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High heels enhance perceived sexual attractiveness, leg length and women's mate-guarding

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Abstract
Women's physical attractiveness is associated with health and fertility, but various fashion accessories could act, however, as supernormal stimuli and may enhance physical attractiveness to the opposite sex. Wearing high heels could contribute to women's physical attractiveness in various ways. Across three independent studies, I investigated whether high heels influence the perception of leg length and consequently their physical attractiveness in both sexes and their role in women's intrasexual competition. Heeled legs were more attractive than non-heeled legs and heeled legs were also viewed as longer than non-heeled legs. Furthermore, high heels promote women's mates guarding of their own partners as well as their perception of the sexual receptivity of the target wearing high heels. In conclusion, visually prolonged leg length by wearing high heels make legs more sexually attractive and high heels promote competition between women for access to the opposite sex.

Keywords Female attractiveness · Fashion · Human mating

Introduction

Across cultures, men have placed a greater emphasis on women's physical attractiveness than vice versa (Li et al. 2002; Walter et al. 2020). These preferences are thought to be unconsciously favoured by reproductive benefits from mating with healthy and/or fertile women. Several components of women's physical attractiveness are associated with high reproductive value. For example, women's low waist-to-hip ratio (WHR), particularly those equal or close to 0.7, is a reliable cue to physical and sexual maturity in young women who have not been pregnant (Lassek and Gaulin 2018, 2019). The higher preference for lower WHRs and female silhouettes with large breasts has also been confirmed using EEG data (Pazhoohi et al. 2020). Facial attractiveness of women has been shown to be associated with symmetry, health (Fink et al. 2014; Hume and Montgomerie 2001; Thornhill and Gangestad 1999; but see Foo et al. 2017), mating success (Rhodes et al. 2005) and women's reproductive success (Jokela 2009). According to the evolutionary logic, male with preferences for females with cues of fertility are more reproductively successful.

Women's Leg Length and Physical Attractiveness

Women's leg length was found to be an important determinant of physical attractiveness (reviewed by Cloud and Perilloux 2014). Legs slightly longer than average in women, but not in men, were found to be sexually more attractive to both men and women (Swami et al. 2006, 2007; Sorokowski and Pawlowski 2008; Sorokowski et al. 2011, but see Frederick et al. 2010 and Kiire 2016 for preferences for the average leg lengths in various cultures). These results were obtained by means of questionnaires using black-and-white silhouettes (e.g., Sorokowski and Pawlowski 2008) or colourful 3D images (Kiire 2016). Leg length is in all probability also influenced by natural selection, because the earliest-known hominids were bipeds (Galik et al. 2004; Haile-Selassie 2001) and lower leg length is negatively related to running economy (Laumets et al. 2017). Relatively longer legs are associated

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with good health (e.g., Gunnel et al. 2005; Lawlor et al. 2002; Lawlor et al. 2004) and some authors speculate about their associations with women's fertility (Fielding et al. 2008). Leg length has been found to negatively correlate with early childhood illnesses, malnutrition (Wadsworth et al. 2002), risk of various illnesses (Hedges et al. 2017; Kim et al. 2008, Whitley et al. 2012, but see positive association between risk of cancer and tallness in Gunnell et al. 2001) and positively with socioeconomic status (Davey Smith et al. 2001). Thus, leg length seems to be cue of an individual's quality.

Women's Sexual Attractiveness and Artificial Improvements

Modern human society provides various opportunities for development of potentially fakeable signals, which do not follow Zahavi's (1975, 1977) criteria of honest signalling (Bradshaw et al. 2019). According to the global statistics released in 2018 by the International Society of Aesthetic Plastic Surgery (ISAPS), women continue to dominate the cosmetic surgical market with 86.4% or 20,207,190 cosmetic procedures worldwide, with liposuction (1,573,680 procedures) being one of the most requested cosmetic surgical procedure. Popular surgical procedure includes liposuction of the circumference of the waist and then the use of purified fat cells to graft to the buttocks (Roberts III et al. 2005). This procedure both narrows the waist and enhances the buttocks (without affecting pelvic morphology), having a synergetic effect on WHR, which enhances woman's attractiveness (Singh and Randall 2007) measured by activation of specific centers in men's brains involved in reward processes (Platek and Singh 2010). Men's perception of women's sexual attractiveness may therefore be influenced by various artificial improvements.

High Heels as Sexual Signals

Women's secondary sexual characteristics contribute to physical attractiveness. Wearing high heels is thought to emphasise some sex specific aspects which make women appear more attractive (Morris 1994; Smith 1999; Smith and Helms 1999). Specifically, high heels artificially increase the attractiveness of women for men through altering women's gait, reducing stride length and increasing pelvis tilt and hip rotation (Morris et al. 2013). Lewis et al. (2017) showed that when women wear high heels, their lumbar curvature increased and they were perceived as more attractive. In real-life situations, men approached women wearing high heels more readily (Guéguen and Stefan 2015). Men also perceived women with high heels as sexier, prettier, and more elegant, with more attractive legs and buttocks (Guéguen et al. 2016). Interestingly, women preferred wearing high heels when imagined an interaction with an attractive man (Prokop and Švancárová 2020). Since high heels are attractive even in the absence of gait cues (Guéguen and Stefan 2015; Guéguen et al. 2016; Lewis et al. 2017; Morris et al. 2013), there must be other reasons that high heels increase women's attractiveness. Lumbar curvature could partly account for the attractiveness of women in the static postures presented in popular magazines (Dietz and Evans 1982; Graff et al. 2013). However, the attractiveness of women with high heels in a sitting/lying position and in pornographic films (Albury 2009) has apparently nothing to do with lumbar curvature. It is hypothesized that high heels can visually elongate woman's legs and consequently increase their attractiveness (Morris 1994; Smith and Helms 1999). As far as I am aware, this hypothesis has not yet been investigated.

Sexual Signalling and women's Intrasexual Competition

Compared with non-human primates, men invest the most of all primates in offspring (Puts 2010). High men's investment triggers women's intrasexual competition (Puts 2010). Women are sensitive to the physical appearance of other women (Fink et al. 2014; Pazda et al. 2014) and the appearance enhancement tactic seems to be the most frequently used tactic in competition with same-sex individuals for access to an opposite sex partner (Bradshaw et al. 2019; Buss 1988; Greer and Buss 1994; Walters and Crawford 1994). If high heels enhance physical attractiveness for the opposite sex, then their use should increase women's intrasexual competition (Watkins and Leitch 2020).

