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ORIGINAL ARTICLE

# Lordosis Posture (Arching the Back) Indicates Sexual Receptivity in Women

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## Abstract

**Objectives** Human females may attract men and solicit their approach through different nonverbal displays and signals. In many non-human animals, a lordosis posture in a female is a reliable signal of sexual receptivity. Recently, it has been argued that this posture is linked to a similar signal between men and women. The current research across three investigations aimed to test the predictions arising from the sexual receptivity hypothesis of lordosis posture.

**Methods** Using realistic 3D generated stimuli, both men and women viewed women's arched back postures in standing, supine and quadruped poses (Studies 1 and 2) and were asked to rate them for perceived sexual receptivity. In Study 3, a male model was used.

**Results** In Study 1 we tested whether the arched back posture in women is an indicator of sexual receptivity. Results showed that both men and women associated increases in the arch of the back with higher sexual receptivity in women. Study 2 predicted and confirmed that sexual receptivity is also perceived from non-standing postures, namely supine and quadruped poses. Study 3 tested the prediction that the perception of sexual receptivity is specific to the posture being adopted by women.

**Conclusion** Collectively this research provides support for the sexual receptivity hypothesis of lordosis posture by showing that sexual receptivity is perceived by an increase in the arch of the back (Study 1), it is perceived as sexually receptive irrespective of the body posture (Study 2), and this is specific to women (Study 3).

**Keywords** Lordosis behavior · Physical attractiveness · Sexual receptivity · Sexual behavior · Arching the back

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Human females display and signal their interest and availability to men using a number of nonverbal behavioral patterns such as smiling, hair flipping, head tilting, and neck presentation (Grammer, 1989; Moore, 1985; Wade et al., 2021). These behavioral patterns that attract men's attention and solicit their approach to women are observed both in the field (Moore & Butler, 1989) and in laboratory settings (Grammer, 1990).

In many non-human animal species, a lordosis posture (i.e., curving the lower spine towards the belly), is a female's display and reliable signal of sexual receptivity, which elicits a male's response through increased attention and copulation attempts (Flanagan-Cato, 2011; Henley et al., 2011; Pfaus & Gorzalka, 1987). Arguing that the lordotic posture or arching the back in women is a phylogenetically conserved mechanism across the taxa, Pazhoohi and colleagues (2018) suggested it also might signal human female's sexual receptivity/proceptivity to men. Specifically, to support their proposal, the authors reviewed the hypothalamic lesion research associated with lordosis reflex in females of different mammalian species (i.e., rats (Clark et al., 1981), hamsters (Malsbury et al., 1977), guinea pigs (Goy & Phoenix, 1963), ferret (Robarts & Baum, 2007), sheep (Clegg et al., 1958), cats (Leedy & Hart, 1985), and monkeys (Aou et al., 1988)), as well as providing a review of mating positions in great apes (Pazhoohi et al., 2018). The chimpanzees only mate in the dorso-ventral position, and the bonobos are known to mate in both dorso-ventral (male mounting female from behind) and ventro-ventral (face to face) positions (Dixson, 2009; p. 88). While this claim by Pazhoohi et al. (2018) has been also echoed by other researchers (Semchenko et al., in press), the evidence of lordosis among anthropoids and extant Hominidae (humans and their closest relatives, *Pan*, *Gorilla*, and *Pongo*) is not available (Burt, 1992; Dixson, 1998; Wallen, 1990), and it should be cautiously approached and considered. Moreover, it should be cautioned that existence of dorso-ventral mating positions does not necessarily mean the existence of lordosis as a communicative signal between males and females of great apes. Further, the ventrally orientated clitoris and vulva in bonobos suggests that female genitalia are adapted for a ventro-ventral position (De Waal, 1995; De Waal & Lanting, 1998).

In their study, Pazhoohi et al. (2018) created 3D models of realistic upright female stimuli and systematically manipulated their back curvatures. The stimuli were presented to participants for attractiveness ratings while their eye movements were recorded. The results showed that small changes in back posture influenced attractiveness, such that as lordosis in the stimuli increased, ratings of attractiveness increased, as well as visual attention to the hip region. Interestingly, this effect on attractiveness was observed for both male and female participants, a result that has recently been replicated with dynamic stimuli (Meskó et al., 2021).

Pazhoohi et al. (2018) proposed that the higher attraction ratings arise because increased lordosis serves as a nonverbal signal of sexual receptivity. An alternative, although related proposal to the behavioural "receptivity signaling hypothesis" is that a morphological change in lordosis may suggest the ability to bear children across multiple pregnancies. Specifically, Lewis et al. (2015), have put forward the "vertebral wedging hypothesis" which stems from the adaptive problem of bipedal locomotion in homo sapiens, whereby women whose morphology resulted in an intermediate degree of vertebral wedging were selected by men as being able to sustain multiple

pregnancies without suffering spinal injuries due to bipedal fetal load. The authors hypothesized that men evolved to show preference for a lumbar angle in women of approximately 45.5 degrees, and showed that men preferred an intermediate angle of lumbar curvature compared to those depicting hyperlordosis and hypolordosis (excessive and insufficient lumbar curvature, respectively).

