CATEGORY-SPECIFICITY OF WOMEN'S SEXUAL AROUSAL ACROSS THE MENSTRUAL CYCLE

by

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Abstract

Unlike men, women’s genital arousal is category-nonspecific with respect to sexual orientation, such that their genital responses do not differentiate stimuli by gender. A possible explanation for women’s nonspecific sexual response is the inclusion of women at different phases of the menstrual cycle or women using hormonal contraceptives in sexual psychophysiology research, which may be obscuring a specificity effect. The present study employs the ovulatory-shift hypothesis – used to explain a shift in women’s preferences for masculine traits during peak fertility – as an explanatory model for women’s nonspecific sexual arousal. Twenty-nine naturally-cycling women were tested at two points in their menstrual cycles (follicular and luteal) to determine the role of hormonal variation, as estimated by fertility status, on the specificity of genital (using vaginal photoplethysmograph) and subjective sexual arousal. Cycle phase at the time of first testing was counterbalanced; however, no effect of order was observed. Inconsistent with the ovulatory-shift model, the predicted mid-cycle shift in preferences for masculinity or sexual activity at peak fertility was not obtained.

Category-specificity of genital arousal did not increase during the follicular phase. A statistical trend was observed for higher genital arousal to couple sex stimuli during the follicular phase compared to the luteal phase, suggesting that women’s genital arousal may be sensitive to fertility status with respect to sexual activity (specifically, couple sex), but not gender. Subjective arousal was not
influenced by fertility status. This study is the first to provide evidence that women’s genital arousal may be influenced by the probability of conception.
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Chapter 1

Introduction

Sexual orientation is not as strong a predictor of genital arousal for women as it is for men. Men’s genital arousal is category-specific (Chivers, Seto, & Blanchard, 2007; Freund, 1964), that is, men show their highest genital responses to sexual stimuli depicting their preferred gender (e.g., heterosexual men prefer stimuli with female targets). Women’s genital arousal, in contrast, is termed category-nonspecific, as women show genital responses to their preferred and non-preferred genders (Chivers & Bailey, 2005; Chivers, Rieger, Latty, & Bailey, 2004; Chivers, et al., 2007; Petersen, Janssen, & Laan, 2009; Suschinsky, & Lalumière, 2011). The ovulatory-shift hypothesis predicts that women may show a preference for more masculine characteristics when the probability of conception is high. It is possible that the same hormonal mechanisms underlying mate preference may similarly effect sexual arousal, thus, including women at different points of the menstrual cycle and women on hormonal contraceptives (HC) may be obscuring a specificity effect. The present study aims to investigate the role of fertility status in women’s category-specificity of genital and subjective arousal.

The Ovulatory-Shift Hypothesis

The menstrual cycle lasts an average of 28 days in the human female (Naik & Pennington, 1981), and is divided into three phases based on the probability of
conception, or the likelihood that a single act of coitus will result in pregnancy at any given phase (Barrett & Marshall, 1969; Regan, 1996; see Figure 1).

Figure 1. Schematic of the menstrual cycle in human women detailing changes in basal body temperature and hormonal levels (follicle stimulating hormone (FSH), luteinizing hormone (LH), estrogen, and progesterone) by day. Cycle phase is divided into three phases based on fertility status, including menstruation (day one to five), follicular phase (day six to 15), ovulation (day 14 or 15), and luteal phase (day 16 to 28). For the purpose of the present study, the follicular phase (high probability of conception) is defined as six to zero days prior to ovulation, and the luteal phase (low probability of conception) is defined as six to 11 days following ovulation (these time periods are highlighted in red). Adapted from Isometrik (Artist). (2009). Diagram of the menstrual cycle (based on several different sources [Diagram]. Retrieved from http://en.wikipedia.org/wiki/File:MenstrualCycle2_en.svg
During the first phase – *menstruation* (day one to five) – the uterine lining sheds and, in a woman with a regular menstrual cycle, the probability of conception is low (Regan, 1996); less than 1% probability that a single act of unprotected sex will result in pregnancy (Wilcox, Dunson, Weinberg, Trussell, & Bair, 2001). This is followed by the *follicular phase* (day six to 14), in which a woman experiences an increase in her probability of conception during the five days prior to ovulation, to approximately 6% (Dunson, Colombo, & Biard, 2002; Gangestad, Thornhill & Graver-Apgar, 2005; Kerin, 1982; Wilcox et al., 2001), at which point it peaks with the release of an ovum at 8% probability of conception (day 14 or 15) (Guida, Tommaselli, Palomba, Pellicano, Moccia, Di Carlo, et al., 1999; Puts, 2006; Wilcox, et al., 2001). The final stage of the menstrual cycle, the *luteal phase* (day 15 to 28), marks a drastic reduction in the probability of conception to approximately 2% (Dunson et al., 2002; Wilcox et al., 2001), and shows the least variability in length (Nelson, 2000).

The human female experiences only a small window of fertility in her menstrual cycle; however, unlike most mammalian species, she remains receptive to coitus regardless of her probability of conception. A growing body of research suggests that, in order to maximize inclusive fitness, natural selection has favoured adaptations in women’s mating behaviour that are sensitive to her probability of conception (for a review see Thornhill & Gangestad, 2008); although her receptivity for coitus does not change with fertility status, there is evidence to suggest that a woman's mate preference and mating behaviours do. This dynamic mating strategy is predicted by the *ovulatory-shift hypothesis*. The current study intends to examine
whether women’s sexual arousal is similarly influenced by the ovulatory-shift hypothesis.

According to the classical parental investment theory (Trivers, 1972), the cost of reproduction is much smaller for men (the amount of energy to produce a single ejaculate) relative to even the minimal cost of childrearing for women (gestation, lactation, early childcare) therefore women must be highly discriminating in their mate choices. In choosing a reproductive mate, women can assess potential male partners on two resources; heritable fitness and the provision of resources. High genetic quality is represented through secondary sex characteristics, which are costly phenotypic markers to produce and thus are commonly observed in animal models as relatively accurate indications of genetic fitness (Maynard Smith, 1985). According to the immunocompetence handicap model (Folstad & Karter, 1992), the androgenic hormone testosterone (which is associated with phenotypic masculinity in humans) acts as an immunosuppressant (Kanda, Tsuchida, & Tamaki, 1996), such that only men of superior genetic quality can afford to display masculine features (Rhodes, Chan, Zebrowitz, & Simmons, 2003; Thornhill & Gangestad, 1999), including low voice pitch (Feinberg, et al., 2006) or facial masculinity (Johnston, Hagel, Franklin, Fink, & Grammer, 2001). As a result, these features are found attractive by the opposite sex (Johnston, et al., 2001). However, high levels of androgenic testosterone are associated with marital instability (Booth & Dabbs, 1993), lower levels of attachment in relationships (Burnham, et al., 2003), and lower levels of parental investment (Gangestad & Simpson, 2000; Penton-Voak & Perrett, 2001; Putz, 2003). Thus, it is possible that
women have evolved a strategic mating strategy to shift their priorities from high genetic quality during peak fertility (the follicular phase of the menstrual cycle), when the probability of conception is high, to childcare and parental contributions when the probability of conception is low (the luteal phase; Gangestad et al., 2005; Penton-Voak, et al., 1999). Therefore, when the probability of conception is highest a preference for heritable fitness has been observed in women in an experimental setting (which women can acquire from masculine men), and when the probability of conception is comparatively lower their preferences have shown to shift to the attainment of resources (which women are more likely to acquire from less masculine men).