The Present Report

In the present work, inspired by the evolutionary significance of the attractiveness of high heels, I explored a possible association between women's leg attractiveness when wearing high heels by means of visual elongation and the role of high heels in intrasexual competition between women. Specifically, I predicted that legs with high heels appear longer than legs with flat-soled shoes and that perceived leg length correlates with leg attractiveness. Moreover, if high heels are attractive to men, their presence would promote intrasexual competition in terms of anticipated mate guarding, and perceptions of sexual receptivity.

Study 1

Study 1 primarily investigated relationships between perceived sexual attractiveness and perceived length of legs using

a forced-choice paradigm in both men and women. Men were compared with women, because men prefer attractive, young mates more than women (Walter et al. 2020). It also investigated whether self-reported age influences the rating of legs with and without heels. This is because older individuals are sexually less active, have fewer mating opportunities and lower standards for the attractiveness of a potential partner than younger individuals (Camacho and Reyes-Ortiz 2005; Prokop et al. 2020). Thus, perceived attractiveness of heeled shoes should decrease with increasing age.

Method

Participants

A total of 329 Caucasian students, attending a mid-sized university in Slovakia, participated in the study. The samples for each study were independent of each other. After excluding students who reported having a homosexual or bisexual orientation or being below age 18, the sample was 199 women (150 of them involved in a romantic relationship) and 97 men (37 of them involved in a romantic relationship) with a mean age of 25 years (SD = 8.41). Data exclusions were determined prior to any analysis.

Measures

Stimuli

Five shoes with high heels (11 cm heels) and five similarly looking flat sole shoes (1 cm heels) with an identical colour (white, black, red, blue and green) were chosen for the experiment. Two photographs of legs of the same 22-year-old woman were used as targets throughout Study 1–3. The female wore shoes with black coloured high and small heels and were photographed from the same distance. The colour of the two original photographs was manipulated in order to create remaining eight photographs using Adobe Photoshop CS2. Specifically, I created a photo filter covering the entire surface area of shoes. Then, I manipulated the color of the filter, which allowed other aspects of the legs, to remain unchanged. Each pair of shoes was presented on one slide (Fig. 1, for full set of stimuli see Supplemental Material) and their position on the right and left side was randomized.

Measures of Sexual Attractiveness and Length of Legs

Participants were asked to choose one photograph from each pair according to the perceived sexual attractiveness of the legs. All the stimuli were then presented again (in random order) following Fink et al. (2014). Participants were asked to choose one photograph from each pair according to the perceived length of legs.

Procedure

The research was carried out online. Before the web page with the online survey was made available, each participant received a unique numerical code to secure individual identity. All the participants received extra credit for a human biology course. Participants were initially asked demographic questions (age, sex, relationship length), then responded to the questions below the photographs. The same procedure was applied in Study 2 and 3.

Statistical Analysis

The participants' choices were binary coded (high heels = 1, flat sole shoes = 0) and summarized scores for perceived attractiveness and length of legs were used for statistical analyses. This means that the larger the number the more they chose the high heel pictures. Data from the ratings were not normally distributed (Kolmogorov-Smirnov test, both $p < .001$) and could not be improved by various transformations. Thus, the Generalized Linear Model (GLM) with the Poisson distribution was applied for analyses, because the Poisson distribution is frequently used for the number of events (Haight 1967). The independent variables were participant's sex and age. The Spearman rank correlation coefficient was used for examining the relationship between summarized scores of perceived leg sexual attractiveness and length.

Results

Factors Influencing Ratings of Leg Attractiveness and Length

The mean scores of leg perceived sexual attractiveness (M = 4.47, SD = 1.19, $N = 296$) and leg length (M = 4.13, SD = 1.62, N = 296) were high which suggest that the participants manifested strong preferences for shoes with high heels, but not for flat sole shoes. A series of binomial tests confirmed that participants almost invariably preferred all five high heeled legs as more attractive (87–91% of all participants) and longer (78–84% of all participants) (all p's < .001). Women scored legs with high heels as more sexually attractive than men (GLM, Wald's $\chi^2 = 33.64$, df = 1, $p < .0001$, Fig. 2). Increased age of participants was associated with lower reported sexual attractiveness of shoes with high heels (GLM, Wald's $\chi^2 = 19.27$, df = 1, $p < .0001$).

The relationship between perceived length and the sexual attractiveness of legs.

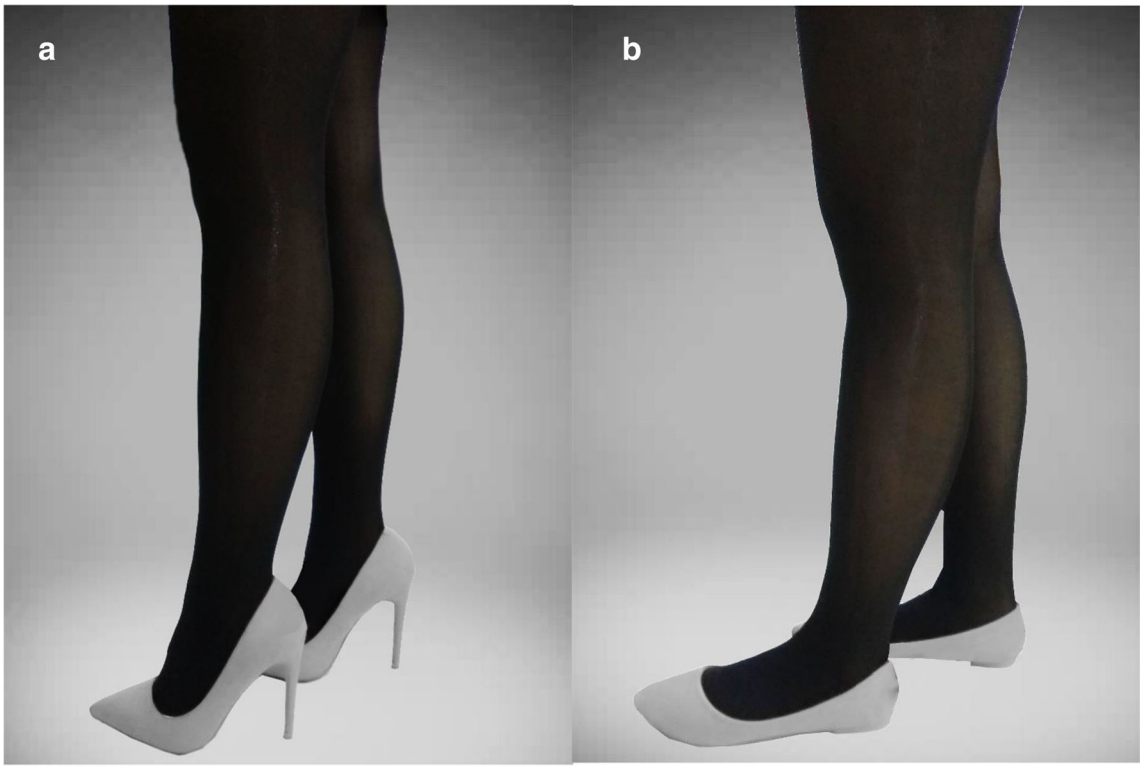

Fig. 1 Example of legs with shoes with high heels (**a**) and flat sole shoes (**b**)

