Gender and Sexual Orientation Differences in Sexual Response to Sexual Activities Versus Gender of Actors in Sexual Films

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In this study, the authors investigated the hypothesis that women's sexual orientation and sexual responses in the laboratory correlate less highly than do men's because women respond primarily to the sexual activities performed by actors, whereas men respond primarily to the gender of the actors. The participants were 20 homosexual women, 27 heterosexual women, 17 homosexual men, and 27 heterosexual men. The videotaped stimuli included men and women engaging in same-sex intercourse, solitary masturbation, or nude exercise (no sexual activity); human male–female copulation; and animal (bonobo chimpanzee or *Pan paniscus*) copulation. Genital and subjective sexual arousal were continuously recorded. The genital responses of both sexes were weakest to nude exercise and strongest to intercourse. As predicted, however, actor gender was more important for men than for women, and the level of sexual activity was more important for women than for men. Consistent with this result, women responded genitally to bonobo copulation, whereas men did not. An unexpected result was that homosexual women responded more to nude female targets exercising and masturbating than to nude male targets, whereas heterosexual women responded about the same to both sexes at each activity level.

Keywords: sexual arousal, sexual orientation, gender differences, vaginal photoplethysmography, penile plethysmography

Female and male sexual orientation are not parallel phenomena. Gender differences in the correlates of sexual orientation have been reported across several lines of research, including birth order, age of pubertal onset, heritability (see Mustanski, Chivers, & Bailey, 2002, for a review), and the development, temporal stability, and exclusivity of same- and opposite-gender sexual experiences and attractions (Bailey, Dunne, & Martin, 2000; Diamond, 2000a, 2000b, 2005; Laumann, Gagnon, Michael, & Michaels, 1994; Savin-Williams & Diamond, 2000). Gender differences are not unique to sexual orientation, however, and have been observed in many aspects of sexuality; for example, large differences on measures of masturbation incidence and attitudes about casual sex and small to moderate differences in other aspects of sexual behavior, such as age at the time of first intercourse and number of sexual partners, have been reported (Oliver & Hyde, 1993).

In recent research, another gender difference in relation to sexual orientation, having to do with sexual response patterns when participants are presented with sexual stimuli (see Chivers, 2005, for a review), has been identified. One expects sexual responses (in terms of subjective and genital sexual arousal) to sexual stimuli depicting male targets or female targets to reflect a person's sexual orientation. This expectation is correct for men: Heterosexual men show greater sexual responses to depictions of women than to depictions of men, whereas gay men show the converse pattern. In contrast, both heterosexual and lesbian women respond substantially to both depictions of women and depictions of men.

The sexual psychophysiology research on this gender difference and sexual orientation difference in sexual response is described in greater detail in the next section. Some definitions are required, however, before proceeding. In this article, sexual stimuli that depict content that corresponds with a person's stated preferences are described as preferred; stimuli depicting anything else are described as nonpreferred. Thus, in regard to sexual orientation, the preferred stimuli for heterosexual men and homosexual women depict women, whereas the preferred stimuli for homosexual men and heterosexual women depict men. A pattern of sexual response that is significantly greater to one's preferred category of sexual stimuli is considered category-specific (i.e., the responses demonstrate specificity). Significant sexual responding to both preferred and nonpreferred sexual stimuli is considered nonspecific.

Specificity of Sexual Response

Male Specificity

Men show category-specific sexual responding. Multiple studies have shown that male genital responses (recorded, in terms of changes in penile circumference or volume, with phallometry) are greater to preferred categories of sexual stimuli with regard to the gender of persons depicted (e.g., Freund, 1963; Mavissakalian, Blanchard, Abel, & Barlow, 1975; Sakheim, Barlow, Beck, & Abrahamson, 1985; Tollison, Adams, & Tollison, 1979) or the age of persons depicted (e.g., Blanchard, Klassen, Dickey, Kuban, & Blak, 2001; Seto, Lalumière, & Blanchard, 2000). The specificity of male genital response is sufficiently robust that phallometric measurement of penile responses are used in forensic evaluations of individuals who might deny their sexual preferences, as in the case of male sex offenders who wish to avoid being diagnosed with pedophilia (for a review, see Seto, 2004). In nonforensic contexts, men's self-reported sexual arousal is category-specific, such that men report their greatest subjective response to their preferred gender (e.g., Chivers, Rieger, Latty, & Bailey, 2004; Mavissakalian et al., 1975).

Female Nonspecificity

Female genital responses, however, appear to be nonspecific. A series of studies has shown that both heterosexual and lesbian women show substantial increases in genital sexual arousal (recorded, in terms of vaginal vasocongestion, with vaginal photoplethysmography) to both preferred and nonpreferred stimuli with regard to the gender of the persons depicted (Chivers et al., 2004; Chivers & Bailey, 2005; Laan, Sonderman & Janssen, 1995; Steinman, Wincze, Sakheim, Barlow, & Mavissakalian, 1981; Wincze & Qualls, 1984). In other words, both heterosexual and lesbian women show substantial genital responses both to stimuli depicting women and to stimuli depicting men, and thus, patterns of genital arousal are only weakly related to a woman's sexual orientation. Self-reported sexual arousal is somewhat category-specific because women report greater sexual arousal to their preferred sexual stimuli, but they also report some sexual arousal to nonpreferred sexual stimuli (Chivers et al., 2004; Chivers & Bailey, 2005; Laan, Sonderman, & Janssen, 1995; Schmidt, 1975). As an illustration, Chivers et al. (2004) found that women showed very similar genital responses to films of female–female, female–male, or male–male intercourse, whereas their subjective responses were significantly greater to the category that corresponded to their sexual orientation (i.e., female–male or male–male intercourse for heterosexual women and female–female intercourse for lesbian women). Men assessed in these same studies demonstrated significantly greater genital and self-reported sexual arousal to films depicting their preferred gender (female–female intercourse for heterosexual men and male–male intercourse for homosexual men).

Chivers and her colleagues (Chivers & Bailey, 2005; Chivers et al., 2004; Suschinsky, Lalumière, & Chivers, 2007) have systematically addressed alternative explanations for the consistent finding of female nonspecificity. They showed that vaginal photoplethysmography is specific to sexual arousal and is therefore not elicited by nonsexually arousing stimuli (Suschinsky et al., 2007; see also Laan, Sonderman, & Janssen, 1995) and that vaginal

photoplethysmography can detect category-specific responding in male-to-female transsexuals with surgically constructed vaginas (Chivers et al., 2004). Further, they demonstrated that women's nonspecific sexual arousal is not explained by limited variability in genital responses: Women show significant increases in vaginal vasocongestion both to preferred and nonpreferred sexual stimuli (Chivers et al., 2004; Chivers & Bailey, 2005).

The ability to genitally respond to sexual stimuli that do not correspond to one's sexual orientation suggests that female genital responding is flexible. Flexibility refers to a pattern of intraindividual variability in sexual preferences, attitudes, and behaviors (see Baumeister, 2000, for a review). For example, women are more likely to experience and express same-sex attractions and less likely to engage in exclusively heterosexual or homosexual contacts (Bailey et al., 2000; Kinsey, Pomeroy, & Martin, 1948; Kinsey, Pomeroy, Martin, & Gebhard, 1953; Laumann et al., 1994; Rust, 1992), and women's sexual identities show less temporal stability than men's (Bell, Weinberg, & Hammersmith, 1981; Diamond, 2000a, 2000b, 2005; Kinnish, Strassberg, & Turner, 2005; Savin-Williams & Diamond, 2000).