Many studies have illustrated that women’s preferences for masculine traits vary as a function of the menstrual cycle. Preferences for facial masculinity (Frost, 1994; Johnston et al., 2001; Penton-Voak & Perrett, 2000; Penton-Voak et al., 1999) low facial asymmetry (Little, Jones, Burt, & Perrett, 2007), vocal masculinity (Feinberg, et al., 2006; Putts, 2005), and skin quality (Jones, et al., 2004) increase during the follicular phase of the menstrual cycle. Women also prefer more masculine body shapes (Little, Jones, & Burriss, 2007), and masculinized biological movement (Provost, Troje, & Quinsey, 2009) when fertile. Another cue of masculinity – dominance – elicits higher ratings of attractiveness during the follicular phase across multiple modalities, including men’s body odors (Havlicek, Robets, & Flegr, 2005), personality characteristics (Lukaszewski & Roney, 2009), and visual behavioural displays (Gangestad, Simpson, Cousins, Garver-Apgar, & Christensen, 2004; Gangestad, Garver-Apgar, Simpson, & Cousins, 2007).
Furthermore, women experience a peak in sexual behaviour when most fertile; they are more likely to engage in erotic fantasies (Dawson, Suschinsky, & Lalumière, in press; Gangestad, Thornhill, & Garver, 2002), and are more likely to attend social gatherings where they might meet new men (Haselton & Gangestad, 2006).

A growing amount of evidence suggests that one of the proximate mechanisms mediating the ovulatory-shift hypothesis is hormone-dependent (Gangestad et al., 2005; Puts, 2006; Wallen & Rupp, 2010). For example, women’s preference for vocal masculinity decreases with predicted progesterone levels and increases with predicted prolactin levels in naturally cycling women, but not women taking hormonal contraceptives (Puts, 2006). The suppression of ovulation in women using hormonal contraceptives results in a non-variable pattern of mate preference consistent with naturally cycling women in the luteal phase; these women appear to experience no mid-cycle peak in preferences for masculinity (Jones, Little, et al., 2005; Jones, Perrett et al., 2005; Puts, 2005; Puts 2006; Welling, et al., 2007). The role of hormones in women’s sexual physiological responses remains unclear (Bancroft, 2005; Palti & Bercovici, 1967); however, observed changes in sexual preferences and behaviours over the course of the menstrual cycle suggest that hormones influence some components of female sexual responses.

**Category-Specificity of Sexual Arousal**

*Category-specificity* of sexual arousal (Chivers et al., 2004; Chivers et al., 2007) describes sexual arousal that is contingent on features, in particular the gender, of a sexual stimulus (Chivers, 2005). For example, sexual orientation
predicts that an individual has a *preferred* and a *non-preferred* gender, thus a stimulus that corresponds with a person’s stated gender preference is described as preferred (e.g., a heterosexual man's preferred stimulus is a woman), while a nonpreferred stimulus does not correspond to an individual’s stated preference (e.g., a heterosexual man’s nonpreferred stimulus is a man). Research has shown that men’s genital responses are category-specific with regards to gender of the sexual targets (Chivers, et al., 2004; Chivers, et al., 2007; Freund, 1963; Mavissakalian, Blanchard, Abel, & Barlow, 1975; Sakheim, Barlow, Beck, & Abrahamson, 1985; Tollison, Adams, & Tollison, 1979). Heterosexual men show greatest physiological arousal to female sexual targets, while homosexual men show their greatest physiological arousal to male sexual targets.

Women’s genital responses do not parallel the pattern of male sexual arousal. Heterosexual women do not demonstrate category-specificity in their genital responses; genital arousal does not differentiate between their stated preferred and nonpreferred gender (Chivers & Bailey, 2005; Chivers, et al., 2004; Chivers, et al., 2007; Petersen, et al., 2009; Suschinsky, & Lalumière, 2011). For example, heterosexual women show similar genital responses to stimuli containing both their preferred (men) and non-preferred (women) sexual targets. There appears to be a gender difference in the stimulus content that elicits genital arousal, such that men are more physiologically responsive to gender, while women are more responsive to cues of sexual activity and less responsive to the gender or even the species of the actors depicted (Chivers et al., 2007). Thus, sexual orientation does not appear to be as accurate a predictor of genital responses for heterosexual women as it is for men.
Instead, women are more responsive to the intensity of the activity presented in a sexual stimulus, in that they show the highest genital and subjective arousal to stimuli depicting couple sex, followed by masturbation, and the least amount of arousal to nude exercise, irrespective of the gender of the actors (Chivers et al., 2007).

At present, explanations for the nonspecific response patterns in women are only speculative. Fertility status has not been examined by previous research as a potential moderator of category non-specificity of women’s genital or subjective arousal in heterosexual women. If women’s sexual response follows predictions derived from the ovulatory-shift hypothesis, such that a preference for masculine/male stimuli emerges during high fertility, then including women at different phases of the menstrual cycle, as well as women using hormonal contraceptives (e.g., Suschinsky et al., 2009) may be obscuring a specificity effect in women’s genital and subjective responses. Further research is needed to determine the role of the menstrual cycle and fertility status in category-specificity of sexual arousal in heterosexual women.

Fertility and Sexual Psychophysiology

If hormonal shifts during the menstrual cycle influence mate preferences (Bancroft, 2005; Gangestad et al., 2005; Puts, 2006; Wallen & Rupp, 2010), then it follows that female sexual psychophysiology might be similarly affected. A small number of studies have investigated whether the menstrual cycle plays a role in patterns of female sexual arousal. These studies have investigated absolute levels of
response across the menstrual cycle, testing the hypothesis that women, when fertile, would show higher levels of physiological and subjective arousal to sexual stimuli than women in non-fertile phases. Mixed results have been obtained from the following studies, suggesting that the role of fertility status in absolute levels of genital and subjective arousal in women is not clear. However, no studies have looked at fertility status and category-specificity of sexual arousal in women, thus subtle shifts in sexual responses towards masculinity when fertile, for example, remains a question.