There was a moderate correlation between perceived sexual attractiveness and the length of legs (Spearman $r = 0.31$, $p < 0.001$, $n = 296$). This correlation was stronger for women (Spearman $r = 0.37$, $p < 0.001$, $n = 199$) than for men (Spearman $r = 0.2$, $p = 0.05$, $n = 97$).

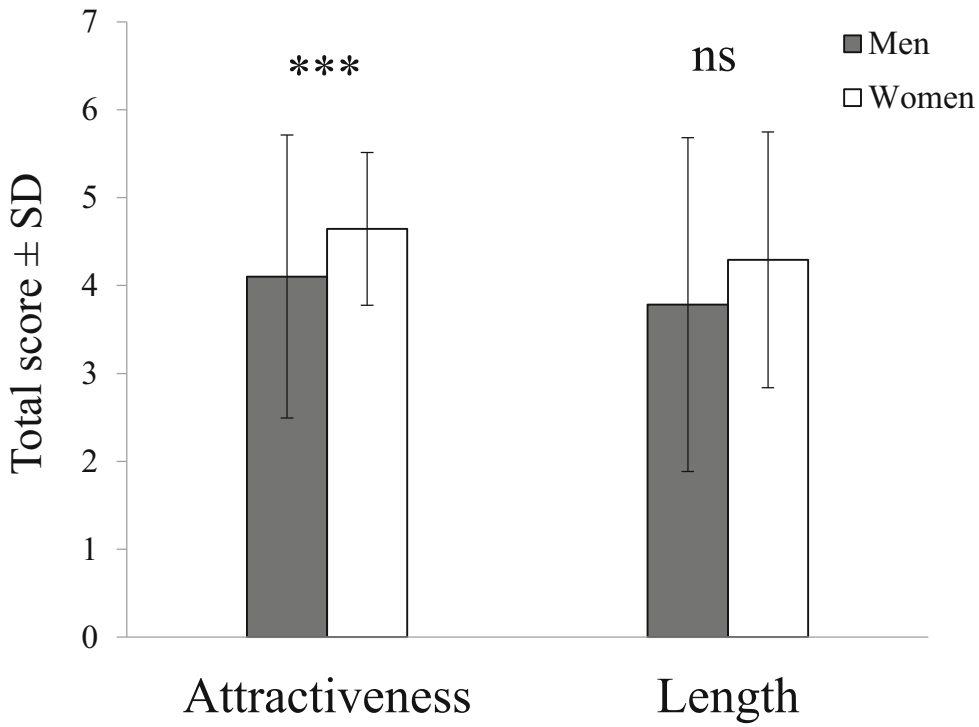

Fig. 2 Gender differences in perceived sexual attractiveness and length of legs. *** $p < .001$, ns = not significant difference

Discussion

Using a forced-choice paradigm, Study 1 demonstrated that legs with high heels are perceived as more sexually attractive than legs with flat-soled shoes. Most importantly, the perceived sexual attractiveness of legs correlated with perceived leg length. This association suggests that legs, subjectively perceived as longer, positively influence perceived sexual attractiveness. High heels therefore visually prolong leg length and consequently affect leg sexual attractiveness. These influences were found to be similar with respect to participant's sex, but, importantly, women seem to be more sensitive to leg sexual attractiveness and length than men. High heels should therefore play a role in female-female competition.

Older participants manifested an overall decrease in ratings of perceived sexual attractiveness of shoes with high heels. This finding is consistent with decreased libido and sexual activity in older people (e.g., Camacho and Reyes-Ortiz 2005; Trompeter et al. 2012; Vermeulen 1991).

Study 2

Study 2 investigated sexual attractiveness of legs using the continuous rating scale of single photographs in men in order to replicate the findings obtained by the forced-choice paradigm from Study 1.

Method

Participants

A total of 74 Caucasian students, attending a mid-sized university in Slovakia, participated in the study. After excluding students who reported having a bisexual and homosexual orientation or being below age 18, the sample was 69 men (39 of them involved in a romantic relationship) with a mean age of 23 years (SD = 4.42). Data exclusions were determined prior to any analysis.

Measures

Stimuli

Five shoes with high heels and the five similarly looking shoes without heels used in Study 1 were chosen for the Study 2. In this study, only legs with one particular kind of shoe (i.e., flat sole or with high heels) were presented on one slide and the order of legs with shoes was randomized identically as in Study 3.

Measures of Sexual Attractiveness of Legs and Length

Participants were asked to rate each photograph on a 9-point Likert scale according to the perceived sexual attractiveness of legs (1 = absolutely sexually unattractive, 9 = extremely sexually attractive). The length of legs was measured with two independent methods. First, participants were asked to choose one of three line segments differing in length identical with the length of legs from knee to toes (Fig. 3). All lines were viewed vertically following Armstrong and Marks (1997). The length of one segment was identical with the length of legs (measured from knee to toes). The remaining two segments were longer or shorter than the length of legs. If the participant chose a segment smaller than a leg, it was scored as 1, and if it chose a segment of the same size as the legs, it was scored as 2 and if a longer segment was chosen, it was scored as 3. The shortest segment was shorter for 20%, and the longest segment was longer for 20% than the medium segment. Second, the participants were asked to write an expected length of leg (from knee to toes) in cm. The summarized scores from segment length and the mean scores from perceived leg length calculated separately for the two shoe types were used in the subsequent analyses. There was no correlation between estimated leg length in cm and with lines for high heels and flat-sole shoes (Spearman $r = -.001$ and .08, $p = .99$ and .50, $n = 69$, respectively).

