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A sex difference in features that elicit genital response

Meredith L. Chivers [a,*], J. Michael Bailey [b]

[a] *Centre for Addiction and Mental Health, 250 College St., Toronto, Ont., Canada M5T 1R8*
[b] *Northwestern University*

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Abstract

Previous research suggests that women's genital arousal is an automatic response to sexual stimuli, whereas men's genital arousal is dependent upon stimulus features specific to their sexual interests. In this study, we tested the hypothesis that a nonhuman sexual stimulus would elicit a genital response in women but not in men. Eighteen heterosexual women and 18 heterosexual men viewed seven sexual film stimuli, six human films and one nonhuman primate film, while measurements of genital and subjective sexual arousal were recorded. Women showed small increases in genital arousal to the nonhuman stimulus and large increases in genital arousal to both human male and female stimuli. Men did not show any genital arousal to the nonhuman stimulus and demonstrated a category-specific pattern of arousal to the human stimuli that corresponded to their stated sexual orientation. These results suggest that stimulus features necessary to evoke genital arousal are much less specific in women than in men.

Keywords: Female sexual arousal; Male sexual arousal; Sex difference; Gender difference; Sexual features; Vaginal photoplethysmography; Penile plethysmography; Vaginometry

Men's sexual interests vary by the preferred category of target and by the preferred activity (Freund et al., 1997). Sexual interests are usually directed toward other sexually mature humans or, much less frequently, in the case of paraphilias, toward animals, body parts, or nonliving objects; sexual interests also involve some type of sexual activity with that target. A relatively objective indicator of men's sexual interests is genital arousal to stimuli reflecting their interest. In laboratory settings, men typically show patterns of genital responding that correspond to their preferred gender (e.g., opposite- or same-sex adults; Freund, 1963, 1974; Freund et al., 1973; Mavissakalian et al., 1975; Sakheim et al., 1985), their preferred age (e.g., adult versus prepubescent/pubescent in the case of pedophilia; Blanchard et al., 2001; Freund and Watson, 1991; Freund and Blanchard, 1989; Seto et al., 2000), and preferred sexual object (e.g., Blanchard et al., 1986). Similarly, incarcerated rapists and sexually coercive men from the community demonstrate relatively greater genital arousal to stimuli depicting sexual aggression than noncoercive men (Bernat et al., 1999; Lalumière and Quinsey, 1994; Lalumière et al., 2003; Lohr et al., 1997). These data indicate a strong relationship between genital sexual arousal and sexual interests in men.

Women's sexuality seems to be organized differently. Genital arousal does not correspond to a woman's stated sexual interests in the way that it does for men. Both lesbian and heterosexual women show substantial genital arousal to films of both preferred and nonpreferred genders (Chivers et al., 2004; Laan et al., 1996). Women also show genital arousal to stimuli depicting non-preferred sexual activities: Stock (1983) reported that women experienced similar levels of genital response to an audio narrative of sexual assault as to a narrative describing consensual sexual intercourse. Laan et al. (1995) and Both et al. (2003) observed significant increases in genital arousal to depictions of a sexual threat when compared to responses to a

* Corresponding author. Tel.: +1 416 535 8501x6960; fax: +1 416 979 6965.
E-mail address: meredith_chivers@camh.net (M.L. Chivers).

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neutral stimulus.[1] These results suggest that genital responses are not as informative about women's sexual interests as they are for men.

If women's genital arousal is nonspecific, as the above data suggest, then what aspect of a sexual stimulus causes a genital response? Laan and Everaerd (1995) proposed that women's genital vasocongestion is a reflexive response to automatic processing of the sexual features of a stimulus. Exactly which features make a stimulus "sexual," however, is unclear. The literature on men's sexual arousal responses suggests that relevant features indicate preferred categories of sexual target and preferred sexual activity. For example, features that indicate a preferred gender would include primary and secondary sexual characteristics (e.g., penis, full breasts). Features that indicate a preferred sexual activity, such as sexual intercourse, would include depictions of genital configurations and characteristic movements (e.g., thrusting). For women, the stimulus features necessary to evoke genital arousal do not seem to reflect preferred gender or activity (Both et al., 2003; Chivers et al., 2004; Laan et al., 1995; Laan et al., 1996; Stock, 1983).