While the stimuli used by Lewis et al. (2015) have been criticized for lack of ecological validity (Pazhoohi et al., 2018), the two hypotheses are by no means mutually exclusive, with one emphasizing the perception of sexual receptivity, and the other a preference for female morphology associated with higher reproductive fitness. The aim of the present study is to put clear predictions arising from the receptivity hypothesis to the test.

We test four predictions across three investigations. Firstly, we aimed to test whether the arched back posture is an indicator of sexual receptivity in women. If, as argued above, such postures may signal sexual receptivity in women (Pazhoohi et al., 2018), then increments in the arched back posture should be associated with an increase in the perception of sexual receptivity. The second aim of the current investigation is to test whether the lack of a sex difference in the perceived attractiveness of women with an arched back posture (Meskó et al., 2021; Pazhoohi et al., 2018) is replicated for perceived sexual receptivity. As men and women should both receive these signals, we hypothesize that there should not be any sex difference in the perception of women's signaling. Note, however, that this equivalence in perception need not translate to an equivalence in how the cue is interpreted. We suggest that men view a lordosis posture as indicating a sexual opportunity, whereas women view a lordosis posture as sexual competition. The latter stems from a recent study testing the perception of lordosis posture on female participants. Women who were higher on intrasexual competitiveness were more likely to view an increase in the arch of the back as more attractive, and thus, a competitive threat (Pazhoohi et al., 2022). Third, we tested the perception of sexual receptivity in non-standing postures, namely in quadruped and supine postures. If arched back postures indicates women's sexual receptivity, such attribution should be perceived in non-standing poses. Fourth, to support the sexual receptivity of arched back as a specifically female cue, we tested if an arched back posture in men will also convey sexual receptivity.

## Study 1

Using 3D generated realistic stimuli this experiment examined if both males and females view a women's arched back posture as an indicator of sexual receptivity.

### Method

**Participants** Participants were recruited from CloudResearch MTurk workers located in Canada who completed an online survey. A total of 239 self-identified heterosexual individuals (138 women and 101 men) aged between 18 and 79 years ($M$=44.27, $SD$=16.59) participated in this study. A total of 107 participants (44.8%) reported being married, and 15.1% reported not being married but in a relationship. Addi-

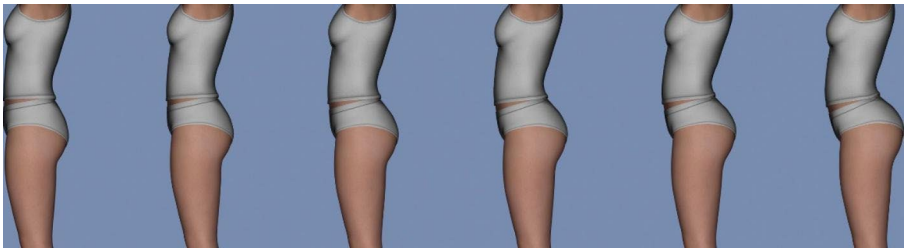

**Fig. 1** Female stimuli in standing posture

tionally, 27.2% reported being single, and 12.9% were either widowed, divorced, or separated. As for their highest educational degree, 30.1% had high school diploma, 23.4% had a post-secondary diploma, 31.0% had undergraduate degree, and 15.5% had postgraduate degree. The raw data supporting the conclusions of this and next two studies will be made available upon request by the authors, without reservation.

**Stimuli** The stimuli used were adopted from Pazhoohi et al. (2018). They were generated using Daz3D software and depicted torsos generated using a female model posed in six systematically manipulated curvatures. The back curvatures of the models in the profile (side) view were aligned with six sinusoid graphs (i.e. $y=\alpha\sin(x)$; where $\alpha=0.6$, 0.65, 0.7, 0.75, 0.8 and 0.85)[1]. These six side view torsos (see Fig. 1) served as the stimuli in the current study.

**Procedure** After consenting to participate in the study, participants answered a set of sociodemographic questions. They were then presented with the stimuli in a random order and both male and female participants were asked to respond to the following items on a 9-point scale from 1 (*not at all*) to 9 (*extremely*): (a) "How sexy is this woman acting?", (b) "How seductive is this woman?", (c) "How flirtatious is this woman?", (d) "This woman is interested in sex.". These items have been used previously as a measure for perceived sexual receptivity of women (Pazda et al., 2012; Peperkoorn et al., 2016). The responses were summed into a single measure of perceived sexual receptivity.

## Results

All post hoc comparisons reported in this study, and throughout the results, were done using Bonferroni correction, and this is reflected in the p values.

