ( $M = 161.32$ ;  $SD = 7.01$ ) and the height of female participants ranged from 138.0 cm to 165.1 cm ( $M = 151.44$ ;  $SD = 5.89$ ). Therefore, similarly to all previously investigated populations, body height is sexually dimorphic in the Hadza, with men being on average 7% taller than women.

From the 74 male participants, the majority (32%) preferred the highest SDS (1.19), indicating a preference for relationships in which the man is much taller than the woman. Many men also preferred to be in a relationship in which the SDS was 1.14 (18%), 1.04 (15%), 1.00 (15%), and 0.96 (15%). An SDS of 1.09 was least preferred (5%) (see Figure 2). Similarly to the men, the majority of female participants (38%) preferred the highest SDS (1.19). From the 54 women, a considerable number preferred a relationship in which the SDS was 1.14 (11%), 1.04 (9%), 1.00 (18%), and 0.96 (16%). Again similar to men, an SDS of 1.09 was least preferred (7%) (see Figure 2). In both men and women, the distribution of height preferences was significantly different from uniform (men:  $X^2[5, n = 74] = 17.14$ ,  $p < .01$ ; women:  $X^2[5, n = 55] = 21.26$ ,  $p < 0.001$ ). Furthermore, the sexes did not differ significantly in their median SDS preference (Mann-Whitney  $U = 2015$ ,  $z = -.098$ ,  $p = .92$ ). In conclusion, both men and women mostly preferred an SDS such that the man was much taller than the woman.

When examining the correlation between one's own height and preferred SDS, we found that neither male height ( $r_s[73] = .01$ ,  $p = .93$ ) nor female height ( $r_s[54] = .11$ ,  $p = .45$ ) was related to the preference for SDS in Hadza.

**Figure 2.** Frequencies (%; left Y-axis) of preferred SDS for Hadza men (white bars) and women (grey bars)



Note: Circle (mean) and error bars ( $\pm$  SE) reflect actual SDS (right Y-axis)



*The association between preferences and actual partner height among the Hadza*

Next, we investigated the patterns of (perceived) actual SDS among couples (obtained through the use of the stimuli), examining data from 62 married men and 52 married women. The majority of male participants (32%) reported to be in marriages with the highest SDS (1.19). Marriages in which the SDS was reported to be 1.14 (24%), 1.09 (7%), 1.04 (18%), 1.00 (13%), or 0.96 (7%) were all lower in frequency. The patterns as reported by the married women were very similar to those reported by the married men. The majority of female participants (33%) reported to be in marriages with the highest SDS (1.19). Fewer women were in marriages in which the SDS was reported to be 1.14 (17%), 1.09 (6%), 1.04 (17%), 1.00 (15%), or 0.96 (12%). Thus, marriages were reported to most likely occur when the SDS was very large, which is at odds with the average SDS of 1.07 in this population (see Discussion).

When examining the association between an individual's preferences and actual partner height, we found a positive correlation in both men ( $r_s[62] = .40, p < .001$ ) and women ( $r_s[52] = .49, p < .0001$ ). This suggests that in both men and women, those people who preferred large SDS were also in marriages with large SDS.