**Measurement of female genital arousal.**

The predominant measure of genital arousal in sexual psychophysiological research is vaginal photoplethysmography (VPP) (Prause & Janssen, 2009). VPP measures real-time changes in vasocongestion in the vagina associated with physiological sexual arousal. VPP consists of a small, tampon-shaped device made of clear acrylic-plastic that women insert into their vagina. A placement device, made of flexible acrylic-plastic ensures depth and orientation of the probe within the vagina (Laan, Everaerd, & Evers, 1995). The probe contains an infrared light-emitting diode (Hoon, Wincze, & Hoon, 1976) that shines onto the inner wall of the vagina, and a photosensitive cell (also contained within the probe) measures the amount of backscattered light, not absorbed by the vaginal tissue. It is assumed that the amount of backscattered light is positively correlated with the amount of blood flow circulating through the capillaries within the vaginal tissue (Sintchak & Geer, 1975), thus increased blood flow to the vagina results in an increased VPP signal.
The output of the photoplethysmograph can be quantified as two separate outputs; the Direct Current (DC) component, which produces an index of vaginal blood volume (VBV), and the Alternating Current (AC) component, which produces an index of vaginal pulse amplitude (VPA). VBV is believed to measure the total volume of blood pooled within the vaginal walls (Hatch, 1979). VPA is an assessment of phasic changes in vaginal blood flow associated with each heartbeat (Sintchak & Geer, 1975). Increases in peak-to-trough VPA amplitude correspond to greater vasocongestion and sexual arousal during a stimulus presentation (Geer, Morokoff, & Greenwood, 1974). VPA has been shown to be a more sensitive and informative measure of sexual arousal than VBV, and thus it is more commonly used within sexual psychophysiology (Geer, Morokoff, & Greenwood, 1974; Heiman, 1977; Osborn & Pollack, 1977).

VPA has been shown to demonstrate good reliability (Prause, Janssen, Cohen, & Finn, 2002; Wilson & Lawson, 1978). Evidence for its discriminative and predictive validity has been documented. For example, VPA discriminates between sexual response and physiological arousal caused by anxiety or changes in affect associated with the presented stimulus (Laan, Everaerd, & Evers, 1995; Suschinsky, et al., 2009). VPA can distinguish premenopausal women from postmenopausal women when viewing baseline response (Brotto, Basson, & Gorzalka, 2004; Brotto & Gorzalka, 2002; Laan, van Driel, & van Lunsen, 2008; Laan, van Lunsen, & Everaerd, 2001), and VPA can differentiate heterosexual from homosexual women using stimuli depicting solitary males and females, when assessed during sexual response (Chivers et al., 2007). Furthermore, sexual response measured by VPA has
been shown to predict the frequency of sexual activity following participation in a psychophysiological study (Both, Everaerd, Laan, & Spiering, 2004).

Labial thermography is another physiological measure of female genital arousal commonly used in research settings. A thermistor is attached to the labia minora using a small clip, and changes in skin temperature during genital arousal are recorded; it is assumed that temperature increases with greater vaginal vasocongestion. Like VPP, labial thermography is a reliable measure of sexual arousal (Henson, Rubin, Henson, & Williams, 1977; Henson, Rubin, & Henson, 1978; Henson, Rubin, & Henson, 1979). Labial temperature measurements and VPA are correlated for most women during the exposure of erotic stimuli (Henson et al., 1979).

Previous research.

Schreiner-Engel, Schiavi, Smith, and White (1981) were the first to investigate the influence of the menstrual cycle on genital arousal. Subjective arousal was also measured by Schreiner-Engel and colleagues, calculated by averaging two questions assessing emotional and physiological arousal on a four-point Likert scale. Thirty naturally-cycling women were assessed at three different times over the course of their menstrual cycle (follicular, ovulatory (late follicular), and luteal phases). All women engaged in erotic fantasy and listened to an auditory tape describing heterosexual erotic behaviour while their genital responses were assessed. Subjective arousal was assessed immediately following the presentation of each stimulus. Significantly higher levels of vasocongestion, as measured by VPP,
were observed during the follicular and luteal phase than during the ovulatory phase. Similarly, subjective arousal revealed a trend for the same pattern of response; however, it was not statistically significant. Although these findings were contrary to what was predicted, such that higher physiological and subjective arousal was not observed during ovulation, this study provided the first evidence that both genital and subjective levels of arousal vary as a function of the menstrual cycle.

Hoon, Vruce, and Kinchole (1982) used VPP and Likert-type scale ratings to assess genital and subjective arousal in 13 naturally-cycling women. Participants listened to erotic audiotapes describing heterosexual intercourse while their genital arousal was measured, and subjective reports were taken 30 seconds following the presentation of each stimulus. Women were assessed at five points across the menstrual cycle (menstruation, follicular, ovulatory (late follicular), luteal, and premenstrual (late luteal)). Visual inspection of the data showed maximum genital arousal during the luteal phase, although these findings did not reach significance, and subjective arousal was unchanged across menstrual phase. The authors concluded that the study showed no evidence for mid-cycle changes in sexual arousal in women.

Meuwissen and Over (1992) assessed subjective and genital responses to sexual fantasy and films of heterosexual sex in ten naturally cycling women tested five times over a single menstrual cycle (menstrual, postmenstrual (early follicular), follicular, luteal, and premenstrual (late luteal)). Genital arousal was measured using VPP and subjective arousal was measured by a verbal rating in the 90 second
interval between stimuli. No significant change in subjective arousal was observed across the menstrual cycle, although genital response varied with cycle phase; women in the premenstrual (low probability of conception) phase had significantly higher genital arousal than women in the follicular and postmenstrual phases. Once again, Meuwissen and Over (1992) demonstrated a counterintuitive effect of menstrual cycle on genital arousal, such that higher genital arousal does not appear to coincide with higher fertility, although fertility status did appear to influence women's sexual arousal.

Slob, Ernste, and van der Werff ten Bosch (1991) investigated the role of the menstrual cycle in female sexual arousal using a between-subject design testing real-time changes in labial temperature and assessing self-reported arousal contained in questionnaires filled out immediately following each stimulus presentation. Participants, consisting of 12 naturally-cycling (NC) women and a control group of 12 HC women, viewed erotic audio-visual stimuli depicting a heterosexual couple. Both groups were measured in the follicular and the luteal phase of their menstrual cycles. Menstrual cycle phase was counterbalanced, such that half of the women viewed the stimuli in the follicular phase in their first testing session and, in their second session, viewed the same stimuli in the luteal phase. The other half of the women initially viewed the stimuli in the luteal phase, and later viewed the same stimuli in the follicular phase. Slob and colleagues found no significant difference in genital arousal across cycle phase. Slob et al.’s (1991) findings contrasted with the conclusions reached by Hoon et al. (1982) and Meuwissen and Over (1992), who both found higher levels of genital arousal during
the luteal phase, but are consistent with the results of Schreiner-Engel et al. (1981).

