

Article

Sexual Receptivity Signal of Lordosis Posture and Intra-Sexual Competition in Women

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Abstract: Previous research has shown that women may use self-enhancement strategies to compete with one other. Lumbar curvature in women is considered to enhance a woman's attractiveness, potentially due to its role in bipedal fetal load and sexual receptiveness. The current study investigated the role of lumbar curvature on women's perceptions of sexual receptiveness as well as its role in women's intrasexual competitiveness. Study 1 ($N = 138$) tested and confirmed that women's intrasexual competition influences their perception of sexual receptivity of women as a function of lordosis posture depicted in a standing posture. Study 2 ($N = 69$) replicated these results and extended them to other postures, namely, the quadruped and supine positions. Study 3 ($N = 106$), using a two-alternative forced-choice task, revealed that other women perceive relatively larger arched-back postures as more threatening to their relationship and frequently as being more attractive. Collectively, this work suggests that women consider a lordotic posture in other women as a signal of sexual receptivity and perceive it as a threat to their relationship. This research provides robust support for the sexually receptivity hypothesis of lumbar curvature, questioning the alternative morphological vertebral wedging hypothesis.



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1. Introduction

Intrasexual competition in women is influenced by traits that are important in intersexual selection in men, such as desirable physical traits [1], attractive features [2], and sexual receptiveness [3]. Given the importance placed on attractive features by men, women may compete with other women to enhance specific traits in order to increase their mating success. Research has shown that women use self-enhancement strategies [4] and are more likely to spend more money compared to men on enhancing their body through beautification products [5] and surgical procedures [6]. Importantly, women are also aware of other women's attractiveness and enhancement strategies [7] and are likely to utilize retention strategies to keep their current partners [2,8]. Studies have also shown that lumbar curvature (i.e., lordosis) in women is considered attractive, due to its role in bipedal fetal load [9] and sexual receptiveness [3].

Research on women's intrasexual competition has shown that women attend to attractive features that are perceived to be important to men, such as breast size, femininity, and waist-to-hip ratio [10]. Recent research has shown, for instance, that women are less likely to introduce other women to their current romantic partner if they possess breasts that are perceived to be attractive and signal fertility, i.e., large, firm breasts [1]. Similarly, Prokop [11] showed that women rated women wearing high-heel shoes versus flat-soled shoes as more interested in sex and that they were less likely to let their partners spend

time with them. Prokop and Švancárová [12] showed that women prefer to wear high-heel shoes as a sexual strategy when interacting with attractive men, potentially as they hold the belief that high heels are sexually appealing to men. Indeed, research has shown that men consider women in high heels as more sexually attractive [13], a finding that translates to both studies of preference in the field [14] and laboratory investigations using static images [11,15] and dynamic stimuli [13,16]. This increase in perceived attractiveness of women in high heels has been attributed to several factors: perceptions of heightened femininity when women walk wearing them [14,16], an increase in the perception of leg length [11], and an increase in lumbar curvature [13,15].

The present study is concerned with this latter factor [3,9]. While conceptually similar, there are two different evolutionary hypotheses for the attractiveness of arched-back postures, with one focusing on an arched back as a morphological adaptation in women bodies, and the other emphasizing lumbar curvature as a nonverbal behavioral adaptation.

According to the “vertebral wedging hypothesis” proposal of Lewis et al. [9], women have evolved to possess an intermediate degree of vertebral wedging, which enables them to walk bipedally while at the same time being able to sustain multiple pregnancies without suffering spinal injuries due to bipedal fetal load. Accordingly, they argue that men have evolved to prefer an intermediate angle of lumbar curvature in women of approximately 45.5 degrees compared to angles typical of hyper- or hypolordosis curvatures.