A 2 (Sex) × 6 (Curvature) mixed repeated measures analysis of variance (ANOVA) was performed with Sex as a between-subjects variable and Curvature as within-subjects variable. The main effects for Sex and Curvature were significant (Sex: $F(1, 237)=10.75$, $p=.001$, $\eta^2=0.04$; Curvature: $F(5, 1185)=12.37$, $p<.001$, $\eta^2=0.05$). Men ($M=4.24$, $SEM=0.20$) rated the stimuli as higher on perceived sexual recep-

[1] These sinusoid curves are convertible to angle degrees using the formula $180/\pi \cdot \arctan(2\alpha/1-\alpha 2)$, and are mathematically equivalent to 61.9°, 66°, 70°, 73.7°, 77.3°, and 80.7°.

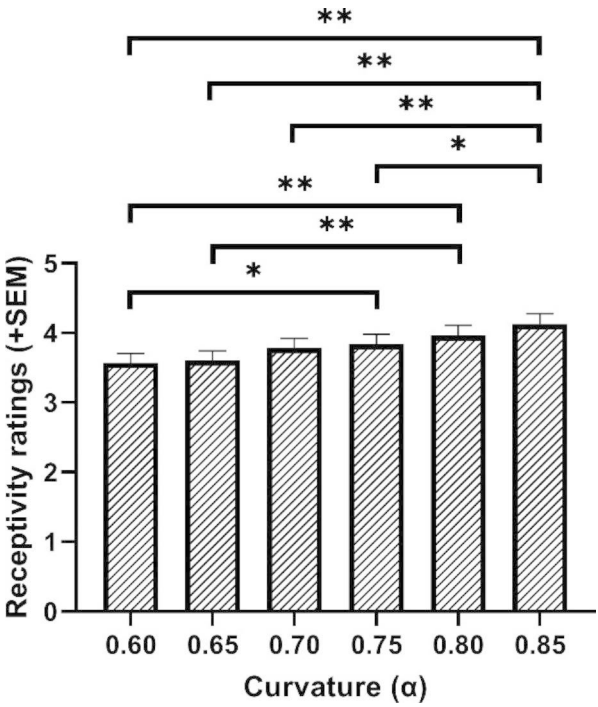


**Fig. 2** Receptivity ratings as a function of curvature ($\alpha$=0.6, 0.65, 0.7, 0.75, 0.8, and 0.85) for models in standing posture. * $p$<.05, ** $p$<.01

tivity than women ($M$=3.37, $SEM$=0.17). Pairwise comparisons showed that the ratings of sexual receptivity increased as curvature increased ($\alpha$=0.60: $M$=3.56, $SEM$=0.13; $\alpha$=0.65: $M$=3.60, $SEM$=0.13; $\alpha$=0.70: $M$=3.78, $SEM$=0.14; $\alpha$=0.75: $M$=3.83, $SEM$=0.14; $\alpha$=0.80: $M$=3.96, $SEM$=0.15; $\alpha$=0.85: $M$=4.12, $SEM$=0.15; see Fig. 2). Perceptions of receptivity for curvature $\alpha$=0.85 was higher compared to all curvatures (all $p$s<0.029) except $\alpha$=0.80 ($p$=.999); Curvature $\alpha$=0.80 was higher compared to $\alpha$=0.60 and $\alpha$=0.65 ($p$s<0.001), but not $\alpha$=0.70 and $\alpha$=0.75 ($p$s>0.231); Curvature $\alpha$=0.75 was higher on receptivity than $\alpha$=0.60 ($p$=.020), but not $\alpha$=0.65 and $\alpha$=0.70 ($p$s>0.057); Curvature $\alpha$=0.70 was higher than $\alpha$=0.60 and $\alpha$=0.65 ($p$s>0.152). The Sex × Curvature interaction was not significant, $F$(5, 1185)=0.68, $p$=.686, $\eta^2$<0.01.

## Discussion

Study 1 investigated the perceptions of women's lordosis behavior in relation to perceptions of sexual receptivity. The findings showed that increases in arching the back increased perceptions of sexual receptivity. Additionally, the effect of lordosis posture did not differ between men and women.