*Tsimane' preferences for Sexual Dimorphism in Stature*

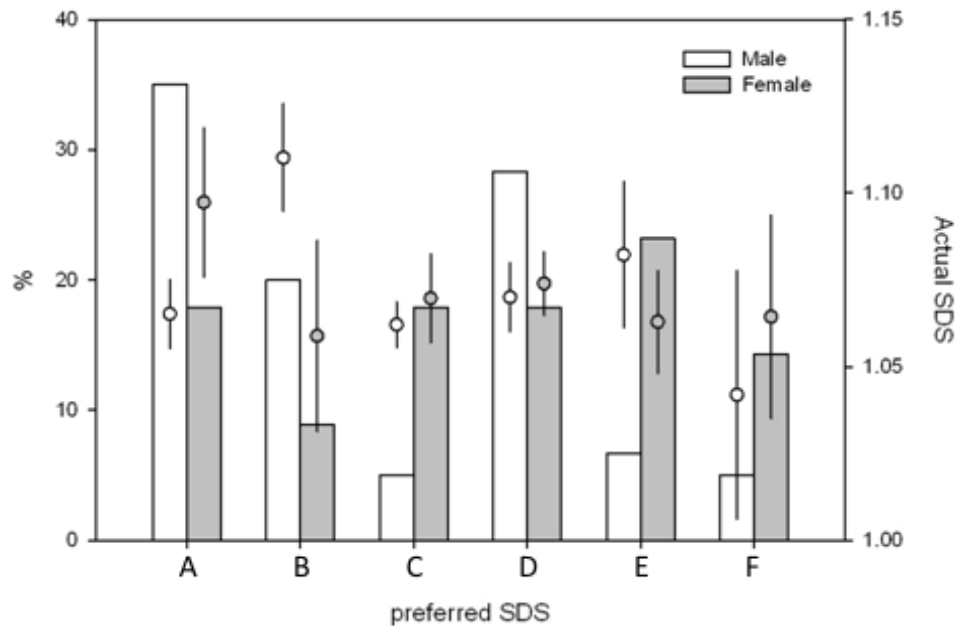
Our sample comprised 70 women between the ages of 17 and 50 ( $M = 30.49, SD = 10.31$ ) and 68 men between the ages of 18 and 50 ( $M = 33.97, SD = 11.56$ ). The height of male participants ranged from 151.3 cm to 180.0 cm ( $M = 166.50; SD = 5.66$ ); the height of female participants ranged from 146.0 cm to 165.9 cm ( $M = 154.92; SD = 4.10$ ). Therefore, body height is sexually dimorphic in the Tsimane', with men being on average 7% taller than women.

For 14 women and 9 men we were unable to record their height preferences. From the 59 male participants, the majority (36%) preferred the highest (1.19) or average (1.04) SDS (27%). A relatively high percentage of participants also preferred an SDS of 1.14 (20%). A lower percentage of men preferred an SDS of 0.96 (5%), 1.0 (7%), or 1.09 (5%) (see Figure 3). Thus, Tsimane' men generally preferred to be taller than their wives, with the largest SDS most preferred. From the 56 women, the highest percentage (23%) preferred an SDS of 1.0, indicating a preference for relationships in which the man and the woman are of the same height. Furthermore, a considerable proportion of females preferred romantic relationships in which the SDS was 0.96 (14%), 1.04 (18%), 1.09 (18%), 1.14 (9%) or 1.19 (18%). In men ( $X^2[5, n = 59] = 29.98, p < .0001$ ), but not in women ( $X^2[5, n = 56] = 3.79, p = .58$ ) the distribution of preferences for SDS was significantly different from uniform. Furthermore, there was a significant difference in median SDS preference between the sexes (Mann-Whitney  $U = 1117, z = -3.06, p < .01$ ). Thus, these results suggest that men are more consistent in their preferences, and that they prefer on average a larger difference in height between themselves and their partner than women do.

Similar to the Hadza, there was no significant correlation between an individual's height and his or her preferred SDS (women:  $r_s[56] = -.02, p = .90$ ; men: ( $r_s[59] = -.22, p = .10$ ).



**Figure 3.** Frequencies (%; left Y-axis) of preferred SDS for Tsimane' men (white bars) and women (grey bars)



Note: Circle (mean) and error bars ( $\pm$  SE) reflect actual SDS (measured; right Y-axis)

#### *The association between preferences and actual partner height among the Tsimane'*

When examining the heights of married individuals, we found no evidence for assortative mating for height, as evidenced by the non-significant correlation between partner heights ( $r_s[76] = .11, p = .35$ ). In total, we observed three couples out of 76 in which the woman was taller than the man. Based on the SDS of all partnered individuals, we found that the average SDS was 1.07 ( $SD = 0.05$ ).

Preferences for SDS did not reflect actual partner height in Tsimane' women ( $r_s[54] = -.15, p = .28$ ) and men ( $r_s[54] = -.04, p = .77$ ). When examining the subsample of men and women that also judged their actual SDS using our stimuli, we also found that preferred SDS did not predict estimated actual SDS (in men:  $r_s[43] = -.06, p = .72$ ; in women:  $r_s[41] = .05, p = .78$ ). Thus, preferences were not related to partner height.

In contrast to the Hadza, we observed that the estimates of actual SDS assessed via stimuli were in line with the average measured SDS of 1.07 in this population, and more generally with the shape of the distribution based on the measured SDSs: 30% of participants' answered that they were in a marriage in which SDS was perceived to be 1.09. A large number of participants also suggested their perceived SDS was 1.04 (24.5%) and 1.14 (21%). Much lower proportions were found for an SDS of 1.19 (10%), 1.00 (9.5%), and 0.96 (5%).