Again, there was no effect of menstrual phase on subjective arousal.

**Order effects of testing.**

Interestingly, Slob et al.’s study (1991) produced an order effect related to menstrual phase, such that women who were first tested in the luteal phase had lower levels of genital arousal in the luteal phase (first testing session) than in the follicular phase (second testing session). In contrast, women who were first tested in the follicular phase had high levels of genital arousal in that first testing session, and continued to show equally high levels of arousal when later tested in the luteal phase. In fact, women who were tested in the luteal phase in their second session showed equally high levels of arousal as women who were tested in the follicular phase during their second testing session. These findings showed a between-subject effect, where a woman’s hormonal state when first exposed to sexual stimuli, and not her hormonal state at the time of testing influenced her initial and subsequent arousal to sexual stimuli. Slob, Bax, Hop, Rowland, and van der Werff ten Bosch (1996) replicated the findings from their 1991 study, and concluded that viewing sexual stimuli in a time of high fertility makes the stimuli more sexually relevant to the observer at subsequent exposures than viewing the stimuli in a time of low fertility.

Wallen and Rupp (2010) investigated whether the order effect, previously only seen using sexual psychophysiology, could be replicated using a different experimental modality, namely viewing-time, a reliable measure of sexual interest
in women (Brown, 1979; Conaglen & Evans, 2006; Rupp, Librach, et al., 2009; Rupp, James, et al., 2009). Wallen and Rupp (2010) tested 15 NC women at three points in the menstrual cycle (menstruation, follicular, and luteal), and 15 HC women were measured at temporal equivalents. The resultant pattern was consistent with the findings by Slob and colleagues (1991; 1996); viewing times were longer for stimuli first presented at mid-cycle (high probability of conception) and remained longer during times of low fertility compared to women who first viewed the same stimuli at a time of low fertility. Subjective ratings of stimuli attractiveness were also obtained after each viewing, but did not change with menstrual phase. Although further research is needed to understand the mechanisms underlying this order effect, Wallen and Rupp (2010) hypothesized that the hormonal conditions at the time of the sexual stimuli’s first exposure alters the stimuli’s reward value, or the positive emotional valence associated with the stimuli, which influences arousal to it at subsequent exposures. For example, exposure to a stimulus when fertile leads to the encoding of that stimulus as sexually competent, or of a high reward value (Wallen & Rupp, 2010), thus subsequent exposures to that stimulus will elicit increased sexual interest, or genital arousal. Studies that have observed cycle phase order effects in genital arousal (Slob et al., 1991; Slob et al., 1996) and sexual interest (Wallen & Rupp, 2010) suggest that the fertility status at time of testing is less important to arousal than fertility status during initial exposure to sexual stimuli.
Summary.

Researchers have provided some evidence that the menstrual cycle is a moderator of sexual arousal (Meuwissen & Over, 1992; Schreiner-Engel et al., 1981; Slob et al., 1991; Slob et al., 1996). Cycle phase seems to affect genital but not subjective arousal, although directionality cannot be determined due to incongruences in both methodologies and results across studies. Different psychophysiological measures were employed across the studies including VPP (Hoon et al., 1982; Meuwissen & Over, 1992; Schreiner-Engel et al., 1981) and labial thermography (Slob et al., 1991; Slob et al., 1996). The assessment of menstrual cycle phase varied across the studies, including a counting method (Schreiner-Engle et al., 1981), a combination of counting with basal temperature (Hoon et al., 1982), or counting with hormonal analyses (Meuwissen & Over, 1992; Slob et al., 1991; Slob et al., 1996). These methods can vary in efficacy (Regan, 1996), and may result in different classifications of fertility status. Furthermore, all studies employed the use of heterosexual couple sex as experimental stimuli, and did not vary in the couple type or the intensity of sexual stimuli. Heterosexual sex stimuli – which contains a male and a female actor – confounds gender, which does not allow for the testing of a mid-cycle shift in preferences for masculine features as predicted by the ovulatory-shift hypothesis. Further research is needed to better understand the role of the menstrual cycle in female sexual arousal, particularly with respect to category-nonspecificity of genital response.
Current Study

The phenomenon of nonspecificity of genital arousal in NC heterosexual women may be the result of including women at different stages of the menstrual cycle in psychophysiological studies. In the present study, we propose to further clarify the complex nature of female sexual arousal with respect to the menstrual cycle, which offers an indirect measure of the effect of hormones on psychophysiological mechanisms governing sexual arousal.

In the current study, we hypothesized that women would show category-specific genital and subjective arousal at peak fertility. Naturally-cycling women’s genital and subjective sexual responses to erotic stimuli, varying by gender of the actor (male or female), and the activity depicted (nonsexual nude exercise, masturbation, or couple sex), was assessed at two points in the menstrual cycle; once at the point of highest probability of conception (follicular phase) and once at the point of lowest probability of conception (luteal phase) (refer to Figure 1). Probability of conception was calculated using a forwards-backwards counting technique developed by Puts (2006).

We expected to see an interaction of menstrual cycle phase and actor gender consistent with the ovulatory-shift hypothesis (Gangestad et al., 2005), such that heterosexual women would show more genital arousal to male stimuli during the follicular phase compared to the luteal phase. Consistent with sexual psychophysiology studies (Chivers et al., 2004; Chivers et al., 2007), a main effect of sexual activity was also expected, such that stimuli increasing in sexual potency would correspond to higher levels of genital arousal independent of actor gender.
and cycle phase. During the luteal phase, we predicted category-specificity of genital arousal would mirror current findings in sexual psychophysiology (Chivers et al., 2007), such that only an effect of sexual activity of the sexual stimuli would emerge. We expected that subjective arousal during the follicular phase and the luteal phase of the menstrual cycle would mirror those predictions made for genital arousal.

Participants completed two tasks to confirm a mid-cycle shift in mate preference; the Report of Behaviour and Feeling questionnaire (Gangestad, Thornhill, & Garver, 2002), which measures sexual interest and behaviour, and a facial-rating task, where the attractiveness of averaged male and female faces ranging in masculinity and femininity are rated. We expected higher reports of sexual interest and behaviour (Gangestad et al., 2002) as well as a shift in women’s preferences towards more masculine faces during the follicular phase of the menstrual cycle (Penton-Voak & Perrett, 2000; Penton-Voak et al., 1999).