Procedure

The research was carried out online. The participants were initially asked demographic questions (age, sex, involvement

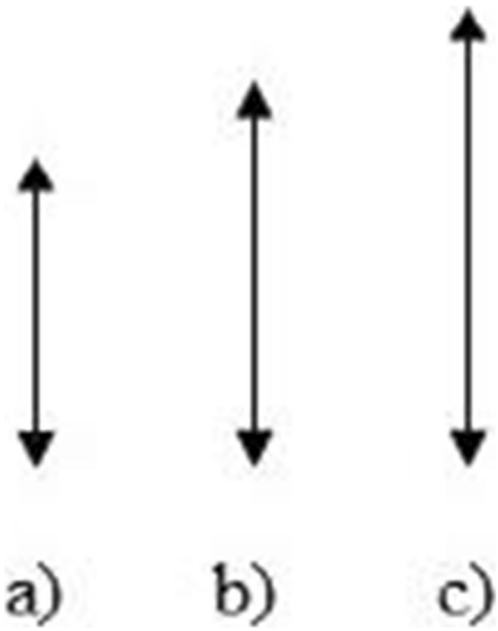

Fig. 3 Example of shorter (**a**), identical (**b**) and elongated (**c**) line segments which participants compared with leg length (measured from knee to toes)

in a romantic relationship), then responded to the questions below the photographs.

Statistical Analyses

Pair-wise comparisons (paired *t*-tests) for the summarized scores, obtained from rating legs with flat soled shoes and with high heels, were used to compare sexual attractiveness of legs. Data for perceived leg length, obtained by two independent methods, were not normally distributed, thus the Wilcoxon paired test was used instead of parametric statistics in these cases.

Results

Legs with shoes with heels were perceived as sexier than legs with flat sole shoes. Perceived length of legs with shoes with heels was slightly, but significantly, longer than perceived length of legs with flat-soled shoes (Fig. 4).

Discussion

By using the continuous rating scale, Study 2 successfully replicated the findings obtained by different men in Study 1. These results collectively suggest that legs with shoes with high heels are more sexually attractive to men and optically longer than legs with flat sole shoes.

Study 3

Study 3 primarily investigated the role of high heels in women's intrasexual competition. Secondly, it investigated the influence of high heels on a person's sexual receptivity and leg sexual attractiveness using a continuous rating scale of single photographs.

Method

Participants

A total of 144 Caucasian students, attending a mid-sized university in Slovakia, participated in the study. After excluding students who reported having bisexual orientation or being below age 18, the sample was 138 women with a mean age of 21 years (SD = 2.78). Data exclusions were determined prior to any analysis.

Measures

Stimuli

Pictures of five shoes with high heels and the five similarly looking flat sole shoes used in Study 1 and 2 were chosen for the Study 3. In this study, only legs with one particular kind of shoe (i.e., high heels or flat sole shoes) were presented on one slide and the order of legs with shoes was randomized.

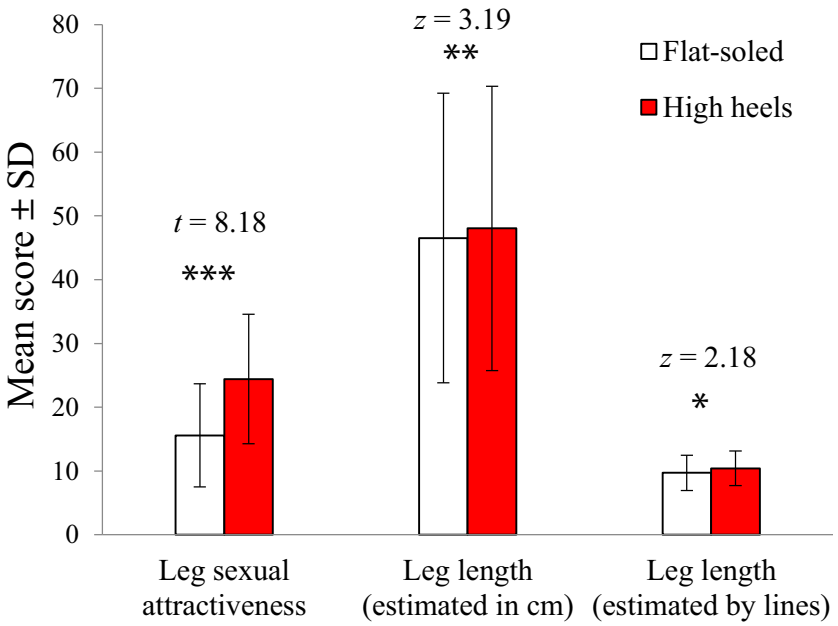

Fig. 4 Differences in men's ratings of shoes with high heels and with flat-soled shoes. ***$p < .001$, ** $p < .01$, * $p < .05$

Measures of Leg Sexual Attractiveness, a person's Sexual Receptivity and Anticipated Mate Guarding

Participants were asked to rate each photograph on a 9-point Likert scale according to perceived sexual attractiveness of legs (1 = absolutely sexually unattractive, 9 = extremely sexually attractive). The perceived person's sexual receptivity was assessed with a single face-valid item from Pazda et al. (2012) ("This person is interested in sex") on the same scale (1 = no, not at all, 9 (yes, definitely). Anticipated mate guarding was assessed with two items from Vaillancourt and Sharma (2011) and Pazda et al. (2014) ("How likely would you be to introduce this person to your boyfriend?" and "How likely would you be to let your boyfriend spend time alone with this person?") using a 1 (not at all likely) to 9 (very likely) scale. Mate guarding items highly correlated with each other ($r = .87$, $p < .001$), thus summarized scores were used in the subsequent analyses (see Pazda et al. 2014 for the same approach). Anticipated mate guarding items were reverse scored, so that high scores refer to high intrasexual competition.

Measures of Length of Legs

Perceived leg length was measured with two different methods identically as in Study 2. The correlations between the variables from both two methods were small for flat sole shoes (Spearman $r = .16$, $p = .06$, $n = 138$) and moderate for shoes with high heels (Spearman $r = 0.26$, $p = .001$, $n = 138$).

Procedure

The research was carried out online. The participants were initially asked demographic questions (age, sex, relationship length), then responded to the questions below the photographs.

Statistical Analyses

Pair-wise comparisons (paired *t*-tests) for the summarized scores obtained from ratings legs with and without heels were used to compare 1) sexual attractiveness of legs, 2) anticipated mate guarding and 3) a perceived person's sexual receptivity. Data for perceived leg length, obtained by two independent methods, were not normally distributed and data transformation was not helpful, thus the Wilcoxon paired test was used instead of parametric statistics in these cases.