We propose that women's genital vasocongestion is provoked by exposure to nonspecific sexual features, that is, any sexual content, whether or not the categories of sexual targets or sexual activities presented are preferred. To test this hypothesis, it was necessary to create a stimulus that excluded plausible sexual targets (human actors) but included sexual content. Our solution was to use a film stimulus depicting nonhumans engaged in copulation. In the present study, we examined the genital and the subjective sexual arousal of women and of men to stimuli depicting human male–male, female–male, and female–female sexual interactions as well as to a stimulus depicting female and male bonobos (*Pan paniscus*) engaging in sexual activity (the nonhuman stimulus). We expected that the sexual content presented in the nonhuman stimulus would be sufficient to elicit genital response in women, but not in men. We did expect women's subjective arousal patterns to reflect their sexual interests, specifically, and that women would not report subjective arousal to the nonhuman stimulus. We expected that men would show category-specific responses to the human stimuli, as consistently demonstrated in previous studies, and would not show any increase in genital responding or report subjective sexual arousal to the nonhuman stimulus.

[1] Although women in these studies were not directly asked whether they preferred coercive sex, it is very unlikely that these women had this interest. A sexual preference manifests as persistent sexual thoughts, feelings, and behaviour involving the object or activity of interest that occur more frequently than sexual thoughts, etcetera for nonpreferred objects or activities. Studies of sexual fantasy content, for example, suggest between 20 and 51% of women report fantasizing about being coerced sexually, but the frequency of these fantasies does not exceed the frequency of fantasies involving consensual sexual contact (Leitenberg and Henning, 1995).

1. Method

1.1. Participants

We recruited heterosexual women and men via advertisements in an "alternative" urban newspaper (Chicago Reader). Fifty women responded to the advertisement, 28 were eligible to participate and scheduled an appointment, and 20 attended the experimental session. Thirty-nine men responded to the advertisement, 35 were eligible to participate and scheduled an appointment, and 20 attended the experimental session. Women were much more likely to be excluded than men because women who used oral contraceptives or were pregnant were not eligible to participate in the study. Individuals were also excluded if they endorsed any of the following: consistent problems with sexual arousal, using medications known or believed to influence sexual arousal and response, having a sexually transmitted disease, and having a nonheterosexual orientation. All participants were offered financial compensation. Heterosexuality was operationally defined as self-report of exclusive or nearly exclusive opposite-gender sexual feelings (i.e., scores of 0 or 1) as assessed using the Kinsey Sexual Fantasy Scale (Kinsey et al., 1953).

Of these participants, 18 women and 18 men produced genital responses that met the minimum response inclusion criterion (a minimum difference of 0.5 standard deviations between maximum arousal to either a human male or human female stimulus and arousal to the neutral stimulus; see Chivers et al., 2004). Mean ages were 28.7 (S.D. = 4.8) and 29.4 (S.D. = 5.3) years for the female and male samples, respectively. Women and men did not differ significantly on any demographic variables but did differ on some sexual experience variables, reflecting commonly observed sex differences in sexuality (Oliver and Hyde, 1993). Men reported more frequent masturbation, $F(2, 36) = 5.9$, $p < 0.05$, a greater desire for more frequent sexual contact with a partner, $F(2, 36) = 9.7$, $p < 0.001$, and a greater number of opposite-gender sexual partners, $F(2, 36) = 10.5$, $p < 0.001$, than women did. Women reported more nonheterosexual sexual fantasies, $F(2, 36) = 12.6$, $p < 0.05$ and less frequent orgasm during sexual intercourse, $F(2, 36) = 5.0$, $p < 0.05$, than men did.

1.2. Audiovisual stimuli

The human sexual stimuli were identical to those used by Chivers et al. (2004): Six, 2 min films depicting female–female, female–male, and male–male oral and penetrative sexual interactions were presented with sound. The nonhuman sexual stimulus consisted of a 2 min film, presented with sound, of female and male bonobos engaging in repeated penile–vaginal. Neutral nonsexual stimuli, depicting landscapes or primates engaging in nonsexual behaviours (e.g., relaxing in a hot spring), were included to compare genital and subjective arousal to sexual versus

nonsexual stimuli. All stimuli were presented in random order. An 11 min adaptation film (depicting landscape scenes accompanied by relaxing music) was used to establish baseline arousal.