An effect of cycle phase on genital and subjective arousal at the first testing session was also expected (Slob et al., 1991; Slob et al., 1996; Wallen & Rupp, 2010). Beginning testing in the follicular phase was expected to produce higher levels of arousal in the second (luteal) testing session compared to women who started testing in the luteal phase. Beginning testing in the luteal phase was expected to show a larger increase in arousal in the second (follicular) phase.
Chapter 2

Methods

Participants

Power analysis for the repeated measures analysis of variance (ANOVA) was conducted using G*Power 3.1.2 (Faul, Erdfelder, Lang, & Buchner, 2007) to test for the main hypothesis, a gender by cycle phase interaction. After inputting the effect size (medium; \( \eta^2 = 0.25 \)), power (0.80), number of groups (cycle phase; 2), and number of measurements (gender; 2), as well as the correlation between measures, in this case vaginal pulse amplitude (VPA) and menstrual cycle phase (Pearson’s \( r = 0.62 \) (Meuwissen & Over, 1992)), calculations revealed that a sample size of 26 women was required. The final sample consisted of 29 naturally-cycling women, ages 18 to 36 (\( M_{\text{age}} = 21.5 \) years, \( SD = 4.2 \)). A post hoc power analysis revealed that a sample size of 29 women produced a power of 0.85. Women recruited for the study by responding to flyers posted on and around Queen’s University campus, St. Lawrence College campus, and downtown Kingston, Ontario. All participants received monetary compensation in the amount of $36 after each testing session, for a total of $72 for completing the study. Participants who attended both testing sessions were entered into a draw to win a “Fun and Safe Sex” gift basket containing adult friendly toys and books valued at $200, and a winner was chosen at random.
Eligibility criteria and data exclusion.

After contacting the lab, women were screened via a telephone interview to determine eligibility for the study (see Appendix A). All women were able to speak and write English fluently, were between the ages of 18 and 40, were experiencing regular menstrual cycles (no shorter than twenty-four days and no longer than thirty-two days), and had not been pregnant or nursing for a minimum of six months prior to participation in this study. Participants had no history of mental illness, substance abuse, and reported no sexually transmitted infections (STI’s). Women reported no history of sexual dysfunction (difficulty becoming sexually aroused, that is lubricated or “wet”, more than half of the time), and no history of pain during vaginal insertion (a superficial pain during more than half of any vaginal penetration or insertion activity). Participants had not been taking any form of hormonal contraceptives or hormonal medications for at least 6 months, and were not taking any other medications that may interfere with sexual responses, including medications to treat a mental illness, medications to treat high blood pressure, or cold or allergy medications that must be used on a daily basis (Meston & Frolich, 2000). Women were also excluded if they were equally or about equally sexually attracted to both women and men, women who were exclusively attracted to women, and women who have never experienced vaginal penetration during sexual activity, used menstrual tampons, or undergone a pelvic examination.

Women who scheduled an appointment with the lab were instructed to refrain from partnered sex and masturbation for twenty-four hours prior to coming to the lab, high-level exercise (aerobic exercise) for three hours prior to coming to
the lab, and any alcohol, drugs or cold medications on the day of participation in the study. Participants were randomly assigned to begin their first testing session in either the follicular phase of the menstrual cycle or the luteal phase, and the second testing session was booked when women were in the opposite phase of the menstrual cycle from which they started.

A total of 103 women contacted the Sexuality and Gender Lab in response to advertisements regarding the study: Thirty-one women declined participation in the study or did not respond further following an explanation of study procedures, 35 were excluded based on the eligibility criteria (16 of which were due to hormonal contraceptive use, four due to menstrual cycles lasting longer than 32 days, and 15 due to other eligibility criteria). Data were excluded for participants who did not attend their second testing session \( n = 6 \) and those who fell outside of the six day window for high or low probability of conception \( n = 2 \); both women reported starting their period more than five days late, making it impossible to accurately determine what cycle phase they were in during testing. The final sample consisted of 29 women; 16 who started testing in the follicular phase, and 13 who started testing in the luteal phase.

**Probability of Conception**

Consistent with the literature on hormone levels across the menstrual cycle (Puts, 2005; Regan, 1996), probability of conception (Barrett & Marshall, 1969; Schwartz, Mayaux, Martin-Boyce et al., 1979; Wilcox et al., 2001), and cycle-mediated shifts in mate preference (Gangestad and Thornhill 1998; Gangestad et al.
2004; Little, Jones & Burriss, 2007; Puts, Gaulin, Sporter, & McBurney, 2004; Thornhill and Gangestad 1999), we used a standard 28-day model of the female menstrual cycle. Women were divided into high probability of conception and low probability of conception, which correspond to the follicular and luteal phase of the menstrual cycle, respectively (Regan 1996).

Probability of conception was assessed using the forwards-backwards counting technique described in Puts (2006). This technique capitalizes on the knowledge that the length of the luteal phase shows the least amount of variability (Nelson, 2000) and is considered the most reliable method of assessing probability of conception (Harris, 2011; Regan, 1996; Wilcox et al., 2001). The onset of the participant’s next menstrual bleeding is estimated, and an approximation of the participant’s distance from ovulation (in days) is made by the backwards counting technique, assuming that ovulation occurs 15 days prior (Bakos, Lundkvist, Wide, & Bergh, 1994). Consistent with the literature, which typically reports hormone levels for a twenty-eight day cycle (Regan, 1996), all women’s follicular phases were transformed to a twenty-eight day equivalent using the equation (Puts, 2005)

\[ D_{LH(28)} = D_{LH} \left[ \frac{13}{(c - 15)} \right] \]

where \( D_{LH(28)} \) represents the distance (in number of days) from the luteinizing hormone (LH) peak (Guida et al., 1999; Puts, 2006; Wilcox, et al., 2001), or ovulation, transformed into a 28 day cycle. A positive \( D_{LH(28)} \) value represents days before the LH peak and a negative value represents days after the LH peak. The value \( c \) represents the average number of days in the participant’s menstrual cycle (the length of time between the first day of menstrual blood flow one month to the
first day of menstrual blood flow the next month). Thus, $D_{\text{LH}}$ (the estimated number of days until the participant’s LH peak) is multiplied by the average number of days prior to the LH peak in a 28 day cycle (13 days) divided by the expected number of days prior to the LH peak in a $c$-day cycle ($c - 15$ days). Because the majority of cycle variation occurs during the follicular phase (Nelson, 2000), $D_{\text{LH}}$ values for the luteal phase were not adjusted. A moderately conservative approach to grouping women in either the follicular or luteal phase of the menstrual cycle was taken, using a weighted average of steroid and peptide hormones from several published studies (see Puts, 2005) to estimate ovulation. Women who were six to zero days prior to expected ovulation in a standardized 28-day menstrual cycle ($D_{\text{LH}(28)} = 6.00$ to $0.00$) were categorized as high probability of conception, or in the follicular phase of the menstrual cycle. Women who were six to eleven days after expected ovulation ($D_{\text{LH}(28)} = -6.00$ to $-11.00$) were categorized as low probability of conception, or in the luteal phase of the menstrual cycle (Dunson, Colombo, & Biard, 2002; Gangestad, Thornhill & Garver-Apgar, 2005; Kerin, 1982; Guida, Tommaselli, Palomba, Pellicano, Moccia, Di Carlo, et al., 1999; Puts, 2006; Wilcox, et al., 2001).