The research conducted to date has suggested there is a gender difference in the specificity of genital response, such that male sexual responding is category-specific, whereas female sexual responding is nonspecific. This gender difference is clearest in studies that have directly compared male and female participants on the same sexual stimuli (e.g., Chivers et al., 2004; Chivers & Bailey, 2005). It is not known, however, why this gender difference exists: Why do women, but not men, show a genital response to nonpreferred sexual stimuli? This leads to two even more fundamental questions: What makes a sexual stimulus sexual? Do the features that make a stimulus sexual differ for men and women?

The Critical Features of Sexual Stimuli

Some investigators have suggested that sexual meaning is ascribed when viewing sexual stimuli and that this sexual meaning, in turn, activates subjective and genital responses (Van Lunsen & Laan, 2004). Surprisingly little is known, however, about what specific features of sexual stimuli are critical to sexual meaning and then to sexual response. In studies reporting nonspecific genital response in female participants, researchers used films portraying nude individuals engaged in sexual activity, which is a common depiction in sexually explicit, commercially available pornography. But what features of these films evoke genital responses? Is it the actors' gender-typical physical characteristics, such as breasts, vulva, or penis? Is it the movements associated with sexual activity? Is it the explicitness of the sexual activity, which can range from kissing and caressing to oral sex to intercourse? We review the relevant research on gender and sexual activity cues next.

Gender Cues

Both heterosexual and gay men demonstrate both self-reported and genital sexual arousal to images of a nude person of their preferred gender who is not engaged in any sexual activity (e.g., Mavissakalian et al., 1975; Tollison et al., 1979). There have been few comparable studies of women, however. Laan and Everaerd

(1995) found no significant increases in women's subjective or genital responses to pictures of male or female figures whether the actors were nude or semiclothed. Other studies using pictures of nude figures also suggested that actor gender cues are not sufficient to elicit reports of sexual arousal from heterosexual women (e.g., Knoth, Boyd, & Singer, 1988). None of these studies included groups of lesbian women, however, so the importance of gender cues with regard to female sexual orientation has not yet been examined.

Sexual Activity Cues

There is evidence that heterosexual women's sexual responses are influenced by the explicitness of depictions of sexual activity, with more explicit depictions eliciting greater self-reported and genital sexual arousal. For example, Laan, Everaerd, van der Velde, and Geer (1995) found that women's sexual responses increased as they viewed films of heterosexual couples engaging in increasingly explicit sexual activities, ranging from kissing and caressing to undressing, breast stimulation, manual stimulation of the genitals, and then to cunnilingus and penile–vaginal intercourse. This finding was replicated by Both, Boxtel, Stekelenburg, Everaerd, and Laan (2005) using films of low (kissing), moderate (caressing), and high (penile–vaginal intercourse) sexual explicitness.

Other studies have shown that both women and men demonstrate significantly greater genital responses to films depicting penile–vaginal intercourse than to films depicting a man and woman kissing and caressing (Suschinsky et al., 2007; Winze, Venditti, & Mavissakalian, 1980). Among men, Gaither and Plaud (1997) showed that heterosexual men's self-reported and genital sexual arousal were greater to depictions of penile–vaginal intercourse than to depictions of oral sex.

Self-report data are also germane. Kelley and Musialowski (1986) found that women's self-reported sexual arousal ratings are more influenced by variation in sexual activity, whereas men's ratings are more influenced by variation in actor characteristics. Ellis and Symons (1990) examined the content of sexual fantasies and found that men are more likely to fantasize about the physical characteristics of the imagined sexual partner, whereas women are more likely to fantasize about the psychological characteristics of the imagined sexual partner and the details of the sexual interactions.

In a more direct test of the hypothesis that sexual activity is a more salient sexual feature for women, Chivers and Bailey (2005) reported that women demonstrate genital responses to stimuli depicting sexual activity but no plausible sexual partner. To determine whether features of sexual activity alone could produce a sexual response in women, these investigators examined women's and men's sexual responses to films depicting heterosexual, gay, or lesbian couples engaging in oral and penetrative sex, as well as a film of female and male bonobo chimpanzees (*Pan paniscus*) engaging in repeated penile–vaginal penetration. The women produced genital responses to the mating bonobos that were larger than their responses to a nonsexual control stimulus depicting landscapes but significantly smaller than their responses to the films depicting human couples; at the same time, women did not report feeling any sexual arousal to the bonobo film. In contrast, men showed no subjective or genital responses to the bonobo film.

Current Study

The gender difference in specificity of genital response may reflect a more fundamental gender difference in the importance of different features of ostensibly sexual stimuli. For men, the most important features may be cues of actor gender, whereas for women, the most important features may be cues of sexual activity. This hypothesis cannot be tested by reanalyzing extant data because previous studies have used film clips of couples engaging in sexual activity (Chivers et al., 2004; Chivers & Bailey, 2005; Laan, Sonderman, & Janssen, 1995; Suschinsky et al., 2007). For example, Chivers et al. (2004) presented films that depicted lesbian, gay, or heterosexual couples engaged in oral and penetrative sex acts and argued that the lesbian and gay stimuli were informative because they were homogeneous with regard to the gender of the actors (i.e., only depicting women or only depicting men). These films, however, confound actor gender and sexual activity. In addition, depictions of lesbian, gay, or heterosexual sex may have different sexual meanings depending on the sexual orientation of the viewer, which may in turn affect sexual response. For example, watching films depicting two men engaged in intercourse may be more taboo for heterosexual viewers than watching films depicting two women engaged in intercourse, given that lesbian sex is a common theme in mainstream, commercially available pornography. For lesbian or gay viewers, watching a man and women engaged in intercourse may not be taboo, given the common representations of heterosexual sex in mainstream media. To determine whether female sexual response to preferred and nonpreferred actors is truly nonspecific and is not an artifact of the sexual stimuli that were used in the previous studies, one must examine women's sexual arousal to stimuli that disentangle actor gender from sexual activity.

In the present study, we sought to clarify the relationships among sexual orientation, gender, and sexual response by presenting homosexual and heterosexual men and women with stimuli depicting men or women engaged in different levels of sexual activity. By using an experimental design that completely crossed actor gender (male target[s] vs. female target[s] depicted) and sexual activity (none/exercise vs. masturbation vs. intercourse), we examined the relative effects of actor gender and sexual activity cues on the sexual responses of women and men.

The first objective, therefore, was to address two novel questions regarding the relationship between sexual orientation and sexual response, which focus on women because of the counterintuitive findings that have been reported to date. These were as follows: (a) Are women's sexual responses category-specific when women are presented with stimuli depicting a solitary male target or a solitary female target, consistent with their stated sexual orientation? and (b) Are women's sexual responses related to the amount of sexual activity depicted in a stimulus, ranging from none (in the case of nude individuals exercising) to masturbation to sexual intercourse? The second objective was to replicate Chivers et al.'s (2004) results showing women's genital responses do not differentiate among stimuli depicting male–male, female–female, or female–male intercourse, whereas men's genital responses do. The third objective was to replicate Chivers and Bailey's (2005) results in which women, but not men, show a significant genital response to a nonhuman stimulus depicting bonobos engaging in penile–vaginal intercourse.

Method

Participants

We recruited women and men via advertisements posted on a student employment website at a local university, placed in a local gay weekly newspaper, and posted in a monthly e-newsletter for lesbian women. The inclusion and exclusion criteria were as follows: Participants who are between the ages of 18 years and 40 years; are able to read and write English fluently; have no history of sexual response difficulties; have no history of mental illness or substance abuse; have no current use of medications or contraceptives known or suspected to influence sexual functioning (i.e., psychotropics, neuroleptics, hormones, antihypertensives, or cold/allergy medications; see Meston & Frolich, 2000); have no active sexually transmitted disease; have a stated sexual preference for women or for men; and for women, are not pregnant and have a regular menstrual cycle.