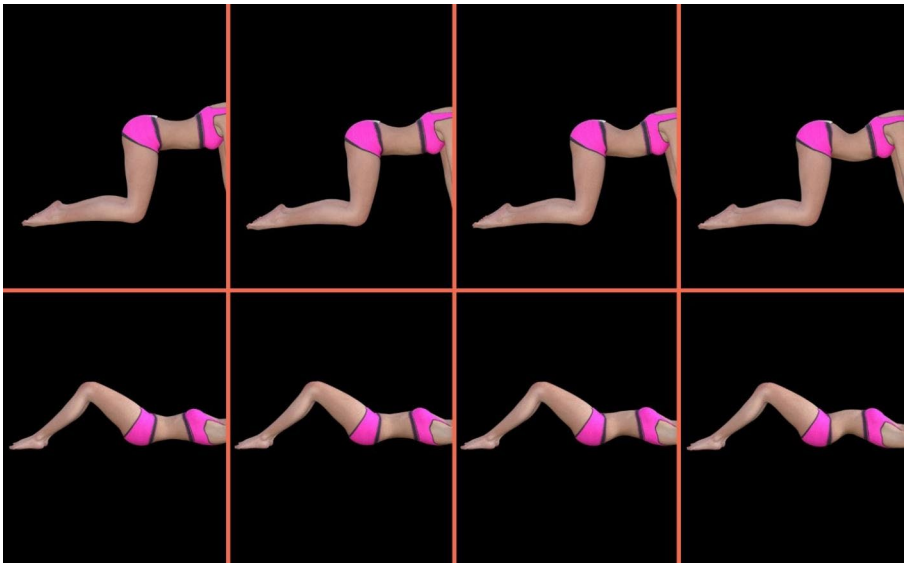

**Fig. 3** Female stimuli in quadruped (upper row) and supine postures (lower row)

## Study 2

To date, all studies measuring the effect of an arched back on perceptions of attraction or sexual receptivity have presented women as standing. The sexual receptivity hypothesis predicts that an increase in perceived sexual receptivity with an increase in the arch of the back should also occur when women are not standing. The present study tested this prediction by asking participants to rate stimuli in quadruped and supine postures.

### Method

**Participants** A total of 241 self-identified heterosexual individuals (144 women and 97 men) aged between 19 and 81 years ($M$=45.25, $SD$=15.12) were recruited from CloudResearch MTurk workers located in Canada. A total of 113 participants (46.9%) reported being married, and 12.0% reported not being married but in a relationship. Additionally, 28.2% reported being single, and 12.9% were either widowed, divorced, or separated. As for their highest educational degree, four individuals reported elementary school, 19.9% had high school diploma, 28.2% had a post-secondary diploma, 37.3% had undergraduate degree, and 12.9% had postgraduate degree.

**Stimuli and Procedure** The stimuli for this study were generated using DAZ 3D software. Four stimuli were generated ($y=\alpha\sin(x)$; where $\alpha=0.55$, 0.65, 0.75 and 0.85) using a female model posed in a quadruped posture with her back modified to create four different curvatures (see Fig. 3 upper row). Another set of stimuli were generated using the same female model posed in supine posture with her back modified

to create four different curvatures equivalent to those of the quadruped posture (see Fig. 3 lower row). In all manipulations, the waist was modified to produce different levels of posture types. The stimuli were randomly presented to all participants in two blocks counterbalanced across participants to present either a quadruped or supine posture first. The rest of the procedures were in line with those in Study 1.

## Results

**Quadruped Posture** A 2 (Sex) × 4 (Curvature) mixed ANOVA was performed with Sex as a between-subjects variable and Curvature as a within-subjects variable. The main effects for Sex and Curvature were significant (Sex: $F(1, 239)=8.53$, $p=.004$, $\eta^2=0.03$; Curvature: $F(3, 717)=6.33$, $p<.001$, $\eta^2=0.02$). Men ($M=4.36$, $SEM=0.27$) rated the stimuli higher on perceived sexual receptivity than women ($M=3.43$, $SEM=0.20$). Pairwise comparisons showed that perceptions of receptivity for Curvatures $\alpha=0.75$ ($M=3.96$, $SEM=0.17$) and $\alpha=0.85$ ($M=4.08$, $SEM=0.17$) were higher than Curvature $\alpha=0.55$ ($M=3.72$, $SEM=0.16$; $ps<0.039$); no other significant difference was observed (all $ps>0.106$; see Fig. 4A). The Sex × Curvature interaction was not significant, Sex × Curvature: $F(3, 717)=1.10$, $p=.345$, $\eta^2<0.01$.

**Supine Posture** The ANOVA was the same as above. The main effects for Sex and Curvature were significant (Sex: $F(1, 239)=5.68$, $p=.018$, $\eta^2=0.02$; Curvature: $F(3, 717)=8.49$, $p<.001$, $\eta^2=0.03$). Men ($M=4.50$, $SEM=0.26$) rated the stimuli more sexually receptive than women ($M=3.69$, $SEM=0.21$). Pairwise comparisons showed that perceptions of receptivity were higher for Curvature $\alpha=0.85$ ($M=4.25$, $SEM=0.17$) than Curvature $\alpha=0.55$ ($M=3.91$, $SEM=0.17$; $p=.002$) and Curvature $\alpha=0.65$ ($M=4.02$, $SEM=0.17$; $p=.025$). Similarly, Curvature $\alpha=0.75$ ($M=4.20$, $SEM=0.18$) was significantly higher than Curvature $\alpha=0.55$ ($p<.001$) and marginally higher than Curvature $\alpha=0.65$ ($p=.061$). No other significant differences were observed ($ps>0.517$; see Fig. 4B). The Sex × Curvature interaction was not significant, Sex × Curvature: $F(3, 717)=0.11$, $p=.951$, $\eta^2<0.01$.

## Discussion

Study 1 reported that changes in lordosis posture for standing models altered perceptions of sexual receptivity. As predicted by the sexual receptivity hypothesis, the effect of lordosis posture was replicated even when the models were not standing. Across quadruped and supine postures, an increase in arch of the back increased male and female perceptions of sexually receptive equally.