Counter-balancing of order was performed to test for an order effect of cycle phase as observed by Slob et al., (1991; 1996) and Wallen and Rupp (2010). Physiological and behavioural studies have demonstrated that responses to sexual stimuli may be more influenced by cycle phase at the time of first testing than the cycle phase at any given subsequent time of testing. Cycle phase was counter-balanced by randomly assigning women to one of two groups; follicular first, or
luteal first using the online tool Research Randomizer. Women were tested in the opposite phase of the menstrual cycle in their second session.

**Apparatus and Materials**

**Demographics.**

Participants completed a paper-based questionnaire assessing age, romantic relationship status, ethnicity, educational background, employment status, and medication use. Physical exercise and substance was also assessed to confirm that participants refrained from proscribed activities or substances prior to testing.

**Menstrual cycle information.**

Using a questionnaire from Gangestad et al., (2002), menstrual cycle information was collected including history of contraceptive use, menstrual cycle length, typical variability of menstrual cycle length, and date of onset of last menstrual flow (see Appendix A). This information is sufficient to determine fertility status to a high degree of reliability (Gangestad et al., 2002; Puts, 2006).

The Report of Behaviour and Feelings (Appendix B) was administered to provide an acute measurement of affective and sexual behaviours and attitudes over the previous two days, which is effective in detecting mid-cycle shifts in sexual desires and behaviours (Gangestad et al., 2002). The first 21 questions probe women’s general mood state and behaviours, which are not expected to change with fertility status. Of the remaining 14 items, three concerned sexual feelings, attractions, and fantasies about somebody other than a current partner (so partnered and single women could be compared within this sample of women). All
questions were rated on a three-point scale, the frequency to which they had engaged in each behaviour within the past 48 hours, from 0 (not at all) to three (more than a few times). Questions included “I felt strong sexual attraction towards someone other than my current sexual partner”, “I fantasized about sex with a stranger or acquaintance”, and “I fantasized about sex with a past partner”.

**Sexual orientation.**

Sexual orientation was assessed using the Kinsey Scale (Kinsey, Pomeroy & Martin, 1948; Kinsey, Pomeroy, Martin, & Gebhard, 1953), a measure commonly used in sexual orientation research to classify a person’s sexual orientation based on romantic attractions, sexual attractions, and sexual fantasies (see Appendix C). Consistent with previous research, we used the Kinsey Sexual Fantasy Scale (Kinsey et al., 1948; Kinsey et al., 1953) to classify women’s sexual orientation (Chivers et al., 2007). The Kinsey fantasy scale is rated on a seven-point Likert-type scale where a score of 0 represents exclusively heterosexual orientation, a score of 6 represents exclusively homosexual orientation, and a score of 3 represents a bisexual orientation (Kinsey, et al., 1948; et al., 1953).

**Genital Sexual Response**

Women’s genital response was assessed using VPP, which measures real-time changes in vasocongestion in the vagina associated with physiological sexual arousal. In line with previous research (Geer, Morokoff, & Greenwood, 1974; Heiman, 1977; Osborn & Pollack, 1977), we have chosen to use vaginal pulse amplitude (VPA), an assessment of phasic changes in vaginal blood flow associated
with each heartbeat (Sintchak & Geer, 1975). As mentioned in Chapter 1, VPA is a reliable and valid assessment of genital arousal in women, whereby increases in peak-to-trough amplitude correspond to greater vasocongestion and sexual arousal during a stimulus presentation.

The VPP signal was sampled at a rate of ten samples per second, band-pass filtered (0.5 to 10 Hz), and digitized (40 Hz). A placement device made of flexible silicone was positioned 5 cm from the base of the gauge. This ensures a standardized placement of the VPP at a proper depth and orientation (Laan et al., 1995a). Movement artifacts were detected and removed from the data by visual inspection prior to data analysis.

**Subjective Sexual Arousal**

Participants reported continuous real-time subjective arousal using a hand-held number keypad that they manipulated during testing. The keypad controls a virtual gauge, represented by a bar presented on the computer monitor adjacent to the erotic stimuli. Participants were instructed to continuously report their level of subjective arousal throughout the videos, from 0% (*no level of subjective arousal*) to 100% (*the highest level of subjective sexual arousal, or a level of arousal associated with orgasm*). Previous studies have found that this real-time continuous technique is an effective measure of subjective arousal in women (Chivers & Bailey, 2005; Chivers et al., 2004; Suschinsky et al., 2009), and does not significantly interfere with female genital responses (Chivers, Seto, Lalumière, Laan, & Grimbos, 2010; Wincze, Hoon, & Hoon, 1977).
Additional self-reports of sexual arousal and affect were obtained before and after the presentation of each erotic stimulus. Before each video, participants assessed their state of sexual arousal (two items), their desire for sexual activity (two items), and affect (six items). After each video, participants were asked these same questions, as well as additional questions assessing sexual repulsion, or being “turned off” by the stimulus (one item), attention to the stimulus (one item), sexual attractiveness of the actor(s) (one item), and quality of the video (three items). All items were presented over a computer monitor and participants responded by entering the value that corresponded with their experience on a Likert scale of 0 (fully disagree with statement) to 9 (fully agree with statement) using the hand-held keypad (see Appendix D). Change scores were computed by subtracting pre-trial values from post-trial values, so that a positive change score reflects an increase in reporting, and a negative value reflects a decrease in reporting. Only self-reported arousal change scores will be reported here.

**Facial-Preference Task**

The facial-preference task was included to confirm a mid-cycle shift in mate preferences. Women participated in a forced-choice preference task during which they were required to choose the most attractive picture out of a pair of faces presented on a computer monitor. Stimuli consisted of eighteen pairs of faces (9 male and 9 female), digitally manipulated in their levels of masculinity and femininity. Participants were instructed to choose the face they found most attractive, and rate the degree to which they found it more attractive than its
counterpart. Underneath the chosen face was a four-point scale where four represented the amount that this face is more attractive than the other face is huge, and one represented the amount that this face is more attractive than the other face is a guess. A higher overall score represented a preference for facial masculinity, while a lower score represented a preference for facial femininity. This experimental design is similar to previous studies (Penton-Voak & Perrett, 2000; Penton-Voak, et al., 1999) and has been effective in showing a mid-cycle shift in preference for masculinity.

Experimental Stimuli

The experimental stimuli consisted of both neutral and erotic videos, presented with sound, previously used by Chivers, and colleagues (2007). These audiovisual stimuli have been shown to elicit both genital arousal and subjective arousal in heterosexual women. Research suggests that audiovisual stimuli is the most effective means of eliciting sexual arousal when compared to auditory narratives, guided imagery, pictures, or sexual fantasy (Abel, Barlow, Blanchard, & Mavissakalian, 1975; Chivers et al., 2010; Heiman, 1980; Julien & Over, 1988; Meuwissen & Over, 1992).