Results

Shoes with high heels were perceived as more sexy, anticipated mate-guarding was more intense and a perceived person's sexual receptivity was higher than in shoes without heels. Both two methods demonstrated that legs with heels were perceived as longer than legs without shoes (Fig. 5). When the analysis was restricted exclusively to women involved in a romantic relationship ($n = 98$), the results remained unchanged.

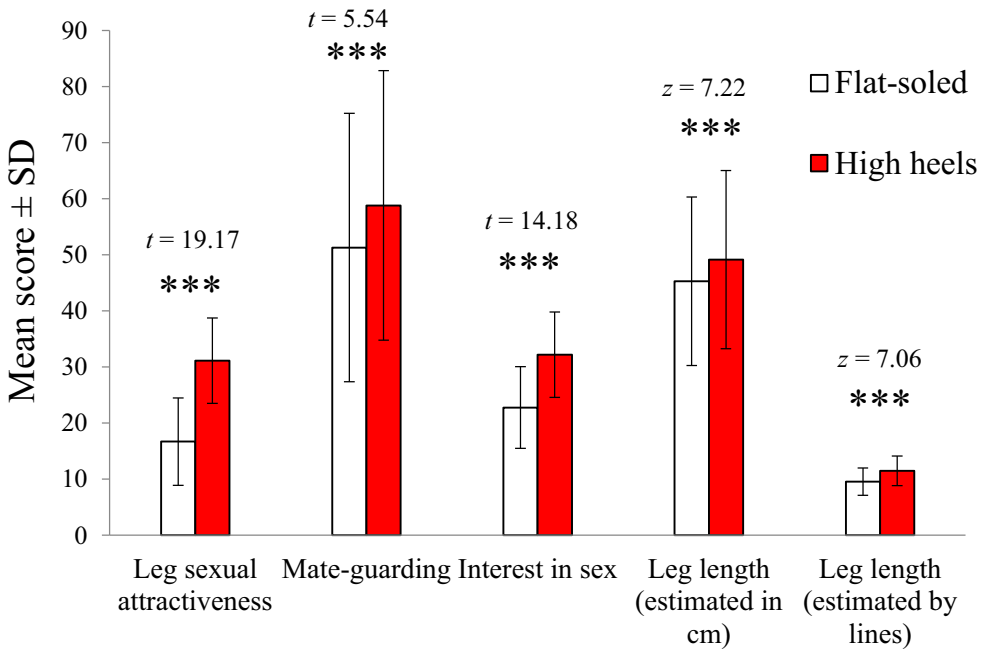

Fig. 5 Differences in ratings of flat-soled shoes and shoes with high heels by women. ***$p < .001$

Discussion

Study 3 showed that high heels promote intrasexual competition. When looking at legs with shoes with high heels, women reported stronger mate-guarding than when looking at flat-soled shoes. Furthermore, the female target in the high heel condition was perceived to be more sexually receptive. Research demonstrated that women are more distressed about threats from rivals who surpass them in terms of physical attractiveness (Buss et al. 2000; Dijkstra and Buunk 1998, 2001; Pazda et al. 2014). Moreover, high heels enhanced both legs and overall sexual attractiveness which is in agreement with current research (Guéguen and Stefan 2015; Guéguen et al. 2016). Study 3 also showed that the accuracy of positive influences of high heels on sexual attractiveness was repeatable in a new sample of women. The use of the continuous rating scale yielded the same results as with the forced-choice method (Study 1).

General Discussion

High heels are one of many artificial practices which women use in order to attract the interest of the opposite sex (Morris 1994; Smith and Helms 1999). Increasing number of evidence suggests that high heels contribute to various aspects of woman's physical attractiveness (Guéguen and Stefan 2015; Guéguen et al. 2016; Lewis et al. 2017; Morris et al. 2013; Smith and Helms 1999). Across three independent studies, I demonstrated that the presence of high heels makes legs longer and therefore more sexually attractive for both sexes. Furthermore, Study 3 showed that high heels play a significant role in woman's competition with members of the same sex.

Although enhanced sexual attractiveness of legs with high heels is in accordance with current research (Guéguen and Stefan 2015; Guéguen et al. 2016; Lewis et al. 2017; Morris et al. 2013), this particular study showed pictures of legs instead of pictures of woman's bodies used in previous research. It therefore rules out other factors which positively influence woman's physical attractiveness to men when wearing high heels, such as lumbar curvature (Lewis et al. 2017), women's gait, reduced stride length and increased pelvis tilt and hip rotation (Guéguen and Stefan 2015; Morris et al. 2013). It needs to be acknowledged, however, that the fact that high heels increase attractiveness even in the absence of cues to gait and posture does not necessarily mean that factors other than gait and posture are responsible for the attractiveness of the heels because the view of legs with high-heeled shoes can remind the observer the posture and gait of women with such shoes.

It has been pointed out that an attractive leg is the straightness of the leg column (Benslimane 2012). It is therefore possible that differences in leg shape or some other factors (correlated to leg length) rather than leg length per se could influence leg attractiveness. However, the present study was based on photographs taken from the same person which eliminates these potentially confounding factors.

An association between longer legs and perceived physical attractiveness (Swami et al. 2006, 2007; Sorokowski and Pawlowski 2008; Sorokowski et al. 2011) and health (e.g., Gunnel et al. 2005; Hedges et al. 2017; Lawlor et al. 2002, 2004; Whitley et al. 2012) provides an ultimate explanation for the enhanced attractiveness of legs with high heels. As far as I am aware, this is the first empirical evidence that high heels enhance leg attractiveness in women also by means of visual elongation which supports earlier hypotheses regarding the functional significance of high heel use (Morris 1994; Smith and Helms 1999). By selection of high heels, women may intentionally attract men's attention. It is important to note that this result was confirmed by both a forced-choice paradigm as well as by continuous ratings by both sexes.

One important outcome from Study 1 is that women rated legs with high heels as more sexually attractive than men and correlation between perceived leg length and perceived attractiveness was stronger for women than for men. Sex differences in evaluation of targets in high heel conditions has not been previously reported (Guéguen et al. 2016; Morris et al. 2013). One explanation for higher attractiveness scores is that women are highly sensitive to the appearance enhancement tactic used by other women when attracting/competing for access to an opposite sex partner (e.g., Bradshaw et al. 2019; Fink et al. 2014; Pazda et al. 2014; Walters and Crawford 1994). Indeed, anticipated mate-guarding was more intense and a perceived person's sexual receptivity was higher in high heel conditions compared with flat-soled shoes condition. Women who are able to correctly interpret the sexual signals of their potential same-sex competitions would be more successful in retaining their sexual partners from poachers by means of social exclusion (Benenson 2009; Buss et al. 2000; Vaillancourt and Sharma 2011) and/or by extreme beautification (Bradshaw et al. 2019). In summary, Study 3 provides initial support that women perceive other women in high heels as sexually receptive.