The alternative “receptivity signaling hypothesis” of lordosis posture proposed by Pazhoohi et al. [3] suggests that an increase in the lumbar curvature is a manifestation of sexual receptivity in women and serves as a vestigial remnant of receptivity–communicative signal between men and women. In an eye-tracking study, Pazhoohi and colleagues [3] showed that small increases in the back curvature were associated with higher ratings of attractiveness and visual attention to the hip region. Pazhoohi et al. [3] also found an incremental increase in ratings of attractiveness with an increase in lordosis posture, which conflicts with the finding reported by Lewis et al. [9]. Pazhoohi et al. [3] argued that a lordotic posture or arching the back in women is a display and reliable signal of sexual receptivity which is a phylogenetically conserved mechanism across the taxa [3]. As such behavior in females of different species elicits male’s response through increased attention and copulation attempts [17–19], it also signals women’s sexual receptivity/proceptivity to men [3].

The current research investigated the role of lumbar curvature on women’s perceptions of sexual receptiveness. In addition, we sought to explore the role of intrasexual competitiveness in women and how they perceive lordosis in different postures. In the first study of the present report, we aimed to test whether women’s intrasexual competition influences their perception of sexual receptivity of women as a function of lordosis posture depicted in a standing posture. This study is conceptually similar to that of Prokop (2020) in which high heels are shown to promote intrasexual competition and indicate higher sexual receptivity, though in Prokop [11], legs and shoes served as stimuli, testing the effect of high heels shoes and the way they affect the perception of leg length. In contrast, the focus in Study 1 is the associated postural effects of high heels on women’s lumbar curvature and how this, in turn, affects perceptions of sexual receptivity.

In Study 2, we tested the sexual receptivity prediction that the effects found in Study 1 will replicate and extend to other postures, namely, the quadruped and supine postures. Note that in doing so, Study 2 also questions the vertebral wedging adaption proposal that emphasizes the perception of lumbar curvature in an upright bipedal posture.

In a third study, we used a two-alternative forced-choice task, asking women to choose a female image with different lumbar curvatures that they would present to their partner and to rate the attractiveness. In doing so, we examined directly if women find other women in more arched-back postures as more threatening to their relationship and more attractive.

2. Study 1

2.1. Method

2.1.1. Participants

The data reported in Study 1 were collected as part of a larger research program testing whether an arched-back posture is perceived as a signal of sexual receptivity in women. The analyses reported in the current study were specifically conducted to test novel hypotheses developed for this research, though part of that program is reported elsewhere [20], Study 1. A total of 138 self-identified heterosexual women aged between 19 and 79 years ($M = 45.70$, $SD = 15.76$) were recruited from CloudResearch MTurk workers located in Canada and participated in this study. A total of 107 participants (44.2%) reported being married, and 17.4% reported not being married but in a relationship. In addition, 23.9% reported being single, and 14.5% were widowed, divorced, or separated.

2.1.2. Stimuli

The stimuli used were adopted from Pazhoohi et al. [3], which depicted side-view 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 $\alpha = 0.6, 0.65, 0.7, 0.75, 0.8, \text{ and } 0.85$). These six side-view torsos were used as the stimuli in this study.

2.1.3. Measures

Intrasexual Competition Scale

Participants completed Buunk and Fisher's [21] 12-item intrasexual competition questionnaire on a 7-point scale from 1 (not applicable at all) to 7 (very much applicable). Higher scores indicate a higher level of intrasexual competition (e.g., "I can't stand it when I meet another woman who is more attractive than I am").

Sexual Receptivity

Participants were asked to respond to four statements that were previously used as a measure for perceived sexual receptivity of women [22,23] on a 9-point scale from 1 (not at all) to 9 (extremely): (i.e., "how sexy is this woman acting?", "how seductive is this woman?", "how flirtatious is this woman?", "this woman is interested in sex". The statements' scores were summed into one scale of sexual receptivity.