1.3. Apparatus

All psychophysiological data were continuously recorded and digitized during baseline and stimulus conditions using Acqknowledge III, Version 3.2 (BIOPAC Systems Inc., Santa Barbara, CA), a MP100 data acquisition unit (BIOPAC Systems Inc.), and a PowerMac 6500 computer.

1.4. Vaginometry

Women's genital responses were assessed via change in vaginal pulse amplitude (VPA), a measure of vaginal vasocongestion specific to sexual arousal (Laan et al., 1995), using a vaginal photoplethysmograph (Sintchak and Geer, 1975). The VPA signal was sampled at a rate of 100 samples/s throughout all stimuli, band-pass filtered (0.5–10 Hz), and digitized (40 Hz). VPA was measured as peak-to-trough amplitude for each vaginal pulse.

1.5. Phallometry

Men's genital responses were assessed with penile plethysmography (Janssen, 2002), using a mercury-in-rubber strain gauge to measure changes in the circumference of the penis as erection developed. The signal was sampled at a rate of 100 samples/s, low-pass filtered (to 0.5 Hz), digitized (40 Hz), and transformed into millimeters of circumference change from baseline. The gauge was calibrated over six, 5 mm steps between sessions (Janssen, 2002).

1.6. Subjective arousal

Participants indicated their subjective sexual arousal while viewing audiovisual stimuli by using a lever that moved through a 180° arc; 0° represented no subjective sexual arousal and 180° the subjective sexual arousal associated with orgasm. The signal was low-pass filtered (to 0.5 Hz), digitized (40 Hz), and transformed into percent deflection.

1.7. Procedure

Participants were assessed individually in a dimly lit, private room, seated in a comfortable recliner with a television monitor five feet away. Participants received instruction on the genital gauge and fitted the gauge themselves. Participants watched the adaptation film and then the experimental stimuli, separated by return-to-baseline intervals. Participants completed distraction tasks during inter-stimulus intervals and, after the sexual arousal assessment, completed questionnaires assessing sexual orientation, sexual experience, masturbation frequency, and orgasmic capacity.

1.8. Data reduction

Both genital and subjective arousal measures were standardized within-subjects to control effects of idiosyncratic variation in responsiveness (Harris et al., 1992), then averaged, separately and within stimulus category, yielding mean genital and subjective arousal values for responses to human (female–female, male–female, and male–male), nonhuman, and neutral stimuli.

2. Results

Genital and subjective sexual arousal to neutral, nonhuman, and human stimuli were examined separately for women and for men. We submitted subjective and genital responses to each stimulus category to planned repeated contrasts, comparing the mean response to each stimulus category to the mean of adjacent categories. The human sexual stimuli were entered in a separate order for each group, reflecting the expected arousal pattern for heterosexual women and men. For women, we entered both genital and subjective arousal to the stimuli in the order of increasing arousal predicted for subjective sexual arousal, that is, neutral, nonhuman, female–female, female–male, and male–male. We expected no significant differences in women's genital arousal to the human stimuli. For men, the expected order of increasing arousal was neutral, nonhuman, male–male, female–male, and female–female. We include the omnibus ANOVA results for sake of completeness.

2.1. Women

The main effect of stimulus category was significant, $F(4, 68) = 23.6$, $p < 0.001$, indicating that the stimuli elicited significantly different levels of genital arousal (Fig. 1). Planned, repeated contrasts revealed that women's genital arousal to the nonhuman sexual stimulus was significantly greater than to the neutral stimulus, $F(1, 17) = 8.9$, $p < 0.01$, and significantly smaller than to the male–male stimulus, $F(1, 17) = 12.5$, $p < 0.01$. Women's responses to the human sexual stimuli were not significantly different from each other, replicating the nonspecificity effect reported by Chivers et al. (2004) in a different sample of women: Female–female versus female–male, $F(1, 17) = 0.1$, $p > 0.05$; female–male versus male–male, $F(1, 17) = 0.75$, $p > 0.05$.