Limitations

The main limitation of this research is an absence of any additional information regarding the perception of legs in context with bodies. I acknowledge that leg-to-body ratio provides more realistic information regarding human physical attractiveness (e.g., Sorokowski et al. 2011; Kiire 2016; Swami et al. 2006). The present study still has merit, however, considering that I manipulated only one trait (legs) without additional confounding factors similarly as other researchers (e.g. Fink et al. 2014; Pazda et al. 2014). Furthermore, based

on the present study, it could be expected that legs, elongated by high heels, could be specifically attractive in women with naturally short legs. This idea needs to be investigated by manipulations with visual stimuli with various leg-to-body ratio features (e.g. Kiire 2016). The contribution of the current study, i.e. the role of high heels in perceived leg length and attractiveness, however, will not be diminished with such additional research.

Pictures of the shoes used in this study indicate that the heeled shoes may simply be sexier than the design of the flat shoes. The high heels are pointy at the front and the flats are round in the front. Pointy fronts, even on the flats, may simply be sexier than round fronts. It is not clear if the pointy fronts can account for the elongation of the leg, but certainly the sexiness. Future research should address this limitation by comparing stimuli varying specifically on heel length while other things being equal.

Conclusions and Future Research

In conclusion, high heels can enhance women's attractiveness to men by means of visual leg elongation. High heels promote competition between women for access to the opposite sex. Further research should be directed at investigating the role of women's intrasexual competitiveness and the probability of conception in real life situations. Finally, the role of high heels in promoting mate guarding by male partners could also be a promising area for further research.

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Compliance with Ethical Standards

Conflicts of Interest The author declares no conflict of interest.

Ethical Statement (Including the Name of the Approval Board) All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee (TU ethics committee, reference 154/17) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Written consent was received before the research was carried out. After the research was completed, the raters were debriefed regarding the research goals.

References

Albury, K. (2009). Reading porn reparatively. *Sexualities, 12*, 647–653. https://doi.org/10.1177/1363460709340373.

Armstrong, L., & Marks, L. E. (1997). Differential effects of stimulus context on perceived length: Implications for the horizontal-vertical illusion. *Perception & Psychophysics, 59*, 1200–1213. https://doi.org/10.3758/BF03214208.

Benenson, J. F. (2009). Dominating versus eliminating the competition: Sex differences in human intrasexual competition. *The Behavioral and Brain Sciences, 32*, 268–269. https://doi.org/10.1017/S0140525X0999046X.

Benslimane, F. (2012). The Benslimane's artistic model for leg beauty. *Aesthetic Plastic Surgery, 36*(4), 803–812. https://doi.org/10.1007/s00266-012-9886-1.

Bradshaw, H. K., Leyva, R. P., Nicolas, S. C., & Hill, S. E. (2019). Costly female appearance-enhancement provides cues of short-term mating effort: The case of cosmetic surgery. *Personality and Individual Differences, 138*, 48–55. https://doi.org/10.1016/j.paid.2018.09.019.

Buss, D. M. (1988). The evolution of human intrasexual competition: Tactics of mate attraction. *Journal of Personality and Social Psychology, 54*, 616–628. https://doi.org/10.1037/0022-3514.54.4.616.

Buss, D. M., Shackelford, T. K., Choe, J. A. E., Buunk, B. P., & Dijkstra, P. (2000). Distress about mating rivals. *Personal Relationships, 7*, 235–243. https://doi.org/10.1111/j.1475-6811.2000.tb00014.x.

Camacho, M. E., & Reyes-Ortiz, C. A. (2005). Sexual dysfunction in the elderly: Age or disease? *International Journal of Impotence Research, 17*, S52–S56. https://doi.org/10.1038/sj.ijir.3901429.

Cloud, J. M., & Perilloux, C. (2014). Bodily attractiveness as a window to women's fertility and reproductive value. In *Evolutionary perspectives on human sexual psychology and behavior* (pp. 135–152). Springer, New York.

Davey Smith, G., Greenwood, R., Gunnell, D., Sweetnam, P., Yarnell, J., & Elwood, P. (2001). Leg length, insulin resistance, and coronary heart disease risk: The Caerphilly study. *Journal of Epidemiology and Community Health, 55*, 867–872. https://doi.org/10.1136/jech.55.12.867.

Dietz, P. E., & Evans, B. (1982). Pornographic imagery and prevalence of paraphilia. *The American Journal of Psychiatry, 139*, 1493–1495. https://doi.org/10.1176/ajp.139.11.1493.

Dijkstra, P., & Buunk, B. P. (1998). Jealousy as a function of rival characteristics: An evolutionary perspective. *Personality and Social Psychology Bulletin, 24*, 1158–1166. https://doi.org/10.1177/01461672982411003.

Dijkstra, P., & Buunk, B. P. (2001). Sex differences in the jealousy-evoking nature of a rival's body build. *Evolution and Human Behavior, 22*, 335–341. https://doi.org/10.1016/S1090-5138(01)00070-8.

Fielding, R., Schooling, C. M., Adab, P., Cheng, K. K., Lao, X. Q., Jiang, C. Q., & Lam, T. H. (2008). Are longer legs associated with enhanced fertility in Chinese women? *Evolution and Human Behavior, 29*, 434–443. https://doi.org/10.1016/j.evolhumbehav.2008.06.003.

Fink, B., Klappauf, D., Brewer, G., & Shackelford, T. K. (2014). Female physical characteristics and intra-sexual competition in women. *Personality and Individual Differences, 58*, 138–141. https://doi.org/10.1016/j.paid.2013.10.015.

Foo, Y. Z., Simmons, L. W., & Rhodes, G. (2017). Predictors of facial attractiveness and health in humans. *Scientific Reports, 7*, 39731. https://doi.org/10.1038/srep39731.

Frederick, D. A., Hadji-Michael, M., Furnham, A., & Swami, V. (2010). The influence of leg-to-body ratio (LBR) on judgments of female physical attractiveness: Assessments of computer-generated images varying in LBR. *Body Image, 7*, 51–55. https://doi.org/10.1016/j.bodyim.2009.09.001.