2.2. Results

A linear mixed model was used to investigate the effect of lumbar curvature on perceived sexual receptivity, with curvature as a factor, intrasexual competition (ISC) as a covariate, and participant as a random factor. The effect for lumbar curve was significant, $F(5,690) = 5.33$, $p < 0.001$, $\eta^2 = 0.03$. Pairwise comparison showed that curvature values $\alpha = 0.80$ and $\alpha = 0.85$ ($\alpha = 0.80$: $M = 3.52$, $SEM = 0.17$; $\alpha = 0.85$: $M = 3.61$, $SEM = 0.17$) were perceived significantly higher on sexual receptivity compared to $\alpha = 0.60$ ($M = 3.16$, $SEM = 0.17$, $ps < 0.001$) and $\alpha = 0.65$ ($M = 3.20$, $SEM = 0.17$, $ps < 0.036$). ICS positively predicted the ratings of sexual receptivity, $\beta = 0.36$, $SE = 0.13$, $df = 138$, $t = 2.77$, $p = 0.006$, marginal $R^2 = 0.05$.

2.3. Discussion

The first study investigated the perception of lumbar curvature in relation to sexual receptivity. The results showed that women perceived an increase in lumbar curvature in a standing posture as more sexually receptive. Women's intrasexual competition was also associated with their perception of sexual receptivity such that higher ratings of competition were linked to higher ratings of sexual receptivity. Collectively, the results of Study 1 indicate that women associated higher sexual receptivity with higher back curvature in women, and those women who were more competitive with other women also perceived them to have higher sexual receptivity.

It is uncertain, however, whether women would perceive curvature in other postures as a cue of increased intrasexual competitiveness. According to the receptivity signaling hypothesis of lordosis posture proposed by Pazhoohi and colleagues [3], such cues of sexual receptivity and intrasexual competitiveness should also be perceived for non-standing postures. To test this prediction, in Study 2, we examined if women associated an increase in female lordosis in quadruped and supine postures with an increase in sexual receptivity and whether their intrasexual competitiveness was associated with such perceptions.

3. Study 2

3.1. Method

3.1.1. Participants

Participants were a total of 69 self-identified heterosexual women aged between 19 and 78 years ($M = 44.43$, $SD = 14.83$), recruited from CloudResearch MTurk workers located in Canada. A total of 37 participants (53.6%) reported being married, and 13.0% reported being in a relationship. Additionally, 23.2% reported being single, and 10.2% were widowed, divorced, or separated.

3.1.2. Stimuli and Procedure

For the purpose of this study, a female model was generated using DAZ 3D software, posed in quadruped posture, with her back modified to create four different curvatures ($y = \alpha \sin(x)$; where $\alpha = 0.55, 0.65, 0.75$, and 0.85 ; see Figure 1 upper row). Another set of four stimuli were generated by posing the female model in a supine posture, with her back modified to create different curvatures (see Figure 1 lower row). In all posture manipulations, the waist was modified while hip and legs were kept fixated and unchanged. The rest of the procedure was similar to Study 1.