There were 205 women who responded to the advertisement: 93 declined participation or did not respond further after receiving more information about the study, 58 were not eligible to participate, 54 were eligible to participate and scheduled an appointment, and 49 of the eligible women attended the experimental session. There were 120 men who responded to the advertisement: 46 declined participation or did not respond further after receiving more information about the study, 20 were not eligible to participate, 54 were eligible to participate and scheduled an appointment, and 47 of the eligible men attended the experimental session. All participants received $50 for their time and expenses.

Apparatus and Materials

Data acquisition. All psychophysiological responses were sampled and recorded with a Limestone Technologies Data-Pac_USB system (Limestone Technologies, Kingston, Ontario, Canada). The Limestone software and hardware were installed on a Pentium Dell desktop computer (Dell Canada Inc., North York, Ontario, Canada).

Self-reported sexual response. While watching the experimental stimuli, women and men manipulated a virtual gauge (i.e., an electronic representation of a bar) to continuously report their subjective state of sexual arousal, defined as their "state of mental or emotional sexual arousal" on a scale from 0% (*no sexual arousal*) to 100% (*most sexual arousal ever felt, sexual arousal associated with orgasm*). Participants raised and lowered the virtual gauge, presented on a computer monitor adjacent to the sexual stimulus, using a keypad attached to the armrest of a comfortable reclining chair.

Female genital response. Women's genital responses were assessed with vaginal photoplethysmography (Sintchak & Geer, 1975). The alternating current component of the vaginal photoplethysmograph signal, vaginal pulse amplitude (VPA), was selected as the dependent measure for this study. VPA represents the phasic changes in vaginal blood flow associated with each heartbeat, such that higher amplitudes reflect greater vaginal vasocongestion. Increases in VPA are specific to sexual response (Laan, Everaerd, & Evers, 1995; Suschinsky et al., 2007). The photoplethysmograph signal was sampled at a rate of 10 samples per second, band-pass filtered (0.5 Hz to 10 Hz), and digitized (40 Hz). VPA was measured as peak-to-trough amplitude for each vaginal pulse.

Movement artifacts were detected by visual inspection of the waveforms and removed prior to further data preparation and analysis.

Male genital response. Men's genital response was measured with a mercury-in-rubber strain gauge, a reliable and valid method of measuring changes in penile circumference (see Janssen & Geer, 2000). The signal was sampled at a rate of 10 samples per second, low-pass filtered (to 0.5 Hz), digitized (40 Hz), and transformed into millimeters of change in circumference. The gauge was calibrated over six 5-mm steps between each participant session, consistent with Janssen's (2002) recommendation.

Experimental stimuli. The experimental stimuli consisted of 18 film clips that were 90 s and that were presented with sound, representing nine stimulus categories: control (landscapes accompanied by relaxing music), nonhuman sexual activity (bonobos or *Pan paniscus* mating), female nonsexual activity (nude exercise), female masturbation, female–female intercourse (cunnilingus and vaginal penetration with a strap-on dildo), male nonsexual activity (nude exercise), male masturbation, male–male intercourse (fellatio and anal intercourse), and female–male copulation (cunnilingus and penile–vaginal intercourse). Participants saw two exemplars of each stimulus category. All of these clips were excerpted from commercially available films.

The exercise clips featured solitary nude women or men engaged in a form of exercise such as yoga, calisthenics, or walking. Masturbation films featured solitary nude women or men stimulating their genitals manually. Exercise and masturbation films were presented with background music, whereas the human intercourse stimuli were presented with the sounds (music and sexual vocalizations) that originally accompanied the films. The nonhuman film was presented with nonhuman primate vocalizations and nature sounds in lieu of the original voice-over narration. The intercourse, control, and nonhuman films were identical to those used by Chivers et al. (2004) and by Chivers and Bailey (2005), except the films were abbreviated to 90 s from 120 s. A 3-min film with nonsexual content (depictions of landscapes and buildings) was used as an adaptation stimulus.

Self-Report Measures

Sexual orientation. Participants were classified as heterosexual or homosexual on the basis of their self-assessment on the Kinsey Sexual Attraction Scale (Kinsey, et al., 1948; Kinsey et al., 1953). Individuals who rated their sexual attractions as predominantly toward opposite-gender persons were classified as heterosexual (score equal to or lower than 2 on a scale from 0 to 6), and those rating their sexual attractions as predominantly toward same-gender persons (score equal to or greater than 4 on the same scale) were classified as homosexual. By this measure of sexual orientation, 20 homosexual women, 29 heterosexual women, 17 homosexual men, and 30 heterosexual men participated in the study.

In the rest of this article, we refer to women with predominantly or exclusively same-gender sexual preferences as homosexual, not lesbian, because many of these women did not identify as such: Of the 20 homosexual women we recruited, 11 identified as lesbian, 1 identified as bisexual, and 7 identified as queer; the remaining woman did not label her sexual identity. Men with predominantly or exclusively same-gender sexual preferences are described as homosexual for the same reason: Of the 17 homosexual men we

recruited, 15 identified as gay, 1 identified as bisexual, and 1 identified as queer. We also wished to avoid confusing sexual identity with sexual orientation (see Mustanski, Chivers, & Bailey, 2002).

Although interesting results have been reported in sexual psychophysiology studies of bisexual-identified male participants (see Rieger, Chivers & Bailey, 2005), we opted to exclude men or women who reported equal sexual attraction to both genders to maximize the clarity of the research design with respect to the category-specificity of gender preferences.

Personal information. Participants completed items assessing their age, romantic relationship status, sexual relationship status, education, household income, ethnicity, and employment status. Homosexual women were significantly older, $F(1, 48) = 21.52$, $p < .0001$, were less ethnically diverse, $\chi^2(3, N = 47) = 9.60$, $p = .02$, and were more likely to be employed full time, $\chi^2(3, N = 47) = 23.27$, $p < .0001$, than heterosexual women. No significant differences were observed between heterosexual and homosexual men.

Procedure. Potential participants responded to advertisements; they were screened for eligibility and were scheduled to attend testing sessions that were predominantly held in the late afternoon or early evening. All participants were asked to refrain from the following prior to testing: (a) sexual activity of any type for 24 hr, (b) physical exercise of all types for 1 hr, because sympathetic nervous system arousal due to exercise potentiates genital responses (Meston & Gorzalka, 1996), and (c) use of alcohol or recreational drugs on the day of testing. At the testing session, all participants indicated that they had complied with these requests. Participants were seated in a comfortable recliner and assessed individually in a dimly lit, private room. A standard computer monitor was placed approximately 1.5 m away at eye level. Participants received instruction on using the genital gauge and then fitted the gauge themselves in private. The experimenter (Meredith L. Chivers) instructed participants to sit as still as possible, to pay full attention to the films, to not manipulate their genital responses (e.g., by contracting their pubococcygeal muscles), and to not touch their genitals during testing. Participants watched the adaptation film and then the 18 experimental stimuli. The stimuli were separated by return-to-baseline intervals so that the participant's genital response could return to a pretrial baseline. The duration of these interstimulus intervals varied, averaging approximately 3 min. While watching the films, participants reported their subjective sexual response, using the keypad to manipulate the virtual gauge. Participants completed distraction tasks during the interstimulus intervals (e.g., counting backward from a starting number by groups of 7, reading aloud from a neutral-content magazine article) and, after the sexual arousal assessment, completed questionnaires regarding their sexual interests, sexual experience, and sexual functioning.