Galik, K., Senut, B., Pickford, M., Gommery, D., Treil, J., Kuperavage, A. J., & Eckhardt, R. B. (2004). External and internal morphology of the BAR 1002′00 *Orrorin tugenensis* femur. *Science, 305*, 1450–1453. https://doi.org/10.1126/science.1098807.

Graff, K. A., Murnen, S. K., & Krause, A. K. (2013). Low-cut shirts and high-heeled shoes: Increased sexualization across time in magazine depictions of girls. *Sex Roles, 69*, 571–582. https://doi.org/10.1007/s11199-013-0321-0.

Greer, A. E., & Buss, D. M. (1994). Tactics for promoting sexual encounters. *Journal of Sex Research, 31*, 185–201. https://doi.org/10.1080/00224499409551752.

Guéguen, N., & Stefan, J. (2015). Men's judgment and behavior toward women wearing high heels. *Journal of Human Behavior in the Social Environment, 25*, 416–425. https://doi.org/10.1080/10911359.2014.976697.

Guéguen, N., Stefan, J., & Renault, Q. (2016). Judgments toward women wearing high heels: A forced-choice evaluation. *Fashion and Textiles, 3*, 6. https://doi.org/10.1186/s40691-016-0058-9.

Gunnel, D., Oliver, S. E., Donovan, J. L., Peters, T. J., Gillatt, D., Persad, R., et al. (2005). Do height-related variations in insulin-like growth factors underlie the associations of stature with adult chronic disease? *The Journal of Clinical Endocrinology and Metabolism, 89*, 213–218. https://doi.org/10.1210/jc.2003-030507.

Gunnell, D., Okasha, M., Davey Smith, G., Oliver, S. E., Sandhu, J., & Holly, J. M. P. (2001). Height, leg length, and cancer risk: A systematic review. *Epidemiologic Reviews, 23*(2), 313–342. https://doi.org/10.1093/oxfordjournals.epirev.a000809.

Haight, F. A. (1967). *Handbook of the Poisson distribution*. New York: John Wiley & Sons.

Haile-Selassie, Y. (2001). Late Miocene hominids from the middle awash, Ethiopia. *Nature, 412*, 178–181. https://doi.org/10.1038/35084063.

Hedges, D. W., Berrett, A. N., Erickson, L. D., Brown, B. L., & Gale, S. D. (2017). Association between infection burden and adult height. *Economics and Human Biology, 27*, 275–280. https://doi.org/10.1016/j.ehb.2017.08.002.

Hume, D. K., & Montgomerie, R. (2001). Facial attractiveness signals different aspects of "quality" in women and men. *Evolution and Human Behavior, 22*, 93–112. https://doi.org/10.1016/S1090-5138(00)00065-9.

ISAPS. (2018). ISAPS global statistics. Downloaded 22.1. 2019. Available at: https://www.isaps.org/medical-professionals/isaps-global-statistics/.

Jokela, M. (2009). Physical attractiveness and reproductive success in humans: Evidence from the late 20th century United States. *Evolution and Human Behavior, 30*, 342–350.

Kiire, S. (2016). Effect of leg-to-body ratio on body shape attractiveness. *Archives of Sexual Behavior, 45*(4), 901–910. https://doi.org/10.1016/j.evolhumbehav.2009.03.006.

Kim, J.-M., Stewart, R., Shin, I.-S., Kim, S.-W., Yang, S.-J., & Yoon, J.-S. (2008). Associations between head circumference, leg length and dementia in a Korean population. *International Journal of Geriatric Psychiatry, 23*, 41–48. https://doi.org/10.1002/gps.1833.

Lassek, W. D., & Gaulin, S. J. (2018). Do the low WHRs and BMIs judged most attractive indicate higher fertility? *Evolutionary Psychology, 16*(4), 1474704918803998. https://doi.org/10.1177/1474704918800063.

Lassek, W. D., & Gaulin, S. J. (2019). Evidence supporting nubility and reproductive value as the key to human female physical attractiveness. *Evolution and Human Behavior, 40*(5), 408–419. https://doi.org/10.1016/j.evolhumbehav.2019.05.001.

Laumets, R., Viigipuu, K., Mooses, K., Mäestu, J., Purge, P., Pehme, A., Kaasik, P., & Mooses, M. (2017). Lower leg length is associated with running economy in high level caucasian distance runners. *Journal of Human Kinetics, 56*, 229–239. https://doi.org/10.1515/hukin-2017-0040.

Lawlor, D. A., Ebrahim, S., & Davey Smith, G. (2002). The association between components of adult height and type II diabetes and insulin resistance: British Women's heart and health study. *Diabetologia, 45*, 1097–1106. https://doi.org/10.1007/s00125-002-0887-5.

Lawlor, D. A., Taylor, M., Davey Smith, G., Gunnell, D., & Ebrahim, S. (2004). Associations of components of adult height with coronary heart disease in postmenopausal women: The British women's heart and health study. *Heart, 90*, 745–749. https://doi.org/10.1136/hrt.2003.019950.

Lewis, D. M. G., Russell, E. M., Al-Shawaf, L., Ta, V., Senveli, Z., Ickes, W., & Buss, D. M. (2017). Why women wear high heels: Evolution, lumbar curvature, and attractiveness. *Frontiers in Psychology, 8*, 1875. https://doi.org/10.3389/fpsyg.2017.01875.

Li, N. P., Bailey, J. M., Kenrick, D. T., & Linsenmeier, J. A. W. (2002). The necessities and luxuries of mate preferences: Testing the tradeoffs. *Journal of Personality and Social Psychology, 82*, 947–955. https://doi.org/10.1037//0022-3514.82.6.947.

Morris, D. (1994). *The naked ape: A zoologist's study of the human animal*. Random House. London: Vintage. Minnesota Press

Morris, P. H., White, J., Morrison, E. R., & Fisher, K. (2013). High heels as supernormal stimuli: How wearing high heels affects judgements of female attractiveness. *Evolution and Human Behavior, 34*, 176–181. https://doi.org/10.1016/j.evolhumbehav.2012.11.006.

Pazda, A. D., Elliot, A. J., & Greitemeyer, T. (2012). Sexy red: Perceived sexual receptivity mediates the red-attraction relation in men viewing women. *Journal of Experimental Social Psychology, 48*, 787–790. https://doi.org/10.1016/j.jesp.2011.12.009.