The experimental stimuli consisted of 17 videos in total. The first video – a neutral film depicting landscapes lasting approximately 200 seconds – was shown at the onset of the study in order to allow participants to adjust to the experimental procedures and to establish a baseline level of response. The remaining 16 videos were each approximately 90 seconds in length, and represented eight stimulus
categories; control (landscapes or fauna), 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, anal penetration), and male-female intercourse (cunnilingus and vaginal penetration). There were two exemplars of each stimulus category, and all of the 16 experimental videos were presented in a predetermined, randomized order using the online program Research Randomizer.

Procedure

Participants were all screened through telephone interviews to ensure they met the eligibility criteria for the present study. To assess cycle phase, participants were asked to provide information about their menstrual cycle (first day of last menstrual bleeding onset, average length of menstrual cycle) during the screening process (Gangestad et al., 2002; Puts, 2006).

Upon arrival to the Sexuality and Gender Lab, located on the Queen’s University campus, participants were greeted and oriented to the lab. Participants were familiarized with study procedures, asked to read and sign a consent form, and were ensured of confidentiality and the right to withdraw from the study at any time. Participants completed a package containing a number of questionnaires assessing personality, sexual history, and sexual attitudes (analysis of this data is not included in this paper), following which participants began the sexual psychophysiology portion of the study.
Participants were instructed to sit in a comfortable recliner chair positioned 1.5 meters from the computer monitor. Videos were presented on the computer monitor, and sound was delivered through headphones. The room was maintained at approximately 23-25°C, and dimly lit. Participants were left to insert the vaginal gauge on their own. Following the insertion of the gauge the participants were instructed to sit in the recliner chair and remain as still as possible throughout the course of the experiment so as to reduce the number of movement artifacts. Communication with the investigator was possible through a hands-free intercom, and the investigator was able to respond by written messages that appeared on the computer monitor.

During testing, participants were first shown the neutral stimulus to orient to the study procedures and establish a VPA baseline, followed by the 16 randomized erotic and neutral stimuli, interspersed with self-reported sexual arousal items, return-to-baseline intervals, and, if needed, distracter tasks (e.g., count backwards from nine-hundred, in multiples of seven) to facilitate return to VPA baseline. Participants were required to return to baseline levels of arousal prior to the onset of each new stimulus, which is usually achieved within a 60 second relaxation period. Participants reported their subjective arousal continuously over the course of the audiovisual presentations using the keypad.

Following the presentation of all of the audiovisual stimuli, participants were asked to remove the vaginal probe, at which time they were moved to a separate testing room where they performed the facial rating task. Participants then completed a second questionnaire asking about their experience participating in the
study, after which they were debriefed, thanked, and the second testing session was scheduled.

Participants returned to the lab for a second session of testing approximately two weeks later, once they were in the opposite phase of the menstrual cycle from their first testing session. The second testing session’s procedures were identical to the first session, with the exception of the questionnaire prior to physiological testing, which was reduced in length as to include only items expected to change over the course of the menstrual cycle. Monetary compensation was provided at the end of each testing session.

Data Reduction and Statistical Analyses

Data analysis was conducted to test two hypotheses: (i) Women will demonstrate category-specificity of genital sexual arousal in the follicular phase compared to the luteal phase of the menstrual cycle; (ii) Women will demonstrate category-specificity of subjective reports of sexual arousal in the follicular phase compared to the luteal phase of the menstrual cycle.

Data were analyzed using SPSS version 19.0. Statistical significance was set at $p < 0.05$. When assumptions of sphericity were not met, the Huynh-Feldt correction was used when $\varepsilon > 0.75$, and the Greenhouse-Geisser correction was used when $\varepsilon < 0.75$. 
Genital arousal.

Two values were calculated for individual scores of genital arousal; the first was a standardized score, used to assess patterns of response, and the second was a percent change score, used to provide a measure of magnitude of arousal.

First, to compute the standardized genital arousal score, an averaged pre-trial baseline arousal value was calculated to account for a potential baseline drift that occurs when genital responding does not return to pre-trial baseline following experimental stimuli (Graham, Janssen, & Sanders, 2000; Henson & Rubin, 1977; Morokoff & Heiman, 1980; Prause & Janssen, 2006). Pre-trial baseline arousal consisted of the mean genital response from a five to 10 second interval prior to the onset of each stimulus, during which time participants answered pre-trial questions. The pre-trial baseline values for all sessions were averaged, to create a mean pre-trial baseline value for each participant. Next, the newly computed mean pre-trial baseline value was subtracted from the mean genital response to each stimulus category. Mean minus baseline genital arousal scores were standardized (transformed into ipsative z-scores) within subjects in order to control for individual variation in resting baselines and genital responsivity, as well as to maximize discriminant validity of genital arousal assessment (Harris, Rice, Quinsey, Chaplin, & Earls, 1992). The standardized mean minus baseline change scores were averaged across the two exemplars presented for each stimulus type to produce a single standardized score for each stimulus type.

The second set of genital arousal scores, computed to measure the magnitude of responses (Morokoff & Heiman, 1980 Prause & Janssen, 2006), was calculated in
a method similar to standardized change scores. Again, an average pre-trial baseline value (calculated by averaging the pre-trial interval across all stimulus categories) was subtracted from the mean genital response to each stimulus category. This change score was divided by the average pre-trial baseline value and multiplied by 100 to give VPA percent change scores. This dependent variable underwent the same statistical analysis as the standardized genital scores.

Of the 29 women who participated in the study, all met the inclusion criteria for minimum sexual response (a minimum difference of 0.5 standard deviations between maximum genital arousal to either male or female stimuli and arousal to the neutral stimulus; see Chivers et al., 2004). Trials for which there were problems with genital data acquisition were excluded from analysis (as, in these instances, VPA signals were unreliable). For these 24 trials, missing variables were inserted. In such cases, mean genital responding was based on the remaining trial within that exemplar category. One participant had unreliable VPA signals for both exemplars of the male exercise stimulus type, and her genital data was excluded from further genital data analysis. The final number of women included in the genital arousal analysis was 28 (follicular first n = 16, luteal first n = 12).

Genital arousal data was subjected to a 2 (menstrual phase; follicular, luteal) x 2 (actor gender; male, female) x 3 (sexual activity; exercise, masturbation, couple sex) x 2 (order; follicular first, luteal first) mixed repeated-measures analysis of variance (ANOVA), where cycle phase, gender, and sexual activity, were the within-subject factors, and order was the between-subject factor. A significant omnibus ANOVA warranted follow-up repeated-measures paired t-tests to determine
whether women showed greater specificity of arousal during the follicular phase than the luteal phase. We expected to find a main effect of sexual activity, a main effect of order, and an interaction between menstrual phase and gender.