Data Exclusion Criteria

Participants were excluded from the data analysis if there were problems with genital data acquisition, the participants' genital responses did not reach a minimum threshold, or they could not be classified as heterosexual or homosexual. Data from 2 women were excluded because these women experienced vaginal muscle contractions during testing that resulted in unreliable VPA signals.

The remaining women ($n = 47$) demonstrated a 0.5 standard deviation or greater increase in their maximum genital response to any sexual stimulus, relative to their response to the control films, and were therefore included in the data analysis (see Chivers et al., 2004, for further details). Data were excluded from 2 men who exhibited little penile response during the testing session (defined a priori as less than 2.5 mm change in penile circumference to any sexual stimulus; see Kuban, Barbaree, & Blanchard, 1999). Data from 1 man were excluded because he reported gender identity confusion and an uninterpretable Kinsey scale score. The remaining men ($n = 44$) all showed at least a 2.5 mm increase in penile circumference and a 0.5 standard deviation or greater increase in maximum genital response to any sexual stimulus, relative to their response to the control films.

Data Reduction and Analysis

Change in genital response was calculated by subtracting pretrial baseline genital response from mean genital response to each experimental stimulus. (Pretrial baseline was established during the 5–10 s interval recorded while the participant was completing pretrial questions; these questionnaire data are not presented in this article). The resulting change scores were standardized within subjects (i.e., ipsatized). Standardization of responses within subjects controls for individual differences in responsivity and maximizes the discriminative validity of genital arousal assessment (see Harris, Rice, Quinsey, Chaplin, & Earls, 1992, regarding phallometric data). Mean values for self-reported sexual arousal, expressed as the percentage increase from pretrial baseline values, were used in the analysis. Mean subjective and genital responses to each stimulus category were then calculated by averaging over the two exemplars of each category.
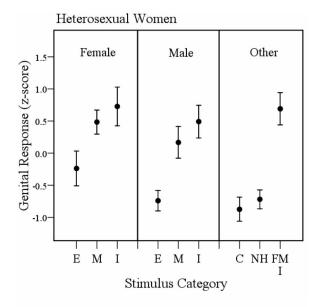
Results

In the following section, we first examine the genital responses of the female participants and then examine the genital responses of the male participants, to compare the relative effects of sexual activity cues and actor gender cues. We then examine the effects of these different kinds of cues on self-reported sexual arousal for female participants and then for male participants. We further analyze the data to examine the category-specificity of women's and men's subjective and genital responses, to replicate the major finding reported by Chivers et al. (2004). Finally, we examine the responses of women and men to the nonhuman stimulus depicting bonobos mating, to replicate the major finding reported by Chivers and Bailey (2005).

Effects of Sexual Activity and Gender

Genital Responses

Female participants. Figure 1 presents the mean genital responses for heterosexual and homosexual women. Women's vaginal responses were predicted to vary with the amount of sexual activity depicted in the stimulus; that is, women were predicted to show their highest genital responses to intercourse, to show intermediate responses to masturbation, and to show their lowest responses to films of nude men or women engaging in exercise (i.e., no sexual activity). As a test of this hypothesis, mean vaginal
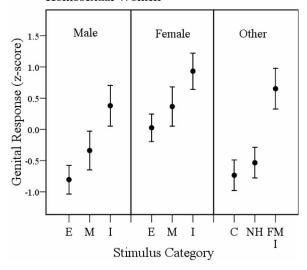
Figure 1. Heterosexual and homosexual women's mean genital response, in z scores, to all categories of stimuli. Error bars represent the 95% confidence interval for the mean. E = exercise; M = masturbation; I = intercourse; C = control; NH = nonhuman; FM I = female–male intercourse.

responses to male exercise, male masturbation, male–male intercourse, female exercise, female masturbation, and female–female intercourse were submitted to a 2 × 2 × 3 mixed-design analysis of variance (ANOVA): The two repeated factors were Stimulus Activity (exercise, masturbation, intercourse) and Stimulus Gender (female, male), and the between-subjects factor was participant Sexual Orientation (homosexual, heterosexual).

A main effect of Stimulus Activity, $F(2, 90) = 54.82$, $p < .001$, $\eta_p^2 = .55$, was found. Planned contrasts showed that masturbation elicited significantly greater vaginal responses than exercise, $F(1, 45) = 43.78$, $p < .001$, $\eta_p^2 = .49$, and couples engaging in sexual intercourse elicited significantly greater vaginal responses than

masturbation, $F(1, 45) = 62.23$, $p < .001$, $\eta_p^2 = .58$. These results support the hypothesis that women's vaginal responses vary with the sexual activity depicted, with more explicit sexual activity eliciting stronger responses.
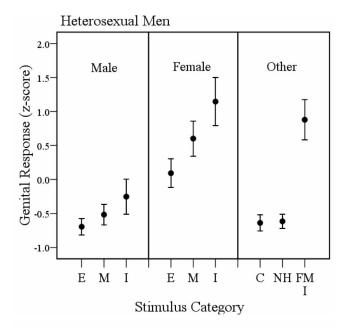
Exercise films depicted no sexual activity, so vaginal responses to these films were not expected to be significantly greater than responses to control stimuli; however, paired t tests showed that women's vaginal responses to female exercise were significantly greater than responses to the control stimulus, $t(46) = 6.43$, $p < .001$, $d = 1.24$ (Dunlap, Cortina, Vaslow, & Burke, 1996). Responses to male exercise, however, were not significantly different from the response to the control stimulus, $t(46) = -0.56$, $p = .58$, $d = 0.10$.

Women's vaginal responses to solitary nude persons exercising or masturbating were predicted to be equal across male and female sexual stimuli, consistent with previous findings regarding the nonspecificity of women's vaginal responses with regard to actor gender. Instead, a significant interaction was found between Sexual Orientation and Stimulus Gender, $F(1, 45) = 4.41$, $p = .04$, $\eta_p^2 = .09$: Homosexual women showed greater vaginal responses to female stimuli than to male stimuli and, therefore, exhibited category-specific genital responding to these films. Heterosexual women experienced similar vaginal responses to male and female sexual stimuli and therefore demonstrated a nonspecific pattern of genital response.

Two-tailed paired t tests between control films and male exercise, masturbation, and intercourse films were conducted to determine whether homosexual women showed significant vaginal responses to male stimuli. Homosexual women had significantly greater responses to male–male intercourse films than to control films, $t(19) = 4.95$, $p < .001$, $d = 1.82$, but did not show significantly greater responses to male exercise, $t(19) = 0.59$, $p = .57$, $d = 0.14$, or to masturbation films, $t(19) = 1.68$, $p = .11$, $d = 0.67$, compared with the control films. This result suggests that a category-specific pattern of genital response can be observed in women, but only among those who report a predominantly or exclusively homosexual orientation and only when they are presented with sexual stimuli that are less intense or explicit (nude figures or solitary figures masturbating).

Male participants. Figure 2 presents the mean genital responses for heterosexual and homosexual men. Mean penile responses to male exercise, male masturbation, male–male intercourse, female exercise, female masturbation, and female–female intercourse were submitted to a 2 × 2 × 3 mixed-design ANOVA. As in the previous analysis, the two repeated factors were Stimulus Activity (exercise, masturbation, intercourse) and Stimulus Gender (female, male), and the between-subjects factor was participant Sexual Orientation (homosexual, heterosexual).