## **Discussion**

In the present study, we sought to investigate SDS (Sexual Dimorphism in Stature) preferences and patterns of partners' actual SDS in couples in two traditional societies—the Hadza of northern Tanzania and the Tsimane' of Bolivia. Our findings show that preferred height differences are different in these populations compared to previous reports on Western populations (Courtiol, Raymond, et al., 2010; Fink et al., 2007; Pawlowski, 2003; Shepperd

and Strathman, 1989; Stulp, Buunk, Pollet, Nettle, et al., 2013; Stulp, Buunk, Verhulst, et al., 2013).

In nomadic foragers from the native Tanzanian Hadza tribe, both men and women most often preferred the SDS with the man being much taller than the woman in the couple (but see the limitations), and men and women were similar in their most preferred SDS. Furthermore, an individual's height did not predict their preferred partner height. We did observe that preferred height differences were associated with (perceived) actual partner height differences in both men and women, suggesting that those who preferred a larger SDS also were in a relationship with a relatively large SDS. Interestingly, in a previous study conducted in the Hadza, Sear and Marlowe (2009) reported no evidence of a male-taller norm in this tribe, but they have been collecting their data since 1995, so there might have been some cultural changes with this regard during the last 20 years.

Preferences for SDS among the Tsimane', foragers and farmers living in the Amazon, were different to those observed among the Hadza (and again different to those observed in Western societies). Whereas partner stature did not seem to be important for women's mate preference (the observed pattern of preferences was not different from random), men did seem to value height in their partner, with the majority of male participants (36%) preferring the largest partner height differences. Consequently, men preferred a larger SDS than women. Like in the Hadza, an individual's height was not associated with preferred SDS. Moreover, and unlike the case in the Hadza, preferred SDS did not predict spousal SDS.

Although the preferences for very large SDS in Hadza men and women and Tsimane' men are different to typical patterns observed in Western countries (e.g., Pawlowski, 2003), the fact that the preferred SDS by men is generally so that the male is taller than the female is at least consistent. The lack of clear height preferences in Tsimane' women, however, is interesting and again at odds with those found in Western populations. We speculate that marriage patterns may account for this result. In the Tsimane', parental influence on children's marital decisions is stronger in the case of daughters compared to sons (Gurven et al., 2009). Women may thus appear to be less selective in terms of preferences for partner height because they have less influence over their choice of marriage partners than in Western populations. In other words, Tsimane' women's preferences may be masked to a certain degree.

Additionally, an overview of published findings from small-scale societies (including the data of this present study) shows that partner height preferences in monogamous societies (e.g., Hadza and Baka) are more similar to those observed in Western societies than in "extremely" polygynous societies like the Datoga, or Yali (see Table 1). We suggest that in societies where partners are free to choose their partners, women's height preferences might tend towards a preference for taller men, whereas this preference might not be observed in other societies, including polygynous societies with significant wealth stratification or when spouses are predominantly selected by relatives. We do note, however, that very few studies on this topic have actually been published (see Table 1), and our conclusions thus should be treated with a degree of caution.

A similar pattern of results like those observed in Western societies may also be present in societies where height is related to measures of social status and physical strength, as is the case for those Western populations (e.g., Judge and Cable, 2004; Sorokowski, 2010; Stulp, Buunk, Kurzban, et al., 2013), in which taller men are also perceived as being more dominant, having higher status, being more intelligent, and being healthier (Chu and Geary, 2005; Jackson and Ervin, 1992; Melamed, 1992). In the Tsimane' adults, there is no association

between height and perceptions of dominance and intelligence (Undurraga et al., 2012). According to Godoy et al. (2010), height is furthermore not associated with income or wealth in this society. Consequently, height may be less important as a trait affecting mate choice in this population, which could explain why women did not express any clear height preference in a potential partner. Similar reasoning might also hold for other populations (e.g., Yali) where no clear SDS preferences were observed (see Table 1).