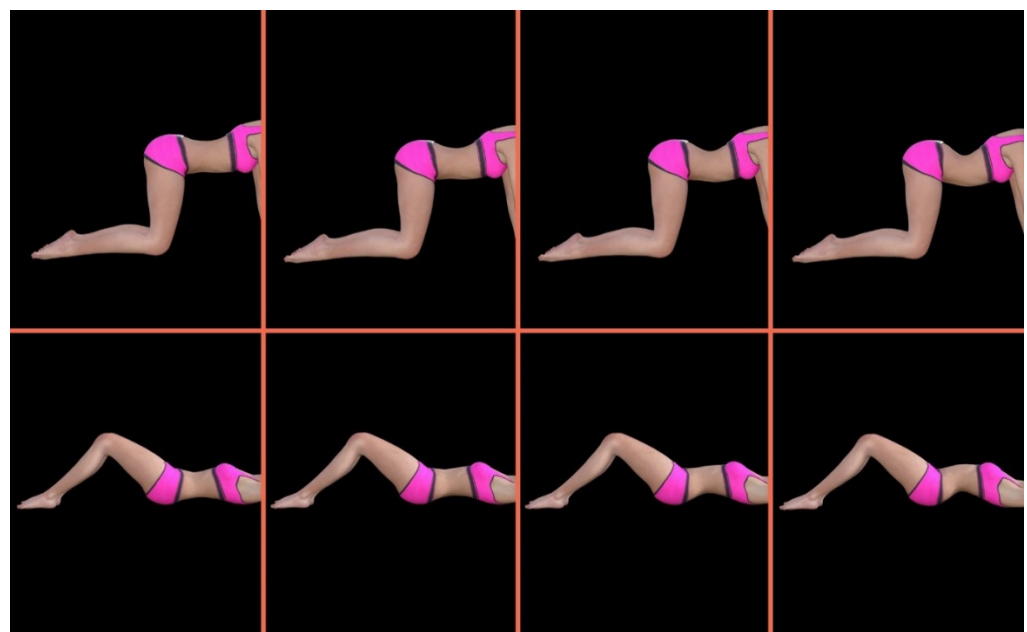


Figure 1. Female stimuli in quadruped (**upper row**) and supine postures (**lower row**).

Stimuli were randomly presented in two separate blocks, each containing either the quadruped or the supine posture.

3.2. Results

3.2.1. Quadruped Posture

A linear mixed model was applied to investigate the effect of lumbar curvature in the quadruped posture on perceived sexual receptivity, with curvature as a factor, intrasexual

competition as a covariate, and participant as a random factor. The effect for lumbar curve was significant, $F(3,207) = 4.26, p = 0.006, \eta^2 = 0.06$. Post hoc analysis showed that Curvatures $\alpha = 0.75$ ($M = 3.72, SEM = 0.25, p = 0.007, \text{Cohen's } d = 0.45$) and $\alpha = 0.85$ ($M = 3.64, SEM = 0.25, p = 0.023, \text{Cohen's } d = 0.40$) were perceived as associated with significantly higher receptivity compared to Curvature $\alpha = 0.55$ ($M = 3.02, SEM = 0.25; ps < 0.023$); no other significant differences were observed (all $ps > 0.373$). ICS positively predicted the ratings of sexual receptivity, $\beta = 0.63, SE = 0.15, df = 69, t = 4.16, p < 0.001$, marginal $R^2 = 0.16$.

3.2.2. Supine Posture

A linear mixed model was implemented to investigate the effect of lumbar curvature in the supine posture on perceived sexual receptivity, with curvature as a factor, ISC as a covariate, and participant as a random factor. The effect for lumbar curve was significant, $F(3,207) = 5.08, p = 0.002, \eta^2 = 0.07$. Post hoc analysis showed Curvatures $\alpha = 0.75$ ($M = 4.36, SEM = 0.29, p = 0.017, \text{Cohen's } d = 0.41$) and $\alpha = 0.85$ ($M = 4.46, SEM = 0.29, p = 0.002, \text{Cohen's } d = 0.49$) were perceived as associated with significantly higher receptivity compared to Curvature $\alpha = 0.55$ ($M = 3.84, SEM = 0.29$); no other significant difference was observed (all $ps > 0.172$). ICS positively predicted the ratings of sexual receptivity, $\beta = 0.64, SE = 0.18, df = 69, t = 3.41, p = 0.001$, marginal $R^2 = 0.13$.

3.3. Discussion

Study 2 replicated the findings of Study 1. Across both postures, women perceived an increase in lumbar curvature as more sexually receptive, which was influenced positively by their intrasexual competitiveness, indicating that women are more wary of more receptive women not only in a standing posture, but also in other postures. Collectively, the results from Studies 1 and 2 provide strong support for the hypothesis of receptivity signaling of the lordosis posture [3]. It should be noted that the effect sizes across these two studies ranged from small to moderate. In our final study, we examined if women were less likely to introduce to their partners females who were in a more receptive posture and how such postures were perceived in terms of attractiveness.