A significant three-way interaction among Stimulus Gender, Stimulus Activity, and Sexual Orientation was observed, $F(2, 84) = 32.76$, $p < .001$, $\eta_p^2 = .44$. The three-way interaction indicates that both heterosexual and homosexual men exhibited significantly greater penile responses to their preferred sexual stimuli than to their nonpreferred sexual stimuli, $F(1, 42) = 111.84$, $p < .001$, $\eta_p^2 = .73$, and greater penile responses as the intensity of the preferred sexual stimulus increased, $F(2, 84) = 49.92$, $p < .001$, $\eta_p^2 = .54$. In other words, men's penile responses were category-specific, and the effect of sexual activity was mostly limited to the preferred category of sexual stimuli (females exer-
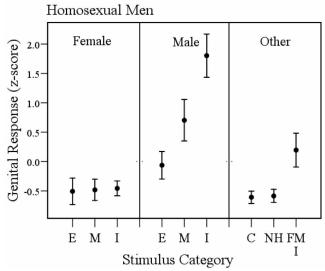
Figure 2. Heterosexual and homosexual men's mean genital response, in z scores, to all categories of stimuli. Error bars represent the 95% confidence interval for the mean. E = exercise; M = masturbation; I = intercourse; C = control; NH = nonhuman; FM I = female–male intercourse.

cising, masturbating, or engaging in sexual intercourse for heterosexual men; males exercising, masturbating, or engaging in sexual intercourse for homosexual men).

Two-tailed paired t tests between men's genital responses to the control films and men's genital responses to each level of sexual activity featuring the nonpreferred gender were conducted separately for heterosexual and homosexual men, to determine whether men showed significant penile responses to nonpreferred sexual stimuli. Heterosexual men had significant increases in penile responses to the male–male intercourse, $t(26) = 2.36$, $p = .03$, $d = 0.67$, but not to the male masturbation, $t(26) = .91$, $p = .37$, $d =$

0.22, or exercise films, $t(26) = -1.16$, $p = .26$, $d = 0.19$. Homosexual men showed an increase in penile responses to female–female intercourse that approached statistical significance, $t(16) = 2.02$, $p = .06$, $d = 0.67$, but not to female exercise, $t(16) = 1.46$, $p = .16$, $d = 0.29$, or to masturbation films, $t(16) = 0.93$, $p = .37$, $d = 0.43$. Thus, the sexual activity presented in the intercourse films was sufficiently intense to generate an increase in genital response to nonpreferred sexual stimuli in both heterosexual and homosexual men.
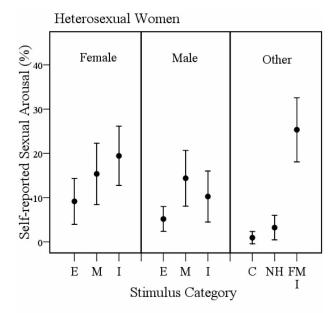
Subjective Responses

Female participants. Figure 3 presents the mean self-reported sexual arousal for heterosexual and for homosexual women. Mean subjective responses to male exercise, male masturbation, male–male intercourse, female exercise, female masturbation, and female–female intercourse were submitted to a 2 × 2 ×3 mixed-design ANOVA that was identical to the ANOVAs described for genital responses.

Women's self-reported sexual responses were predicted to vary with the amount of sexual activity depicted in the stimulus. As expected, there was a significant main effect of Stimulus Activity, $F(2, 90) = 25.39$, $p < .001$, $\eta_p^2 = .36$. There was also a significant interaction between Stimulus Gender and Stimulus Activity, $F(2, 90) = 5.85$, $p = .004$, $\eta_p^2 = .12$. All women reported significantly greater sexual arousal to masturbation than to exercise films, $F(1, 45) = 27.18$, $p < .001$, $\eta_p^2 = .38$, and to intercourse than to masturbation films, $F(1, 45) = 5.97$, $p = .02$, $\eta_p^2 = .12$. The effect of sexual activity was significantly different, however, for homosexual and heterosexual women's subjective responses to intercourse and masturbation films, $F(1, 45) = 6.08$, $p = .02$, $\eta_p^2 = .12$. Heterosexual women reported greater sexual arousal to male masturbation than to male–male intercourse, whereas homosexual women were more sexually aroused by male–male intercourse than by male masturbation.

Women's subjective responses were expected to be category-specific. There was a significant main effect for Stimulus Gender, $F(1, 45) = 26.22$, $p < .001$, $\eta_p^2 = .37$, and a significant two-way interaction between Stimulus Gender and Sexual Orientation, $F(1, 45) = 7.10$, $p = .01$, $\eta_p^2 = .14$. All women reported greater subjective responses to the female films; however, homosexual women rated these films as significantly more arousing than heterosexual women did ($M = 21.25$ vs. $M = 14.65$, respectively), and heterosexual women rated the male stimuli as significantly more arousing than homosexual women did ($M = 9.93$ vs. $M = 6.30$). Heterosexual women's subjective responses were not category-specific because they reported greater response to female stimuli than to male stimuli; homosexual women's subjective responses were somewhat category-specific because they reported greater sexual arousal to female stimuli than to male stimuli, but they also reported some sexual arousal to male stimuli.

Male participants. Figure 4 presents the mean subjective responses for heterosexual and homosexual men. Mean continuous self-report of sexual arousal was submitted to a 2 × 2 × 3 mixed-design ANOVA, as in the previous analyses.

Men's subjective sexual responses were expected to be category-specific and were expected to show an effect of sexual activity. The three-way interaction among Stimulus Gender, Stim-
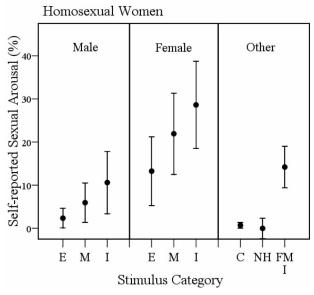
Heterosexual Women

Homosexual Women

Figure 3. Heterosexual and homosexual women's mean self-reported sexual responses, in percentage increase from baseline, to all categories of stimuli. Error bars represent the 95% confidence interval for the mean. E = exercise; M = masturbation; I = intercourse; C = control; NH = nonhuman; FM I = female–male intercourse.

ulus Activity, and Sexual Orientation was significant, $F(2, 84) = 20.22$, $p < .001$, $\eta_p^2 = .33$, and supported these predictions. As with their genital responses, heterosexual men and homosexual men reported significantly greater sexual arousal to stimuli that depicted their preferred gender, $F(1, 41) = 61.59$, $p < .001$, $\eta_p^2 = .60$, and their subjective responses generally showed a sexual activity effect for their preferred gender, $F(2, 84) = 38.12$, $p < .001$, $\eta_p^2 = .48$. Heterosexual men, however, reported similar increases in sexual arousal to female–female intercourse and female masturbation ($M = 24.10$ vs. $M = 23.59$, respectively).

Concordance Between Genital and Subjective Sexual Arousal

The agreement between genital and self-reported sexual arousal (concordance) was computed for each participant, across all 18 stimuli, for a total of 18 pairs of data points per participant. Mean change in subjective or genital sexual response, in standardized units, was used as the dependent variable. Mean subjective–genital correlations were computed by calculating the Pearson correlation coefficient for each participant, z transforming the correlation, calculating the mean z-transformed correlation for each of the four
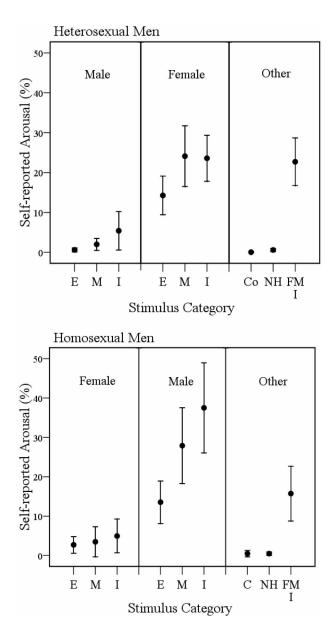
Heterosexual Men

Homosexual Men

Figure 4. Heterosexual and homosexual men's mean self-reported sexual responses, in percentage increase from baseline, to all categories of stimuli. Error bars represent the 95% confidence interval for the mean. E = exercise; M = masturbation; I = intercourse; C = control; NH = nonhuman; FM I = female–male intercourse.

gender by sexual orientation groups, and back-transforming the resulting mean to a Pearson correlation coefficient.