We also examined the relationship between preferred SDS and actual SDS. In the Hadza, there was a positive correlation between preferred and actual SDS, suggesting that in this population mate preferences might influence mate choice. Among Tsimane', however, preferred SDS did not correlate with actual SDS. Thus, preferred height differences did not noticeably relate to actual partner height differences. One reason for the existence of this effect in the Hadza, but its absence in the Tsimane', is that in the latter population marriage partners are substantially influenced by parents (Gurven et al., 2009). Although there may be conflicts between parents and offspring about the most appropriate partner (Apostolou, 2008; van den Berg, Fawcett, Buunk, and Weissing, 2013), it is difficult to predict how "preferences" among individuals and their parents diverge in this population. Nonetheless, it is certain that because of the parental influence, the choice of partner is more constrained in the Tsimane' than the choice of Hadza men and women. Another reason why preferred SDS was not associated with actual SDS among Tsimane', may be the limited number of mate options (Wolanski and Siniarska, 1984) in this society. A man mostly chooses a partner from his cousins (Winking et al., 2011). Finally, characteristics other than height may be much more important when selecting a mate (Stulp, Buunk, and Pollet, 2013).

Another possible explanation of the between-population differences with respect to partner height preferences and mating patterns may be the fact that the relationship between height, health, and survival is dependent on the environment (Godoy et al., 2010; Sear, 2010; Stulp and Barrett, in press). For instance, life history theory predicts that in ecologies with high mortality and scarcity of resources, more energy should be invested in reproduction rather than growth, and shorter rather than taller individuals may have an advantage in such populations (Walker et al., 2006). However, comparing the Hadza with the Datoga (see Table 1), two neighboring populations, we find remarkably different SDS preferences. Given that these tribes live in very similar ecological conditions but are culturally very distinct—the Datoga are polygynous pastoralists, and the Hadza are serially monogamous nomadic foragers—these divergent preferences may be due to differences in cultural practices (e.g., traditions, mating systems, economy) rather than ecological conditions.

We note some limitations of our study. First, the stimuli used may have resulted in biased measures of actual SDS between partners in the Hadza. Indeed, both when choosing their preferred SDS (see Figure 1) and when indicating their actual SDS, most men and women indicated a rather large difference. For instance, 63% of men and 56% of women indicated that their actual SDS was between 1.09 and 1.19. Given that the average SDS in this population equals 1.07, the large proportion of respondents reporting these higher values suggests that Hadza men and women may have perceived our stimuli or our questions differently to other populations. Alternatively, our Hadza sample may have been biased towards couples with large SDS. There are two important things to note here, however: First, although there may have been biases in perception, these are unlikely to explain the correlation between mate preferences for SDS and actual SDS in men and women; second, similar limitations were not observed in the Tsimane'. In the latter sample, the perceived SDS between partners was in line

with the average SDS and its distribution in that population. Moreover, perceived partner SDS was strongly associated with measured partner SDS, suggesting that, in the Tsimane' sample, preferences for SDS are reliable. Another limitation is that, although we interpreted the association between preferred SDS and actual SDS in the Hadza as a correspondence between partner preferences and choice, we cannot rule out the possibility that partner characteristics influence partner preferences (see Courtiol, Picq, et al., 2010 for a discussion).

We suggest that height preferences in (small-scale) societies may best be interpreted as a compromise between the costs and benefits associated with male and female body height, relating to reproduction, individual well-being, and survival. Because of different ecological and social pressures, height preferences may vary among foragers, traditional pastoralists, and farmers. In some societies, height in men is associated with dominance and status, which may facilitate male reproductive success and have an impact on female preferences. Power asymmetries between the genders, in equalities in wealth, pathogen loads, and access to modern medicine might be additional factors that help explain height preferences. Documenting further variation in height preferences across distinct populations is required before any reliable conclusions can be drawn regarding how patterns of height preference co-vary with ecological and social circumstances.

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## **References**

- Apostolou, M. (2008). Parent-offspring conflict over mating: The case of family background. *Evolutionary Psychology*, 6, 456–468.
- Becker, N. S. A., Touraille, P., Froment, A., Heyer, E., and Courtiol, A. (2012). Short stature in African pygmies is not explained by sexual selection. *Evolution and Human Behavior*, 33, 615–622.
- Beigel, H. G. (1954). Body height in mate selection. *The Journal of Social Psychology*, 39, 257–268.
- Brewer, G., and Riley, C. (2009). Height, relationship satisfaction, jealousy, and mate retention. *Evolutionary Psychology*, 7, 477–489.
- Butovskaya, M. L. (2013). Aggression and conflict resolution among the nomadic Hadza of Tanzania as compared with their pastoralist neighbors. In D. P. Fry (Eds.), *War, peace, and human nature the convergence of evolutionary and cultural views* (pp. 278–296). Oxford: Oxford University Press.
- Butovskaya, M. L., Vasilyev, V. A., Lazebny, O. E., Burkova, V. N., Kulikov, A. M., Mabulla, A., ... Ryskov, A. P. (2012). Aggression, digit ratio, and variation in the