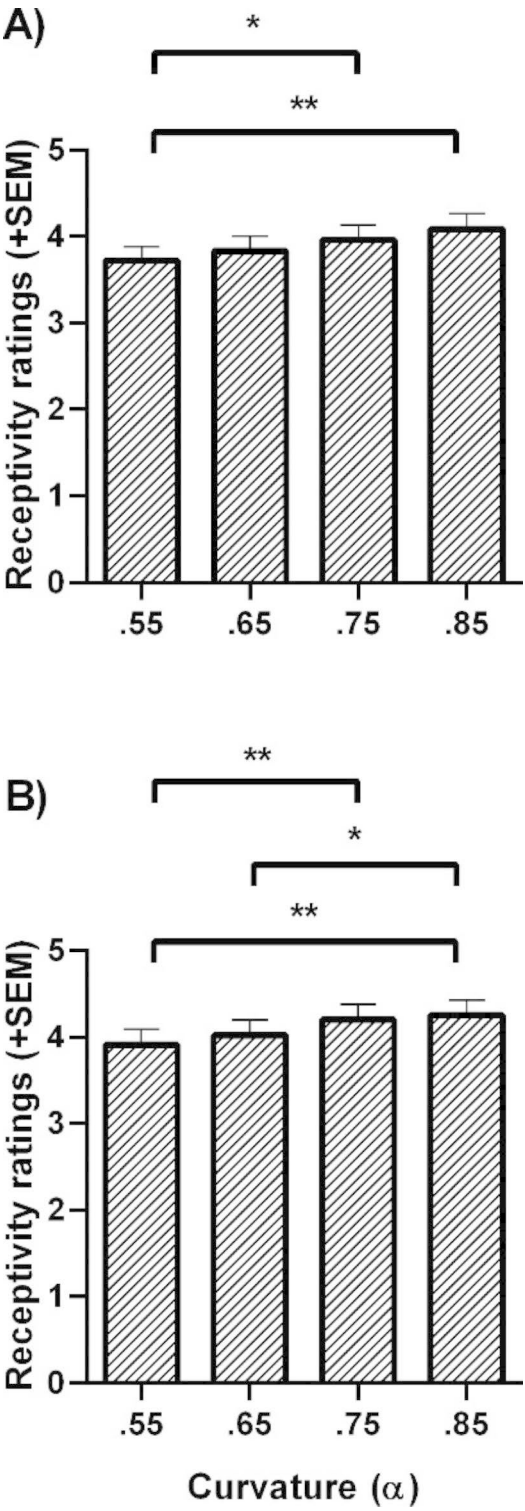


**Fig. 4** A) Receptivity ratings as a function of curvature for female models in (A) quadruped posture and, (B) supine posture. * $p < .05$, ** $p < .01$

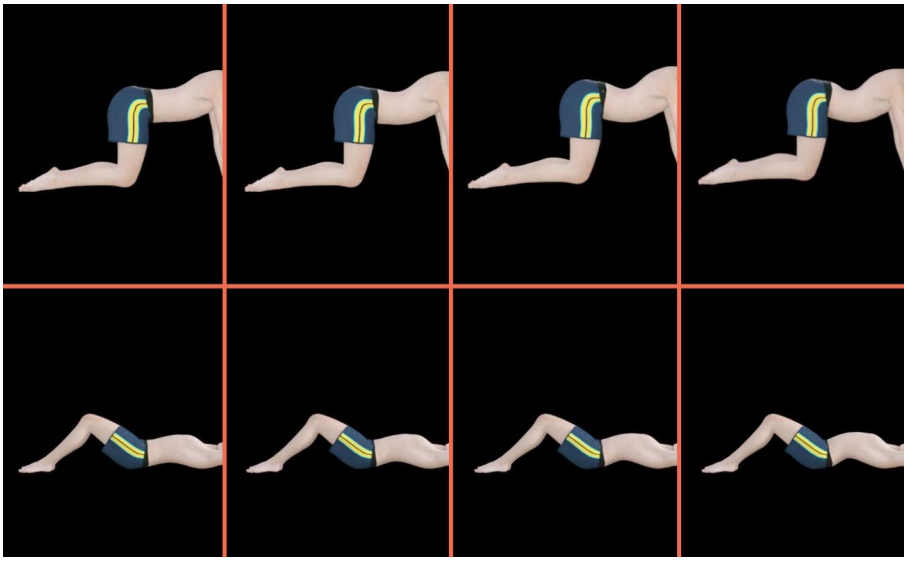

**Fig. 5** Male stimuli in quadruped (upper row) and supine postures (lower row)

## Study 3

To test if sexual receptivity of an arched back is specifically a female cue, a male model posing in the postures used in Study 2 were created, and tested for perceptions of receptivity.

### Method

**Participants** A total of 132 self-identified heterosexual individuals (81 women and 51 men) aged between 23 and 76 years ($M = 46.48$, $SD = 15.30$) from CloudResearch MTurk workers located in Canada participated in this study. A total of 64 participants (48.5%) reported being married, and 12.9% reported being in a relationship. Additionally, 26.5% reported being single, and 12.1% were either widowed, divorced, or separated. As for their highest educational degree, one individual reported elementary school, 18.2% had high school diploma, 31.1% had a post-secondary diploma, 35.6% had undergraduate degree, and 14.4% had postgraduate degree.