4. Study 3

4.1. Method

4.1.1. Participants

Participants were a total of 106 self-identified heterosexual women aged between 23 and 70 years ($M = 41.42, SD = 12.26$), recruited from CloudResearch MTurk workers located in the U.S.A. A total of 53 participants (50.0%) reported being married, and 21.7% reported being in a relationship. Additionally, 15.1% reported being single, and 13.2% were widowed, divorced, or separated.

4.1.2. Stimuli and Procedure

Three sets of stimuli were used for three postures, i.e., standing, quadruped posture, and supine posture, which were the same as those used and described in Studies 1 and 2. The stimuli for each posture were presented in a random order within that posture's block, and the three blocks were also presented in a random order to the participants. Within each block, the participants were asked to "Consider your partner asks you to show him a photo of your friend" and, using a two-alternative forced-choice paradigm, they were asked two questions: "Which photo of your friend would you show to your partner?" and "Which one is more attractive?". The alternatives differed in lumbar curvature.

4.2. Results

To test the selection preference for which photo would be shown to a partner as a function of lumbar curvature, a chi-squared proportion test was conducted for each set of stimuli. For all three postures, women were more likely to show the stimuli with less

curvature to their participants compared to those with more curvature (see Table 1). For perceived attractiveness, women selected stimuli with increased lumbar curve significantly more often than those with less curve for the standing and supine postures, while the reverse was the case for the quadruped posture (Table 1).

Table 1. Chi-squared goodness-of-fit proportion test for probability of threat and attractiveness judgements of female stimuli in the standing, quadruped, and supine postures by women as a function of lumbar curvature.

Condition	Posture	Level	Count	Proportion	χ^2	df	p
Threat (Showing to a Partner)	Standing	Less Curvature	948/1590	0.60	58.89	1	<0.001
		More Curvature	642/1590	0.40			
	Quadruped	Less Curvature	412/636	0.65	55.57	1	<0.001
		More Curvature	224/636	0.35			
	Supine	Less Curvature	407/636	0.64	49.82	1	<0.001
		More Curvature	229/636	0.36			
Attractiveness Judgement	Standing	Less Curvature	724/1590	0.46	12.68	1	<0.001
		More Curvature	866/1590	0.54			
	Quadruped	Less Curvature	346/636	0.54	4.93	1	0.026
		More Curvature	290/636	0.46			
	Supine	Less Curvature	283/636	0.44	7.7	1	0.006
		More Curvature	353/636	0.56			

Note. Count: frequencies for participants who chose the image as threatening or attractive as a function of the level of curvature.

4.3. Discussion

The findings of this study showed that women perceive other women in more arched-back postures as more threatening to their relationships, as they were less likely to show such images to their partners. This result was obtained regardless of the posture (the effect was found for all three postures of standing, quadruped, and supine positions, although the effect sizes ranged from small to moderate), as predicted by the receptivity signaling hypothesis of lordosis posture [3]. Moreover, women more frequently considered bodies with more curvatures as more attractive in the standing and supine postures, while they preferred less curvatures in the quadruped posture compared to more curved ones. This latter finding suggests that, while increased back arching in the quadruped posture is an indication of higher sexual receptivity (Study 2) and a higher threat to one's relationship (Study 3), it is not appealing from an attractive or aesthetic viewpoint. This particular separation between what is perceived to be a sexual receptive posture and what is perceived to be an attractive posture, though not predicted by the sexual receptivity hypothesis, is consistent with it. That is, arching the back in women is considered to be a display and reliable signal of sexual receptivity, which is a phylogenetically conserved mechanism across the taxa [3]. This behavior in females of different species elicits male's response through increased attention and copulation attempts [17–19], not because animals consider the female attractive, but because the posture signals a female's sexual receptivity [3]. Thus, while it may be that human postures that signal sexual receptivity may also be considered attractive, the two are theoretically dissociable and as demonstrated in the present study, they are also functionally and behaviorally separable. It is also worth noting that this separation is not predicted by the vertebral wedging hypothesis, which explicitly states that a women's arched back is perceived to be more attractive to men because it signals the ability to sustain multiple pregnancies without suffering spinal injuries due to bipedal fetal load.