- androgen receptor, serotonin transporter, and dopamine d4 receptor genes in African foragers: The Hadza. *Behavior Genetics*, 42, 647–662.
- Buunk, A. P., Pollet, T. V., Klavina, L., Figueredo, A. J., and Dijkstra, P. (2009). Height among women is curvilinearly related to life history strategy. *Evolutionary Psychology*, 7, 545–559.
- Cameron, C., Oskamp, S., and Sparks, W. (1977). Courtship American style: Newspaper ads. *The Family Coordinator*, 26, 27–30.
- Chu, S., and Geary, K. (2005). Physical stature influences character perception in women. *Personality and Individual Differences*, 38, 1927–1934.
- Courtiol, A., Picq, S., Godelle, B., Raymond, M., and Ferdy, J. B. (2010). From preferred to actual mate characteristics: The case of human body shape. *PLOS ONE*, 5, e13010.
- Courtiol, A., Raymond, M., Godelle, B., and Ferdy, J. B. (2010b). Mate choice and human stature: Homogamy as a unified framework for understanding mating preferences. *Evolution*, 64, 2189–2203.
- Fink, B., Neave, N., Brewer, G., and Pawlowski, B. (2007). Variable preferences for sexual dimorphism in stature (SDS): Further evidence for an adjustment in relation to own height. *Personality and Individual Differences*, 43, 2249–2257.
- Gillis, J. S., and Avis, W. E. (1980). The male taller norm in mate selection. *Personality and Social Psychology Bulletin*, 6, 396–401.
- Godoy, R., Magvanjav, O., Nyberg, C., Eisenberg, D. T. A., McDade, T. W., Leonard, W. R., ... Gravlee, C. (2010). Why no adult stunting penalty or height premium? Estimates from native Amazonians in Bolivia. *Economics and Human Biology*, 8, 88–99.
- Godoy, R., Reyes-García, V., Vadez, V., Leonard, W. R., Huanca, T., and Bauchet, J. (2005). Human capital, wealth, and nutrition in the Bolivian Amazon. *Economics and Human Biology*, 3, 139–162.
- Graziano, W. G., Brothen, T., and Berscheid, E. (1978). Height and attraction: Do men see women eye to eye? *Journal of Personality*, 46, 128–145.
- Gurven, M., Winking, J., Kaplan, H., von Rueden, C., and McAllister, L. (2009). A bioeconomic approach to marriage and the sexual division of labor. *Human Nature*, 20, 151–183.
- Huanca, T. (2008). *Tsimane' oral tradition, landscape, and identity in tropical forest*. La Paz: Wa-Gui.
- Jackson, L. A., and Ervin, K. S. (1992). Height stereotypes of women and men: The liabilities of shortness for both sexes. *Journal of Social Psychology*, 132, 433–445.
- Judge, T. A., and Cable, D. M. (2004). The effect of physical height on workplace success and income: Preliminary test of a theoretical model. *Journal of Applied Psychology*, 89, 428–441.
- Kurzban, R., and Weeden, J. (2005). HurryDate: Mate preferences in action. *Evolution and Human Behavior*, 26, 227–244.
- Lynn, M., and Shurgot, B. A. (1984). Responses to lonely hearts advertisements: Effects of reported physical attractiveness, physique, and coloration. *Personality and Social Psychology Bulletin*, 10, 349–357.
- Marlowe, F. (2010). *The Hadza: hunter-gatherers of Tanzania*. California: University of California Press.
- Melamed, T. (1992). Personality correlates of physical height. *Personality and Individual Differences*, 13, 1349–1350.