A main effect of stimulus category was also found using subjective sexual arousal as the dependent variable, $F(4, 68) = 17.9$, $p < 0.001$ (Fig. 2). Women's subjective arousal showed a different pattern than their genital arousal: Women did not report being sexually aroused by the nonhuman stimulus. Planned contrasts revealed that women's sub-

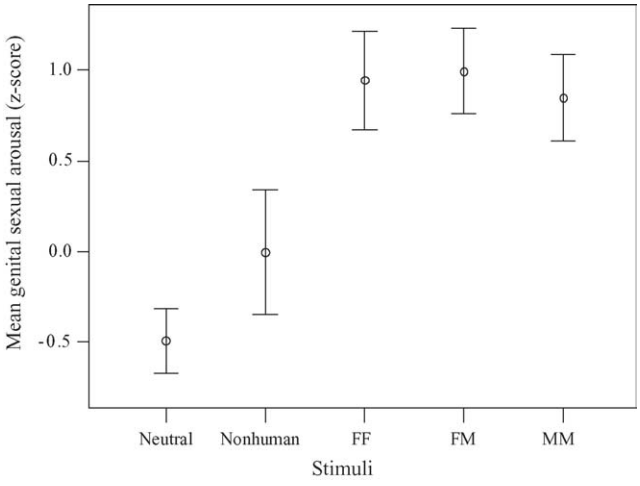

Fig. 1. Women's mean genital sexual arousal responses to neutral, nonhuman, female–female (FF), female–male (FM), male–male (MM) stimuli. Error bars show standard error of the mean. Units are within-subject standard deviations.

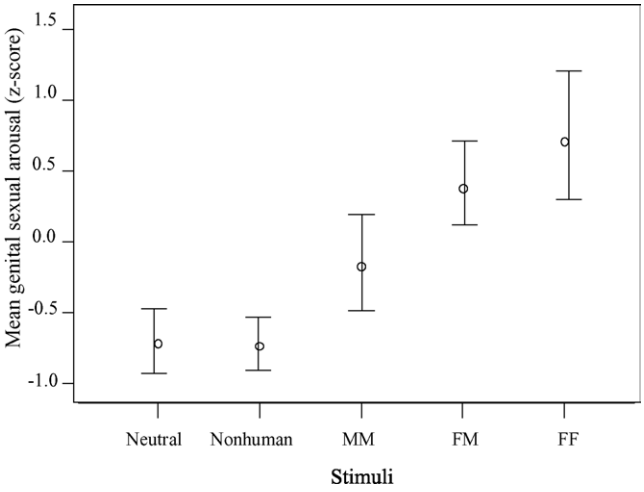

Fig. 3. Men's mean genital sexual arousal responses to neutral, nonhuman, male–male (MM), female–male (FM), female–female (FF) stimuli. Error bars show standard error of the mean. Units are within-subject standard deviations.

jective arousal to the nonhuman stimulus was not significantly greater than to the neutral stimulus, $F(1, 17) = 1.85$, $p > 0.05$. Women's subjective arousal was greatest to the female–male sexual stimulus: Women reported significantly less arousal to the female–female than female–male stimulus, $F(1, 17) = 11.9$, $p < 0.05$, and significantly greater arousal to the female–male versus male–male stimulus, $F(1, 17) = 14.8$, $p < 0.01$.

2.2. Men

The omnibus test of stimulus category was significant, $F(4, 68) = 14.2$, $p < 0.001$ (Fig. 3). Planned contrasts showed that men, unlike women, did not show genital arousal to the nonhuman stimulus when compared to the neutral stimulus, $F(1, 17) = 0.04$, $p > 0.05$. Men's genital arousal to human sexual stimuli showed a category-specific pattern: Arousal to the male–male stimulus was significantly lower than to the female–male stimulus, $F(1, 17) = 4.93$, $p < 0.05$; there was no significant difference between genital responses to the female–male and female–female sexual stimulus, $F(1, 17) = 1.2$, $p > 0.05$.