Pazda, A., Prokop, P., & Elliot, A. (2014). Red and romantic rivalry: Viewing another woman in red increases perceptions of sexual receptivity, derogation, and intentions to mateguard. *Personality and Social Psychology Bulletin, 40*, 1260–1269. https://doi.org/10.1177/0146167214539709.

Pazhoohi, F., Arantes, J., Kingstone, A., & Pinal, D. (2020). Waist to hip ratio and breast size modulate the processing of female body silhouettes: An EEG study. *Evolution and Human Behavior, 41*, 150–169. https://doi.org/10.1016/j.evolhumbehav.2020.01.001.

Platek, S. M., & Singh, D. (2010). Optimal waist-to-hip ratios in women activate neural reward centers in men. *PLoS One, 5*, e9042. https://doi.org/10.1371/journal.pone.0009042.

Prokop, P., & Švancárová, J. (2020). Wearing high heels as female mating strategy. *Personality and Individual Differences, 152*, 109558. https://doi.org/10.1016/j.paid.2019.109558.

Prokop, P., Zvaríková, M., Zvarík, M., & Fedor, P. (2020). Cues of pregnancy decrease female physical attractiveness for males. *Current Psychology*, 1–8. https://doi.org/10.1007/s12144-020-00608-4.

Puts, D. A. (2010). Beauty and the beast: Mechanisms of sexual selection in humans. *Evolution and Human Behavior, 31*, 157–175. https://doi.org/10.1016/j.evolhumbehav.2010.02.005.

Rhodes, G., Simmons, L., & Peters, M. (2005). Attractiveness and sexual behaviour: Does attractiveness enhance mating success? *Evolution and Human Behavior, 26*, 186–201. https://doi.org/10.1016/j.evolhumbehav.2004.08.014.

Roberts, III, R. L., Weinfeld, A. B., & Nguyen, K. (2005). "Universal" and ethnic ideals of beautiful buttocks and how to create them surgically. Paper presented at the annual meeting of American society for aesthetic plastic surgery, New Orleans, LA, April, 30.

Singh, D., & Randall, P. K. (2007). Beauty is in the eye of the plastic surgeon: Waist–hip ratio (WHR) and women's attractiveness. *Personality and Individual Differences, 43*(2), 329–340. https://doi.org/10.1016/j.paid.2006.12.003.

Smith, E. O. (1999). High heels and evolution: Natural selection, sexual selection and high heels. *Psycholgy, Evolution & Gender, 30*, 245–277. https://doi.org/10.1177/107110079902000113.

Smith, E. O., & Helms, W. S. (1999). Natural selection and high heels. *Foot & Ankle International, 20*, 55–57. https://doi.org/10.1177/107110079902000113.

Sorokowski, P., & Pawlowski, B. (2008). Adaptive preferences for leg length in a potential partner. *Evolution and Human Behavior, 29*, 86–91. https://doi.org/10.1016/j.evolhumbehav.2007.09.002.

Sorokowski, P., Szmajke, A., Sorokowska, A., Cunen, M. B., Fabrykant, M., Zarafshani, K., et al. (2011). Attractiveness of leg length: Report from 27 nations. *Journal of Cross-Cultural Psychology, 42*, 131–139. https://doi.org/10.1177/0022022110392229.

Swami, V., Einon, D., & Furnham, A. (2006). The leg-to-body ratio as a human aesthetic criterion. *Body Image, 3*, 317–323. https://doi.org/10.1016/j.bodyim.2006.08.003.

Swami, V., Einon, D., & Furnham, A. (2007). Cultural significance of leg-to-body ratio preferences? Evidence from Britain and rural Malaysia. *Asian Journal of Social Psychology, 10*, 265–269. https://doi.org/10.1111/j.1467-839X.2007.00235.x.

Thornhill, R., & Gangestad, S. W. (1999). Facial attractiveness. *Trends in Cognitive Sciences, 3*(12), 452–460. https://doi.org/10.1016/S1364-6613(99)01403-5.

Trompeter, S. E., Bettencourt, R., & Barrett-Connor, E. (2012). Sexual activity and satisfaction in healthy community-dwelling older women. *The American Journal of Medicine, 125*, 37–43. https://doi.org/10.1016/j.amjmed.2011.07.036.

Vaillancourt, T., & Sharma, A. (2011). Intolerance of sexy peers: Intrasexual competition among women. *Aggressive Behavior, 37*, 569–577. https://doi.org/10.1002/ab.20413.

Vermeulen, A. (1991). Androgens in the aging male. *The Journal of Clinical Endocrinology & Metabolism, 73*, 221–224.

Wadsworth, M. E. J., Hardy, R. J., Paul, A. A., Marshall, S. F., & Cole, T. J. (2002). Leg and trunk length at 43 years in relation to childhood health, diet and family circumstances: Evidence from the 1946 national birth cohort. *International Journal of Epidemiology, 31*, 383–391. https://doi.org/10.1093/ije/31.2.383.

Walter, K. V., Conroy-Beam, D., Buss, D. M., Asao, K., Sorokowska, A., Sorokowski, P., ... & Amjad, N. (2020). Sex differences in mate preferences across 45 countries: A large-scale replication. *Psychological Science*, article number: 0956797620904154. https://doi.org/10.1177/0956797620904154.

Walters, S., & Crawford, C. B. (1994). The importance of mate attraction for intrasexual competition in men and women. *Ethology and Sociobiology, 15*, 5–30. https://doi.org/10.1016/0162-3095(94)90025-6.

Watkins, C., & Leitch, A. (2020). Using sexual selection theories to examine contextual variation in heterosexual women's orientation toward high heels. *Archives of Sexual Behavior, 49*, 849–860. https://doi.org/10.1007/s10508-019-01539-3.

Whitley, E., Martin, R. M., Smith, G. D., Holly, J. M. P., & Gunnell, D. (2012). The association of childhood height, leg length and other measures of skeletal growth with adult cardiovascular disease: The Boyd–Orr cohort. *Journal of Epidemiology & Community Health, 66*, 18–23. https://doi.org/10.1136/jech.2009.104216.

Zahavi, A. (1975). Mate selection–a selection for handicap. *Journal of Theoretical Biology, 53*, 205–214. https://doi.org/10.1016/0022-5193(75)90111-3.

Zahavi, A. (1977). Cost of honesty (further remarks on handicap principle). *Journal of Theoretical Biology, 67*, 603–605. https://doi.org/10.1016/0022-5193(77)90061-3.