- Pawlowski, B. (2003). Variable preferences for sexual dimorphism in height as a strategy for increasing the pool of potential partners in humans. *Proceedings of the Royal Society of London, Series B: Biological Sciences*, 270, 709–712.
- Ringhofer, L. (2010). *Fishing, foraging, and farming in the Bolivian Amazon on a local society in transition*. New York: Springer.
- Salska, I., Frederick, D. A., Pawlowski, B., Reilly, A. H., Laird, K. T., and Rudd, N. A. (2008). Conditional mate preferences: Factors influencing preferences for height. *Personality and Individual Differences*, 44, 203–215.
- Sear, R. (2006). Height and reproductive success: How a Gambian population compares to the West. *Human Nature*, 17, 405–418.
- Sear, R. (2010). Height and reproductive success: Is bigger always better? In U. J. Frey, C. Störmer, and K. P. Willführ (Eds.), *Homo novus—a human without illusions* (pp. 127–143). Berlin, Heidelberg: Springer.
- Sear, R., Allal, N., and Mace, R. (2004). Height, marriage and reproductive success in Gambian women. *Research in Economic Anthropology*, 23, 203–224.
- Sear, R., and Marlowe, F. W. (2009). How universal are human mate choices? Size doesn't matter when Hadza foragers are choosing a mate. *Biology Letters*, 5, 606–609.
- Seki, M., Ihara, Y., and Aoki, K. (2012). Homogamy and imprinting-like effect on mate choice preference for body height in the current Japanese population. *Annals of Human Biology*, 39, 28–35.
- Shepperd, J., and Strathman, A. (1989). Attractiveness and height: The role of stature in dating preference, frequency of dating and perceptions of attractiveness. *Personality and Social Psychology Bulletin*, 15, 617–627.
- Sorokowski, P. (2010). Politicians' estimated height as an indicator of their popularity. *European Journal of Social Psychology*, 40, 1302–1309.
- Sorokowski, P., and Butovskaya, M. (2012). Height preferences in humans may not be universal: Evidence from the Datoga people of Tanzania. *Body Image*, 9, 510–516.
- Sorokowski, P., and Sorokowska, A. (2012). Judgments of sexual attractiveness: A study of the Yali tribe in Papua. *Archives of Sexual Behavior*, 41, 1209–1218.
- Sorokowski, P., Sorokowska, A., Fink, B., and Mberira, M. (2012). Variable preferences for sexual dimorphism in stature (SDS) might not be universal: Data from a semi nomad population (Himba) in Namibia. *Journal of Cross-Cultural Psychology*, 43, 32–37.
- Stulp, G., and Barrett, L. (in press). Evolutionary perspectives on human height variation. *Biological Reviews*.
- Stulp, G., Buunk, A. P., Kurzban, R., and Verhulst, S. (2013d). The height of choosiness: Mutual mate choice for stature results in suboptimal pair formation for both sexes. *Animal Behaviour*, 86, 37–46.
- Stulp, G., Buunk, A. P., and Pollet, T. V. (2013a). Women want taller men more than men want shorter women. *Personality and Individual Differences*, 54, 877–883.
- Stulp, G., Buunk, A. P., Pollet, T. V., Nettle, D., and Verhulst, S. (2013b). Are human mating preferences with respect to height reflected in actual pairings? *PLOS ONE*, 8, e54186.
- Stulp, G., Buunk, A. P., Verhulst, S., and Pollet, T. V. (2013c). Tall claims? Sense and nonsense about the importance of height of US presidents. *The Leadership Quarterly*, 24, 159–171.
- Undurraga, E. A., Zebrowitz, L., Eisenberg, D. T. A., Reyes-Garcia V., TAPS Bolivia Study Team, and Godoy, R. (2012). The perceived benefits of height: Strength, dominance,

- social concern, and knowledge among Bolivian native Amazonians. *PLOS ONE*, 7, e35391.
- Valentova, J. V., Stulp, G., Třebický, V., and Havlíček, J. (2014). Preferred and actual relative height among homosexual male partners vary with preferred dominance and sex role. *PLOS ONE*, 9, e86534.
- van den Berg, P., Fawcett, T. W., Buunk, A. P., and Weissing, F. J. (2013). The evolution of parent-offspring conflict over mate choice. *Evolution and Human Behavior*, 34, 405–411.
- Walker, R., Gurven, M., Hill, K., Migliano, A., Chagnon, N., De Souza, R., ... Yamauchi, T. (2006). Growth rates and life histories in twenty-two small-scale societies. *American Journal of Human Biology*, 18, 295–311.
- Winking, J., Gurven, M., and Kaplan, H. (2011). Father death and adult success among the Tsimane: Implications for marriage and divorce. *Evolution and Human Behavior*, 32, 79–89.
- Wolanski, N., and Siniarska, A. (1984). Species module and assortative mating in man. *Journal of Human Evolution*, 13, 247–253.