These correlations were large for heterosexual and homosexual men, $r(27) = .82$ and $r(17) = .85$, respectively. The correlations for heterosexual and homosexual women were lower, $r(27) = .56$ and $r(20) = .58$, respectively, but were higher than are typically found; in a recent meta-analysis of studies that have examined concordance, an average correlation of .30 for women and .68 for men was found (Chivers, Seto, Lalumière, Laan, & Grimbos, 2005). However, the correlations obtained in the present study were quite similar to those reported by Chivers et al. (2004), .48 for women and .88 for men, and did not differ across sexual orientation for either women or men.

Replication of the Gender Difference in Category-Specificity

To compare category-specific responding in this sample with the results of Chivers et al. (2004), we computed a male–female difference score by subtracting responses to the female stimuli from responses to the male stimuli, across each sexual activity (exercise, masturbation, intercourse) and type of response (genital, self-reported). A more positive difference score indicates greater response to male stimuli, whereas a more negative difference score indicates a greater response to female stimuli. Correlations between the resulting difference scores and Kinsey Sexual Attraction ratings (reverse coded for women, such that high ratings indicate greater attraction to men) were calculated to provide estimates of category-specificity with regard to gender (see Table 1); in other words, the correlations indicate the extent to which participants' Kinsey ratings corresponded to their subjective and genital response.

The correlation values that were obtained are very similar to those reported by Chivers et al. (2004): For female participants, the correlations between self-reported arousal and sexual orientation were significant and positive, whereas correlations between genital arousal and sexual orientation were not statistically significant. For male participants, both genital sexual arousal and self-reported sexual arousal were strongly and significantly correlated with sexual orientation. Correlations obtained for male participants were significantly greater than were those obtained for female participants for both genital and self-reported sexual responses to all categories of sexual stimuli.

Replication of a Gender Difference in Response to Nonhuman Stimuli

Chivers and Bailey (2005) reported that heterosexual female participants showed a significant increase in vaginal responses to depictions of bonobo chimpanzee copulation, compared with responses to control films, but did not report increased subjective sexual arousal to the nonhuman films. Male participants did not show any subjective or penile response to the films of bonobos mating.

Paired t tests comparing participants' mean sexual responses with the nonhuman and control films were conducted for women and men separately, collapsing across sexual orientation, to determine whether the present study replicated these results. For women, there was a significant vaginal response, $t(46) = 2.10$, $p = .04$, $d = 0.38$, but no increase in self-reported sexual arousal, $t(46) = 1.16$, $p = .25$, $d = 0.19$. For men, there was no significant increase in either penile responses, $t(43) = 0.37$, $p = .71$, $d = 0.05$, or subjective responses, $t(42) = 1.50$, $p = .14$, $d = 0.17$. Thus, the present study replicated the main finding reported by Chivers and Bailey (2005) in a new sample of women and men.

Discussion

Summary

The results of the present study were consistent with our hypotheses. Sexual activity was a stronger determinant of women's sexual response than was the gender of the actor(s) in the sexual films, whereas for men, actor gender was a stronger determinant of their sexual responses. The response patterns of homosexual and heterosexual men were essentially mirror images of each other, with both their subjective and penile responses corresponding to their preferred gender. There was a significant effect of sexual activity on male sexual responses, but primarily for their preferred gender. A different pattern of results was found for heterosexual and homosexual women. Heterosexual women's subjective and vaginal responses varied as a function of sexual activity but not actor gender, whereas homosexual women's sexual responses varied as both a function of sexual activity and actor gender. The effects of actor gender cues and sexual activity cues are summarized and discussed in the following sections.

Table 1

Within-Group Correlations Among Male–Female Difference Scores and a Continuous Measure of Sexual Orientation, for Each Type of Sexual Activity and Sexual Response

	Genital response			Self-reported response		
Sample	Exercise	Masturbation	Intercourse	Exercise	Masturbation	Intercourse
Female participants	.23	.22	.24	.42**	.55***	.36*
Male participants	.64***	.78***	.83***	.74***	.77***	.74***
z[a]	−2.41**	−3.79***	−4.35***	−2.32*	−1.85*	−2.64**

[a] Fisher's z-test for the significance of the difference between female participants' correlations and male participants' correlations (Cohen & Cohen, 1983).
* $p < .05$.   ** $p < .01$.   *** $p < .001$.

The Critical Features of Sexual Stimuli

Gender cues. There was a significant effect of gender cues on the subjective and genital responses for both heterosexual and homosexual men but not for heterosexual women. Unlike previous studies, homosexual women in the present study showed category-specific vaginal responding to depictions of solitary male targets or female targets exercising or masturbating but showed nonspecific responding to depictions of couples engaged in intercourse.

It is possible that the specificity of homosexual women's vaginal responses is overwhelmed by a sexual activity effect when the stimuli are sufficiently intense; this would explain the nonspecificity of homosexual women's sexual responses when they are presented with explicit films of couples engaging in intercourse (Chivers et al., 2004; Chivers & Bailey, 2005; Laan, Sonderman, & Janssen, 1995; Wincze & Qualls, 1984). It is interesting to observe in this context that explicit depictions of sexual intercourse are also sufficiently intense to elicit a small genital response to nonpreferred actors in men; heterosexual men produced a significant increase in penile response to depictions of two men engaged in intercourse, whereas homosexual men produced a response, which approached statistical significance, to depictions of two women engaged in intercourse. This finding has been reported by other investigators (e.g., Mavissakalian et al., 1975; Sakheim et al., 1985; Steinman et al., 1981; Wincze & Qualls, 1984). These penile responses to nonpreferred stimuli, however, were much less than the penile responses to depictions of the preferred gender, even when no sexual activity was shown (nude exercise).

As a group, women reported greater sexual arousal to stimuli depicting female targets than to stimuli depicting male targets. This seems counterintuitive, yet it is consistent with past sexual psychophysiology research. Both lesbian and heterosexual women report greater sexual arousal to stimuli depicting female targets (heterosexual or lesbian couples) than to stimuli depicting only male targets (Chivers et al., 2004; Chivers & Bailey, 2005; Steinman et al., 1981; Wincze & Qualls, 1984). Why would women report greater sexual arousal to female targets, especially when, for heterosexual women, female targets are not of the preferred gender? One possible explanation is that women identify with the depicted female targets. Approximately 30 years ago, Symons (1979) proposed that men and women differ in their responses to visual sexual stimuli, whereby men attend to the physical characteristics of actors and women identify with the actors, imagining themselves in the sexual interaction. Symons suggested that women would experience greater sexual arousal (he did not distinguish between subjective or genital response) to films that depict women because these films would allow women to identify with the female actor. Consistent with this idea, women's self-reported sexual arousal is positively related to imagining oneself as a participant in the sexual activities that are portrayed (Janssen, Carpenter, & Graham, 2003).