Men's subjective arousal responses mirrored their genital responses. A significant main effect of stimulus category was found, $F(4, 68) = 30.1$, $p < 0.001$ (Fig. 4). The planned contrasts showed that men did not report greater subjective arousal to the nonhuman stimulus, relative to the neutral stimulus, $F(1, 17) = 0.09$, $p > 0.05$. Men's subjective arousal to the human sexual stimuli was also category-specific. Men reported significantly greater arousal to the

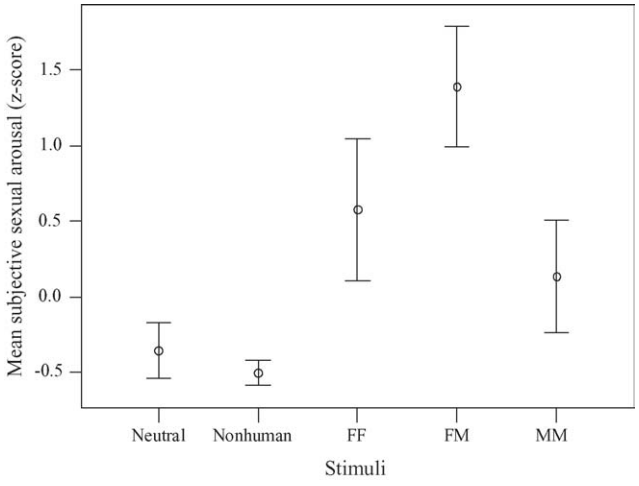

Fig. 2. Women's mean subjective sexual arousal responses to neutral, nonhuman, female–female (FF), female–male (FM), male–male (MM) stimuli. Error bars show standard error of the mean. Units are within-subject standard deviations.

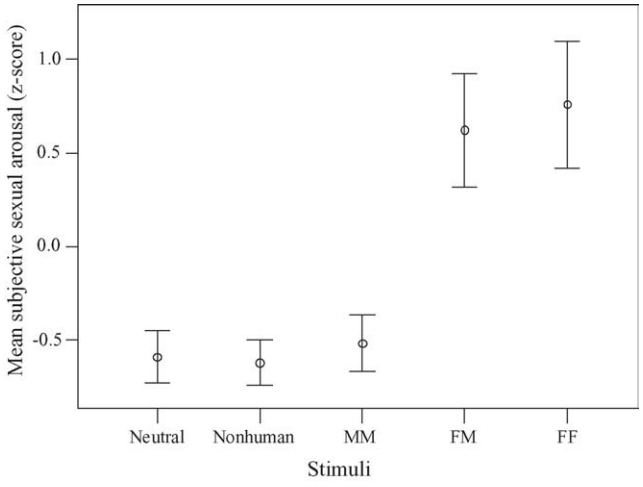

Fig. 4. Men's mean subjective sexual arousal responses to neutral, nonhuman, male–male (MM), female–male (FM), female–female (FF) stimuli. Error bars show standard error of the mean. Units are within-subject standard deviations.

female–male than male–male stimuli, $F(1, 17) = 23.4$, $p < 0.001$, and relatively equivalent arousal to the female–male and female–female stimuli, $F(1, 17) = 0.25$, $p > 0.05$.

3. Discussion

Our results suggest that nonspecific sexual features are sufficient to induce intermediate levels of genital arousal in women, even in the absence of a subjective appraisal of the stimulus as sexually arousing. In other words, women showed a significant increase in genital arousal to a nonhuman sexual stimulus, but did not report being sexually aroused by this stimulus. In contrast, men showed neither genital nor subjective arousal to the nonhuman sexual stimulus; nonspecific sexual features were not sufficient to elicit genital arousal in the male sample. Women also showed a nonspecific pattern of genital arousal to human sexual stimuli, replicating the effects reported by Laan et al. (1996) and Chivers et al. (2004) in a different sample of women. Conversely, men's genital arousal was category-specific, with the highest level of response to the female–female and female–male stimuli. These results suggest there is a sex difference in the stimulus features necessary to evoke genital arousal.