**Stimuli and Procedure** The stimuli and procedure were the same as in Study 2, save for a male model being used instead of the female model (see Fig. 5). As before, the stimuli were presented randomly in two separate blocks, one for each posture, with the order of block counterbalanced across participants. As in Study 1 and 2, participants rated the male image for sexual receptivity.

### Results

**Quadruped Posture** A 2 (Sex) × 4 (Curvature) mixed ANOVA was performed with Sex as a between-subjects variable and Curvature as a within-subjects variable. The main effect of Sex was significant, $F(1, 130)=4.09$, $p=.045$, $\eta^2=0.03$; men ($M=3.15$, $SEM=0.27$) rated the stimuli more sexually receptive than women ($M=2.44$, $SEM=0.22$). However, no significant effect was found for Curvature, $F(3, 390)=0.44$, $p=.719$, $\eta^2<0.01$, and the interaction of Sex × Curvature: $F(3, 390)=2.07$, $p=.103$, $\eta^2<0.01$) was also nonsignificant (Fig. 6A).

**Supine Posture** The supine posture data were analysed as above. The main effects for Sex and Curvature, and their interaction, were not significant (Sex: $F(1, 130)=2.60$, $p=.109$, $\eta^2=0.02$; Curvature: $F(3, 390)=1.22$, $p=.299$, $\eta^2<0.01$; Sex × Curvature: $F(3, 390)=1.04$, $p=.373$, $\eta^2<0.01$; Fig. 6B).

### Discussion

In Study 3, we investigated if increased ratings of sexual receptivity for lordosis posture occurs for a male model. They do not. The results suggest that lordosis posture is associated with sexual receptivity only for images of females.

## General Discussion

The present research aimed to investigate predictions arising from the receptivity hypothesis of lordosis posture, testing whether an arched back in women may be considered an indicator of sexual receptivity. To test this hypothesis, we examined if an increase in the arch of the back in women is associated with higher ratings of sexual receptivity. The results of Study 1 showed that with an increase in the arching the back individuals perceived women's sexual receptivity to increase. This finding was similar for both male and female participants, in line with our prediction that both men and women would perceive the lordosis signals of sexual receptivity. Critically, though both men and women may be sensitive to the sexualised cue of arched back, it does not follow that the interpretation of that cue is identical for both sexes. Specifically, we suggest that men perceive back curvature as a behavioral cue associated with sexual receptivity and interest, while women perceive curvature as a cue of sexual receptivity and intrasexual competitiveness. That is, men may rely on women's lordosis as a nonverbal indicator associated with sexual interest, and this may influence their attention to mating related behaviors. In contrast, women may associate lordosis with more intrasexual competitive displays. Indeed, a recent study found that women who scored higher on an intrasexual competition were more likely to consider increases in arching the back as attractive because they were more likely to consider lordosis posture as a threat (Pazhoohi et al., 2022). Moreover, women were less likely to show images of other females who are displaying a relatively larger arched-back posture to a partner (Pazhoohi et al., 2022).