The current study cannot directly address the merits of the identification hypothesis regarding gender differences in sexual responding. We believe, however, that this explanation is not sufficient because it cannot explain why women respond subjectively and genitally to films of two men having sexual intercourse or why women respond genitally to films of bonobos mating. Further research is needed on the appraisal and meaning of sexual stimuli and on the relationship between these cognitive processes and physiological sexual response.

Sexual activity cues. Our results replicate previous research in which it was found that heterosexual women produced genital responses that are related to the intensity of the sexual stimuli (Laan, Everaerd, van der Velde, & Geer, 1995; Both et al., 2005). Men also demonstrated this effect of sexual activity cues, but the effect was primarily restricted to stimuli that depicted their preferred gender. Women, but not men, showed a small increase in genital response to the nonhuman sexual stimulus, replicating the results of Chivers and Bailey (2005), even though the length of the film clip was 30 s shorter in the current study and though these clips were presented twice rather than once. This suggests that vaginal responding to nonhuman sexual activity is a reliable effect. In a similar vein, homosexual women produced significant vaginal responses to films of male targets engaged in sexual intercourse and heterosexual women produced a significant vaginal response to films of female targets masturbating; it seems that women can become genitally aroused by cues of sexual activity, even when the actors are of the nonpreferred gender (or species).

Consistent with previous studies, heterosexual women did not show significant vaginal responses to nude male exercisers. This result nicely illustrates the gender and sexual orientation differences in sexual responding, as homosexual women and both homosexual and heterosexual men do respond to depictions of a nude person of their preferred gender, even when they are engaging in a nonsexual activity like exercise. It is also consistent with research that suggests heterosexual women report less interest than men or lesbian women in visual sexual stimuli featuring nude people of their preferred gender (Bailey, Gaulin, Agyei, & Gladue, 1994).

Although it was unexpected, heterosexual women did show some sexual response to the solitary female exercisers. Although the exercise films were selected to depict no sexual activity, some aspect of these films was perceived as sexual by women, as indicated by their small but significant subjective and genital responses. We speculate that this responding may be a result of an unforeseen confound in the exercise stimuli. As the women exercised, their vulvas were sometimes exposed, for example, during leg raises or certain stretches. The genitals of the men who exercised were in plain view during the entire film presentation, but their penises were flaccid. Seeing an exposed vulva is unusual outside of sexually intimate situations, so women may have interpreted the sight of an exposed vulva as sexual. In contrast, seeing a flaccid penis is not restricted to sexual situations, unlike seeing an erect penis. If our speculation is correct, then we can expect no sexual response from heterosexual women to a film of exercising women who did not expose their vulvas and a significant sexual response to depictions of exercising nude men with erect penises.

There is some support for the idea that an exposed vulva or an erect penis are prepotent sexual stimuli from another line of research: In a study of brain activation to images of erect penises and engorged vulvas, Ponseti et al. (2006) found that both women and men showed greater activation of the brain regions associated with incentive motivation when viewing images of aroused genitalia of their preferred gender. It is unclear, however, whether this pattern of neural activation reflects sexual arousal, as the researchers did not assess subjective or genital responses. Future sexual psychophysiological research could test the prepotency of genital

cues by presenting close-up images of genitals in different states (e.g., exposed vulva vs. vulva obscured by pubic hair, flaccid penis vs. erect penis).

Possible Explanations for the Gender Differences in the Specificity of Sexual Responding

The nonspecificity of heterosexual female sexual responses and the specificity of male sexual responses are congruent with research in which other psychophysiological methodologies, such as viewing time measures, electroencephalograms, or functional magnetic resonance imaging were used to examine gender differences in the specificity of sexual responding (Costa, Braun & Birbaumer, 2003; Costell, Lunde, Kopell, & Wittner, 1972; Hamann, Herman, Nolan, & Wallen, 2003; Wallen, 2006; Wright & Adams, 1999). For example, Wallen (2006) reported that heterosexual men showed greater activation of brain areas associated with sexual arousal to preferred, compared with nonpreferred, sexual stimuli, whereas heterosexual women did not show this differential activation. The general pattern of results from these different lines of research is that men show significantly greater responses to preferred than to nonpreferred stimuli, whereas women do not. Below, we consider possible explanations for this gender difference.

Excitation transfer. Why do women, but not men, show substantial genital responses to depictions of nonhuman copulation or depictions of nonpreferred couples engaging in sexual intercourse? One possibility is excitation transfer, whereby watching taboo or nonpreferred sexual stimuli elicits greater general, nonsexual arousal among women than among men and this general arousal is interpreted as sexual arousal or facilitates sexual response (see Meston & Frolich, 2003). Studies of women's responses to sexual fantasy, however, suggest that taboo themes are rated as less sexually arousing than depictions of consensual genital sexual contact (Meuwissen & Over, 1991), and measures of general arousal, such as skin conductance, are not significantly correlated with measures of sexual response during presentations of sexual stimuli (Laan, Sonderman, & Janssen, 1995). Vaginal vasocongestion is a specific response to sexual stimuli and is not elicited by generally arousing films that evoke feelings of anxiety or exhilaration (Laan, Sonderman, & Janssen, 1995; Suschinsky et al., 2007). It seems unlikely, therefore, that a gender difference in excitation transfer can explain the gender difference in specificity of sexual response.

Male inhibition of response. Category-specific responding in men may occur because men inhibit their subjective and genital responses to nonpreferred stimuli. There is evidence that men have some voluntary control over their penile responding, and it is possible that homophobia causes heterosexual men to inhibit their sexual responses to depictions of men. However, preliminary findings suggest it is unlikely that men inhibit sexual response to nonpreferred stimuli: Adams, Motsinger, McAnulty, and Moore (1992) demonstrated that men are able to reduce but not increase their responses to nonpreferred sexual stimuli, whereas Safron et al. (2007) did not observe activation in brain areas associated with suppression of sexual arousal (i.e., right superior frontal and anterior cingulate cortices, see also Beauregard, Lévesque, & Bourgouin, 2001) when gay and heterosexual men viewed nonpreferred sexual stimuli. We also note that men do demonstrate moderate

increases in genital responding to films of their nonpreferred gender target engaged in sexual intercourse; therefore, the difference in women's and men's sexual arousal patterns is one of degree rather than kind.

Female flexibility. Another possibility is that nonspecificity of female vaginal responding—across different levels of sexual activity for heterosexual women and for depictions of intercourse for homosexual women—may be a manifestation of greater female flexibility. Another example of female flexibility in sexuality is the relatively modest agreement between continuously assessed subjective and genital sexual arousal observed across sexual psychophysiology studies that report data for both measures (Chivers et al., 2005). As we mentioned in the introduction, there is also evidence that women have greater flexibility in sexual attitudes, sexual behaviors, and sexual preferences than do men (Baumeister, 2000). Nonspecificity of genital responding may therefore be part of a broader pattern in female sexuality. Indeed, some have speculated that this pattern, in which one sex is categorical with respect to their sexual interests whereas the other is more flexible, is characteristic of mammalian species (Goy & Goldfoot, 1975); among humans, women may be the more flexible sex.

Is Female Sexual Responding Automatic?