Although women showed significantly greater arousal to the nonhuman sexual stimulus than to the neutral stimulus, the magnitude of this response was lower than that to human sexual stimuli. This difference might be attributable to the amount of sexual activity depicted in the nonhuman sexual stimulus materials compared with the human stimulus materials. Sexual activity in the nonhuman stimulus was presented in short episodes (each intromission lasted for approximately 10 s) compiled to create a 120 s stimulus, whereas the human stimuli depicted sustained sexual activity for the entire 120 s. If the nonhuman stimulus depicted sustained and intense sexual activity, which is uncommon for nonhuman primates, it is possible that women's genital responses to the nonhuman stimulus would have been comparable to their responses to human stimuli. It is also possible that gender-nonspecific human features are necessary for women to achieve higher levels of genital arousal.

These data provide support for Laan and Everaerd's (1995) idea that women's genital vasocongestion is an automatic response to any "sexual" features: Women experienced a rapid genital response to a stimulus that displayed frank sexual activity but neither corresponded with their interests nor evoked concomitant subjective sexual arousal. Another example of this automatic response is the lack of habituation in women's genital arousal to repeated presentations of a sexual stimulus (Laan and Everaerd, 1995b). Men, in contrast, do show habituation of genital arousal (O'Donahue and Geer, 1985).

There is other evidence that genital arousal is partially independent of psychological processes in women. The correlation between genital and subjective arousal is consistently smaller in women than in men (Chivers et al., in preparation; Laan and Everaerd, 1995). Research examining the temporal relationship between genital and subjective arousal in women shows that maximum genital arousal precedes maximum subjective arousal by about one minute (Polan et al., 2003). Studies examining the effects of pharmaceutical agents on women's sexual arousal have generally concluded that pharmaceutically-induced increases in genital vasocongestion do not translate into significant increases in subjective arousal (Laan et al., 2002; Meston and Heiman, 1998; Meston and Worcel, 2002). Collectively, these studies indicate that a fundamentally different process underlies the sexual arousal systems of women and men.

Why would women's genital arousal system be automatically responsive to depictions of nonhuman sexual activity? Visual sexual features common to nonhuman and human sexual activity may be among a class of biologically prepared stimuli (cf., Seligman, 1971) that automatically initiate neural sexual responding (Geer et al., 1992). Genital vasocongestion prepares the vagina for sexual activity via lubrication, facilitating penile penetration and reducing the likelihood of genital injury or infection of the reproductive tract. Reflexive genital vasocongestion in response to nonspecific visual sexual features may be an evolved protective mechanism (Laan, 1994). Having reflexive and low-cost vasocongestion to nonspecific sexual features may have improved fitness in ancestral environments by reducing the probability of adverse events such as injury during sexual intercourse. The evolutionary psychology perspective from which we derive these speculations may provide a helpful framework from which to develop and test these and other hypotheses about sex differences in sexual psychology (e.g., Symons, 1979).

That women demonstrated a genital response to a nonhuman sexual stimulus does not suggest women have a latent preference for sex with animals. Although genital response to preferred sexual stimuli has long been equated with a sexual preference in sex research, this assumption is most likely valid for males only. There is, to date, no convincing evidence that women's genital response to preferred and nonpreferred sexual stimuli corresponds to their stated sexual preferences (Chivers et al., 2004). In fact, the current study and our previous research suggest that little can be inferred about a woman's sexual preference on the basis of her genital responses alone.

Our results further our understanding of women's sexual arousal processes in three ways. First, our data suggest that women's genital arousal is elicited by nonspecific sexual features. That is, sexual activity is a sufficient sexual feature for females. Second, they suggest that women's genital arousal is not dependent on preferred sexual partner features. Third, they indicate that significant increases in genital response can occur in the absence of subjective sexual arousal, as other researchers have also noted (Laan and Everaerd, 1995). Our study, however, cannot specify what comprises a nonspecific sexual feature, other than to rule out features

related to preferred sexual targets. By comparing the nonhuman to human stimuli, we can speculate that nonspecific features may concern movements (penile thrusting), postures (face-to-face intercourse) or cross-species physical features (an erect penis) associated with sexual activity. Further studies using stimuli designed to isolate these and other stimulus features would address this question.

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