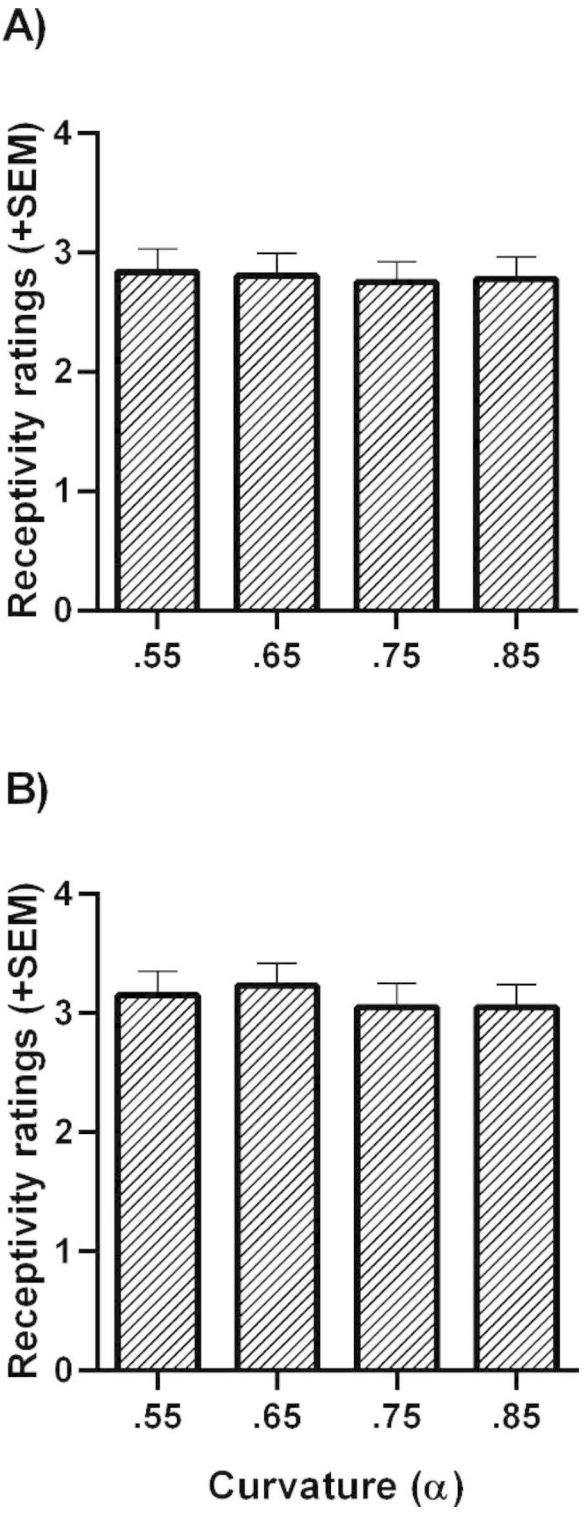


**Fig. 6** A) Receptivity ratings as a function of curvature for male models in (A) quadruped posture and, (B) supine posture

Furthermore, we hypothesized that if back posture indicates women's sexual receptivity, such attribution should also be perceived in non-standing postures. In Study 2, we measured the perception of sexual receptivity in non-standing postures, namely in quadruped and supine postures. We found that both men and women associate an increase in arching the back in women with an increase in sexual receptivity. This finding clearly supports the receptivity hypothesis of lordosis posture by indicating that perceptions of sexual receptivity is a behavioral adaptation (Pazhoohi et al., 2018). In other words, this result indicates that perceived sexual receptivity of an arched back is not limited to a bipedal posturing, thereby bringing into question whether previous reports that an arched back is perceived to be more attractive because it indicates a morphological adaptation for pregnancy and child bearing ability in bipedal women (Lewis et al., 2015). While the vertebral wedging hypothesis could claim, post-hoc, that lumbar curvature in non-standing postures may be considered attractive (although this hypothesis needs to be tested) from a functional perspective, it is not predicted by it.

Finally, we hypothesized and confirmed in Study 3, that such receptivity perception of lordosis posture is women-specific, as an increase in men's lordosis posture did not influence perceptions of sexual receptivity for male or female participants. Though this finding was predicted by the sexual receptivity hypothesis of lordosis posture, the finding that it is specific to women is consistent with vertebral wedging hypothesis, as the latter is based on a sex difference in morphology of lumbar curvature. Still, the stimuli shown in Study 3 were either in supine or quadruped poses which does not necessarily point to bipedalism, and therefore need not provide support for vertebral wedging hypothesis.

Collectively, the findings of this paper supports the sexual receptivity hypothesis (Pazhoohi et al., 2018). Although an intermediate lumbar curvature could be preferred because it is a morphological adaptation to bipedalism (vertebral wedging hypothesis, Lewis et al., 2015) and can be used as a cue to reproductive success, we show that curvature is indicative of sexual receptivity in a variety of poses, such as in the upright, quadruped, and supine postures. Lastly, since studies have primarily relied on female images to test sexual receptivity in lumbar curvature and/or lordosis posture, we tested if these perceptions are also seen in men. Study 3 showed that arching the back was not associated with increased sexual receptivity in men, suggesting that lordosis is solely a female nonverbal indicator of sexual interest. The findings from men's perceptions are also consistent with Error Management Theory (Haselton & Buss, 2000). Men were more likely to interpret increases in women's lordosis posture as sexually receptive, while men's lordosis posture was never perceived as sexually receptive.

Previous research has shown that lordosis is a sexual signal in non-human animal species (Flanagan-Cato, 2011; Henley et al., 2011; Pfaus & Gorzalka, 1987). Research in human populations has shown that lordosis is associated with increases in attractiveness (Lewis et al., 2017; Mesko et al., 2021; Pazhoohi et al., 2018) suggesting that lordosis posture is an important nonverbal cue in human mating. This has also been elucidated in research tracking eye-movements, where increased visual attention is directed to increases in lordosis posture. Our findings are in support of previous research (Pazhoohi et al., 2018). Both men and women consider increases in

arching the back as a cue to sexual receptivity in women, highlighting the important function of this sexual behavior in females. Furthermore, these findings are more in line with the sexual receptivity hypothesis proposed by Pazhoohi et al. (2018), as sexual receptivity was not only demonstrated in upright standing poses, but in quadruped and supine positions.

The current studies are the first to our knowledge to investigate lordosis in men and women using different postures. By incorporating different postures, we were able to show that sexual receptivity is not only a sexual cue attributed to the upright position, but in quadruped and supine positions as well. This suggests that both sexes may use these nonverbal cues as a sexual signal for mating (males) or as a signal that may contribute to intrasexual competitive displays (females). Further investigations attempting to demonstrate the real perception of lordosis behavior can look into its role in perceptions of reproductive success and possibly fertility. In female populations, investigating the perceived competitiveness of other women's lordosis posture, as displayed through high heel shoes, can provide for fruitful investigations. For example, women's perceptions of large breasts are associated with intrasexual competitive displays, with women unlikely to introduce a current partner to women with large breasts (Garza et al., 2021). The lordosis behavior is perceived in a similar way (Pazhoohi et al., 2022).