5. General Discussion

The present research investigated the effect of lordosis posture and intrasexual competition in women across three studies. The results of the first study showed that women perceive an increase in lumbar curvature in a standing posture as more sexually receptive,

and their intrasexual competition is also influenced by their perception of sexual receptivity. Women perceive increases in lumbar curvature as signals of sexual receptivity in other women, which is influenced positively by their intrasexual competitiveness. This result was replicated in Study 2 using non-standing quadruped and supine postures, indicating that women are more concerned about more receptive women, irrespective of body posture. Moreover, these results are predicted by the receptivity signaling hypothesis of lordosis posture [3], rather than by the vertebral wedging adaption hypothesis, which holds that women with an arched back are more attractive in a standing posture because this feature signals the ability to successfully support multiple pregnancies [9].

Similarly, results of the third study showed that women are less likely to show images of other females who are displaying a relatively larger arched-back posture to a partner, consistent with their perceiving such females as representing a greater threat to their relationship. This effect was found across all three postures—standing, quadruped, and supine—highlighting once again that the lordosis posture appears to be a signal of sexual receptivity that is unrelated to bipedal locomotion. Moreover, while women with more back curvatures were considered as more attractive in the standing and supine postures, this result was reversed for the quadruped posture. This latter finding indicates that, while sexual receptivity and attractiveness may often covary, they are not supported by the same construct, consistent with Pazhoohi et al.'s [3] emphasis on sexually receptivity rather than attraction. As noted above, this dissociation between sexual receptivity and attraction is not predicted by the vertebral wedging hypothesis. Moreover, the results of the present investigation suggest that transient alternations in back curving that result from posturing or the wearing of high-heel shoes will trigger an increase in perceived sexual receptivity, as well as an increase in perceived attraction [9,13,14]. It is also worth noting that this ability of women to temporarily alter their back posture and trigger heightened perceptions of sexual receptivity and attraction does not sit comfortably with the more rigid morphological wedging hypothesis proposed by Lewis et al. [9].

Finally, this study highlights the fact that women are attentive to the physical features of other women, such that intrasexually competitive women are particularly attuned to changes in physical features of other women that signal an increase in sexually receptivity. This dovetails with previous studies indicating that men and women are attuned to the same physical features of women, albeit for different reasons. For men, particular featural changes may be attractive because they suggest an increase in sexual receptivity, whereas for women, the same featural changes may signal a potential sexual competitor and, as such, represent a threat to a current relationship [1,2,8,10]. Adding to the current literature, we find that lumbar curvature across different positions is also perceived to be threatening to one's current relationship.

There are a few limitations to the current study. Our participants were women from Canada, and therefore, whether our findings will generalize to a larger and more diverse population remains an open question. It is worth noting, however, that we did sample participants from a wide age range and did not restrict ourselves to younger college-aged women. Additionally, we used computer-generated avatars to demonstrate variation in lordosis. Future work may also benefit from using real-life images or models to portray lordosis that can increase the realism of the images used. Lastly, we used dispositional measures of intrasexual competition. It would be of interest to see how intrasexual competition saliency in the form of an experimental manipulation may influence or perhaps enhance women's perceptions of lordosis in other women.

In summary, the current investigation across three studies showed that women consider a lordotic posture in other women as a signal of sexual receptivity and perceive these women as a threat to their relationship. As predicted by the sexually receptivity hypothesis, this outcome is not specific to changes in upright postures. Also consistent with the sexual receptivity hypothesis, perceptions of receptivity and attraction are dissociable. In contrast, the generalization of perceived sexual receptivity across different postures is not predicted by the vertebral wedging hypothesis, nor is our finding of a dissociation

between sexual receptivity and attraction explained by it. Finally, we found that when women are presented with an arched back, whether as a result of wearing high-heel shoes or not, they are regarded as more sexually receptive by women and, thus, as a threat.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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