Flexibility in genital sexual responding may be related to the automaticity of female genital arousal. It has been suggested that vaginal responding is reflexively activated by sexual stimuli (Chivers, 2005; Laan & Everaerd, 1995). Genital response precedes subjective sexual arousal (Lake Polan et al., 2003), can be observed within seconds of the onset of a sexual stimulus (Laan & Janssen, 2007), and can occur in the absence of subjective sexual arousal (Chivers & Bailey, 2005). Reflexive vaginal responding may have had fitness benefits for our female ancestors because vaginal vasocongestion produces lubrication, which reduces the likelihood of injury and subsequent infection during vaginal penetration. Ancestral women who did not reflexively lubricate would have been more likely to experience injuries or infections that could have rendered them reproductively sterile or resulted in their deaths. According to our research, seeing a nude person is not sufficient to elicit a vaginal response among heterosexual women; instead, depictions of sexual activity, either in the form of masturbation or sexual intercourse or nonhuman mating, are necessary. For homosexual women, whose sexual arousal patterns are less female-typical, more intense depictions of sexual activity, such as sexual intercourse, are necessary for reflexive vasocongestion to occur when films do not portray their preferred gender of actor.

Sexual Orientation and Sexual Responding Among Women

The difference between heterosexual women and homosexual women in the specificity of their sexual responding can be viewed as a difference in the threshold at which the effect of sexual activity cues exceeds the effect of gender cues. Thus, homosexual women are more male-typical than are heterosexual women in this threshold, showing category-specificity to depictions of solitary nude figures exercising or masturbating. Diamond (2005) has distinguished between homosexual women with a more stable lesbian sexual identity and those with a more fluid lesbian sexual

identity. It is possible that women with a more stable lesbian sexual identity are even more category-specific in their sexual responding; however, we were not able to test this hypothesis because our sample of homosexual women was not assessed for the temporal stability of their sexual identity. One could also compare the sexual responding of homosexual women with an exclusive attraction to other women versus those who also have some attraction to men; between homosexual women with, versus homosexual women without, a history of sexual contacts with men; and between homosexual women who are more masculine and those who are more feminine (e.g., Singh, Vidaurri, Zambarano, & Dabbs, 1999).

The reliable observation that heterosexual women's sexual responses do not distinguish between depictions of female targets or depictions of male targets does not mean heterosexual women are bisexual in orientation. Heterosexual women do not identify as bisexual, and they clearly do not make symmetrical choices regarding the gender of their sex partners, as evidenced by their much greater involvement with men than with women and by their reported preference for men in their sexual thoughts, fantasies, and attractions. To conclude that women are bisexual on the basis of their sexual responding overlooks the complexity and multidimensionality of female sexuality.

Instead of a sexual orientation linked to sexual responding, women's romantic and sexual partner choices may be more influenced by their emotional attachments (see Diamond, 2003). Diamond suggested that the processes underlying romantic and affectionate bonding are not intrinsically gendered (i.e., oriented toward female targets or male targets) and, particularly among women, have the capacity to kindle sexual desire. For an ostensibly heterosexual woman, sexual desire for another woman may emerge from a close emotional relationship instead of from sexual attraction to and arousal by women. Self-report data on the development of female sexual orientation support this proposition; women report that social and emotional factors are more salient than sexual arousal to the development of their sexual interests in the same gender (Diamond, 2000a, 2000b) or opposite gender (Knoth, Boyd, & Singer, 1988), whereas men indicate sexual arousal is more salient than the other factors (Savin-Williams & Diamond, 2000). The current study demonstrates that female sexual response, among heterosexual women, is also not intrinsically gendered and that female sexual response may thus facilitate greater flexibility of sexual expression.

Study Limitations

Volunteers for sexual psychophysiology research are not representative of the general population (e.g., Morokoff, 1986; Wolchik, Braver, & Jensen, 1985). Compared with the general population, volunteers for sexual psychophysiology research report more sexual partners, greater masturbatory and noncoital sexual experiences such as oral sex, more liberal sexual attitudes, less sexual inhibition, and more interest in and experience with sexually explicit materials (Morokoff, 1986; Wolchik et al., 1983, 1985). The gender and sexual orientation differences reported in this study, especially the nonspecificity of vaginal responses observed among heterosexual women, may be limited to those individuals who volunteer for sexual psychophysiology research. If this is correct, sexuality variables such as those listed above should

be related to the specificity of sexual responding. In a test of this idea, however, Chivers et al. (2004) found no such relationships, suggesting nonspecificity of genital response is not an artifact of a recruitment bias among heterosexual women. Because the present results converge with the results from studies that examined sexual responses with the use of other assessment methodologies, we believe the nonspecificity of heterosexual women's vaginal response is not restricted to our particular samples.

The present results pertain only to the processing of visual sexual stimuli. The solitary stimuli portrayed only visual sexual cues, as there were no sexual vocalizations (such as moans, sighs, or grunts) accompanying the films of nude figures exercising or masturbating. The films depicting intercourse, however, did include such sounds. It is possible that these vocalizations augment sexual responses to the visual sexual stimuli, so that the effect of sexual activity level cannot be attributed only to the visual cues that were available. In men, there is some support for the idea that such sounds matter, as Gaither and Plaud (1997) have demonstrated that the addition of auditory cues of sexual activity significantly increased men's self-reported and genital sexual arousal to their preferred sexual stimuli. For women the addition of sexual vocalizations does not appear to augment self-reported or genital sexual arousal (Lake Polan et al., 2003). The confounding of visual and auditory cues in our set of films depicting intercourse, however, does not explain why men show a category-specific pattern of sexual response, whereas heterosexual women show a nonspecific vaginal response.

Final Comments

Female and male sexual responding appear to be organized differently in terms of the relative importance of sexual activity and gender cues and in the level of agreement between subjective responses and genital responses to sexual stimuli. A unique aspect of our findings is that we directly observed a gender difference in sexual responding by objectively measuring sexual arousal with measures of genital vasocongestion. Oliver and Hyde (1993) noted that the research they reviewed in their meta-analysis of gender differences in sexuality relied on self-report, which meant it was possible that their results might be explained by a gender difference in willingness to report sexual behavior. Genital sexual arousal is less susceptible to respondent biases than is self-reported sexual arousal.

The results of the present study add to a growing body of research on the greater flexibility of women's sexuality with regard to sexual identity, same-sex attraction, and same-sex behavior (Bailey et al., 2000; Diamond, 2005; Kinsey et al., 1948, 1953; Laumann et al., 1994; Savin-Williams & Diamond, 2000). This gender difference fits into a larger pattern among mammals, in which one sex is categorical with respect to their same-sex contacts versus their opposite-sex contacts, whereas the other is more flexible (Goy & Goldfoot, 1975). It would be of great theoretical interest in the study of sexuality to identify the factors that determine which sex will be more flexible and to describe the ontogenetic and phylogenetic development of sexual flexibility.

We also found evidence of a sexual orientation difference in female sexual responses. Unlike heterosexual women, who showed nonspecific subjective and vaginal responses with regard to actor gender, homosexual women in the present study exhibited

a mix of male-typical (category-specific genital arousal to solitary nude figures exercising or masturbating) and female-typical responding (nonspecific genital arousal to couples engaged in intercourse, lower agreement between subjective and genital measures of sexual arousal). A similar pattern of results, whereby homosexual women demonstrate both gender-typical and gender-atypical traits has been reported in other domains, including mate preferences and choices, childhood gender nonconformity, and occupational preferences (Bailey et al., 1994; Bailey & Zucker, 1995; Lippa, 2002).

Our results do not speak to the origins of the mixed pattern of sexual responding among homosexual women, which could include genetic, neurohormonal, and sociocultural factors (see Mustanski et al., 2002). Further sexual psychophysiology research on the sexual responses of homosexual women and on distinguishing lesbian subtypes—with the use of markers of neurohormonal exposure, measures of socialization and sociocultural values, and measures of other domains in which gender and sexual orientation differences have been found—could contribute to our understanding of the development of sexual orientation among women. Such research could also shed more light on our more general understanding of human sexual arousal and processing of sexual stimuli.

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