## Limitations and Future Directions

The use of 3D avatars, although beneficial for manipulation purposes, may not be generalizable compared to using real life images or models. Future studies may wish to consider using real images and possibly incorporating multiple stimuli to provide more observations in their analysis. Adding multiple manipulations, such as manipulating waist to hip ratios, breast size, and other features associated with attractiveness, would also be an interesting avenue of research to consider in the future. Furthermore, in the current studies, there were no experimental manipulations or primes used prior to viewing and rating the stimuli. It could be argued that a priming task may elicit stronger responses in both men and women in ratings of sexual receptivity. Participants simply viewed and rated the stimuli without any context, and although arching the back was associated with sexual receptivity, both men and women can alter their curvature when engaging in non-sexual activities, such as stretching and exercising. Moreover, participants were only asked to rate the sexual receptiveness of the target using a 4-item measures. Perhaps, exploring participants' sexual behavior, such as asking if they have ever positioned themselves similar to the target image when engaged in sexual behaviors, can illuminate the association between arching the back and sexual receptivity. Another limitation of this study was lack of information on the ethnicity of the participants, as Canada is a multi-ethnic country and differences in ethnic background when evaluating a Caucasian model might have influenced the results. In addition, using measures of intrasexual competition could elucidate the relationship between same-sex ratings of lumbar curvature and arching the back. Although both men and women considered arching the back as sexually receptive, they may have done so for different reasons. Men may

overestimate sexual intent, as suggested by Error Management Theory (Haseleton & Buss, 2000); and women may consider attractive features important in intrasexual selection, as has been shown in research in women's perceptions of women's bodies (Fisher & Archibald, 2019), waist-to-hip ratios (Fink et al., 2014), breast size (Garza et al., 2021), and lordosis posture (Pazhoohi et al., 2022). Additionally, using only one target model is another limitation of the current study, and in order to further generalize the findings, future research could use female models from different racial and age groups, of various heights and weights, and different types of clothing. Moreover, the differences in color, size, and style of the clothing used in Studies 2 and 3 might have confounded the results and the future research might choose to implement more homogeneity in terms of male and female models. Furthermore, some might argue that as the lordosis behavior is a dynamic cue, hence stimuli in motion more appropriately serve to test the sexual receptivity hypothesis (Meskó et al., 2021; Ranson et al., 2023). While in the Study 3 we used a sample of heterosexual participants to test whether sexual receptivity of an arched back is specifically a female cue, future research could examine a similar question using male images and a sample of homosexual men. Previous research indicates a difference in body shape preference as a function of men's sexual orientation (Swami & Tovée, 2008; Tiggemann et al., 2007). Accordingly, homosexual men might indicate differences compared to heterosexual men when rating sexual receptivity and/or attractiveness of an arched back male model. Furthermore, by explicitly comparing perceived attractiveness of lordosis posture in standing (bipedal) and non-standing poses (quadruped and supine), future research could provide more insight and evidence to support either the sexual receptivity hypothesis or vertebral wedging hypothesis. Once again, it is noteworthy to mention that both hypotheses are viable and indeed not mutually exclusive, as is indicated by Pazhoohi et al. (2022) and Semchenko et al. (in press).

One discrepancy between the method of the current study and those of Lewis et al. (2015) where angles are used, is the use of sinusoid curves for systematically measuring the back curvature in the current study. Our method was based on the first study that experimentally tested lordosis posture in humans in the literature (Pazhoohi et al., 2018) where it was assumed that humans are evolved the ability to flexibly change their body poses and signal their intentions. However, the method used by Lewis et al. (2015) was to test the predictions about morphological adaptions, based on medical measurement of lumbolumbar and lumbosacral angles (Fernand & Fox, 1985). We believe that using a similar method of measurement of body posture in Study 1 and 2, where standing versus non-standing postures were used, and the fact that the Study 1 stimuli are comparable to Lewis et al., sufficiently bridges any perceived gaps between the investigations. Accordingly, we suggest future research should use the sinusoid curves for creating such more realistic and flexible stimuli (see Pazhoohi et al., 2018 for a more comprehensive criticism of stimuli used by Lewis et al., 2015).

In summary, results of the current research provided support for receptivity signaling hypothesis of lordosis posture by showing that arched back posture is perceived as an indicator of sexual receptivity in women, but not men. This was true for both male and female participants. It was also true across different body postures, and thus it is not exclusive to a standing posture associated with homo sapiens bipedalism and lumbar wedging.

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**Data Availability** Authors will share upon request.

## Declarations

**Conflict of interest** The authors declare no conflict of interest.

**Ethical approval** The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Behavioural Research Ethics Committee of the University of British Columbia.

**Informed consent** Informed consent was obtained from all subjects involved in the study.

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