Women’s genital responding was tested using gay (male only) and lesbian (female only) couple sex stimuli because heterosexual couple sex contains both male and female actors, which may obscure a category-specific response pattern during the follicular phase of the menstrual cycle. Given that previous research has reported nonspecific genital responses to couple sex stimuli including heterosexual couple sex (Chivers et al., 2004; Chivers et al., 2007; Petersen et al., 2009), we conducted an additional repeated-measures mixed ANOVA of the couple sex stimuli to test the hypothesis that arousal responses would be greatest to preferred (heterosexual) sex in the follicular phase, with cycle (follicular, luteal) and couple type (gay, lesbian, heterosexual) as the within-subject factors and order (follicular first, luteal first) as the between-subject factor.

Subjective arousal.

Subjective arousal was also calculated using two dependent variables, consistent with previous research (e.g., Chivers et al., 2007). First, mean values were calculated for continuous subjective responses collected during the presentation of stimuli (averaged from the two exemplars of each category) by subtracting baseline scores from mean values of subjective arousal to each stimulus, where baseline scores were the value of subjective arousal reported at the onset of the video. Second, change scores were computed by subtracting participants’ self-rated
arousal on a pre-trial question prior to the stimulus presentation from their self-rating arousal on the post-trial question (also averaged across the two exemplars of each category). A positive score indicated an increase in arousal following stimulus presentation, a negative score indicated a decrease in arousal, and a score of zero indicated no change in arousal. The data from two women were removed from the subjective arousal analysis because of technical errors in data collection ($N = 27$: Follicular first $n = 14$, luteal first $n = 12$).

Subjective arousal data was subjected to a $2 \times 2 \times 3 \times 2$ mixed repeated-measure ANOVA, as described above using both mean minus baseline continuous self-report scores, and post- minus pre-trial subjective arousal questions as the dependent variable. Paired $t$-tests were conducted to follow up any significant effects from the omnibus ANOVA, and an additional repeated-measures ANOVA, identical to that proposed for genital arousal, comparing subjective arousal to the three couple sex stimuli (heterosexual, lesbian, and gay) was included. Subjective arousal scores were expected to show a similar mid-cycle shift in specificity of arousal as outlined for genital arousal.
Chapter 3

Results

Demographics

Summary statistics for demographic variables are shown in Tables 1 and 2. No significant differences were observed between women who started testing in the follicular phase compared to women who started in the luteal phase for any of the demographic variables. Women in this sample were predominantly European Canadian (55%), while the remaining women were Asian Canadian (35%), African Canadian (3%), or did not identify their ethnicity (7%). Women reported either exclusive or predominant sexual attractions towards men, and were highly educated.
### Table 1

**Means and Standard Deviations for Demographic Variables by Order of Testing**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Order 1 (follicular phase first)</th>
<th>Order 2 (luteal phase first)</th>
<th>Total (N = 29)</th>
<th>F value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>22.9 (5.7)</td>
<td>19.9 (1.4)</td>
<td>20.6 (2.69)</td>
<td>1.08</td>
</tr>
<tr>
<td>Kinsey fantasy scale</td>
<td>0.4 (0.7)</td>
<td>0.2 (0.4)</td>
<td>0.3 (0.6)</td>
<td>0.40</td>
</tr>
<tr>
<td>Menstrual cycle length in days (measured in follicular phase)</td>
<td>29.3 (2.2)</td>
<td>29.2 (1.4)</td>
<td>29.3 (1.8)</td>
<td>0.18</td>
</tr>
<tr>
<td>Menstrual cycle length in days (measured in luteal phase)</td>
<td>29.2 (2.7)</td>
<td>29.2 (1.4)</td>
<td>29.2 (2.1)</td>
<td>0.05</td>
</tr>
<tr>
<td>Relationship length (in months)a</td>
<td>14.8 (6.7)</td>
<td>14.3 (9.9)</td>
<td>14.5 (8.3)</td>
<td>2.11</td>
</tr>
</tbody>
</table>

*Note.* The Kinsey fantasy scale is rated on a seven-point Likert-type scale where a score of 0 represents exclusively heterosexual orientation, a score of 6 represents exclusively homosexual orientation, and a score of 3 represents a bisexual orientation (Kinsey et al., 1948; Kinsey et al., 1953).

a Included only women in a relationship (Order 1, n = 6; Order 2, n = 6).
Table 2

*Observed and Expected Values for Demographic Variables by Order of Testing*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Order 1 (follicular phase first)</th>
<th>Order 2 (luteal phase first)</th>
<th>Total (N = 29)</th>
<th>$\chi^2$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>10 (8)</td>
<td>6 (8)</td>
<td>16 (14.5)</td>
<td>0.00</td>
</tr>
<tr>
<td>Other</td>
<td>5 (6.5)</td>
<td>8 (6.5)</td>
<td>13 (14.5)</td>
<td>0.69</td>
</tr>
<tr>
<td>Relationship Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partnered</td>
<td>6 (6)</td>
<td>6 (6)</td>
<td>12 (14.5)</td>
<td>0.53</td>
</tr>
<tr>
<td>Single</td>
<td>10 (8.5)</td>
<td>7 (8.5)</td>
<td>17 (14.5)</td>
<td>0.00</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some university or college</td>
<td>16 (14)</td>
<td>12 (14)</td>
<td>28 (9.7)</td>
<td>0.57</td>
</tr>
<tr>
<td>High school diploma</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Confirmation of Menstrual Cycle Phase

Face preference task.

A repeated-measures ANOVA was conducted to test for a mid-cycle shift in preference for facial masculinity, such that a greater preference for facial masculinity was expected to emerge during the follicular phase (see Figure 2). The dependent variable was the averaged preference scores for male and female faces, and the independent variables were gender (male, female) and cycle phase (follicular, luteal). A main effect of gender was revealed ($F(1, 28) = 13.98, p < 0.01, \eta_p^2 = 0.33$) such that women showed a preference for male faces ($M = 3.79, SD = 0.14$) over female faces ($M = 3.23, SD = 0.11$), independent of cycle phase. No interaction of cycle by gender was observed ($F(1, 28) = 2.86, p = 0.10, \eta_p^2 = 0.09$).
Figure 2. Mean preference score for averaged male and female faces. Error bars represent standard errors of the mean.

* $p < 0.01$
REPORT OF SEXUAL BEHAVIOUR AND FEELINGS.

A repeated-measures mixed ANOVA was performed using a three-item composite score of sexual interest to test if women's sexual attractions or fantasies increased during the follicular phase of the menstrual cycle (see Figure 3). Cycle phase (follicular, luteal) was the within-subject factor, and order (follicular first, luteal first) was the between-subject factor. No effect of cycle was found $F(1, 28) = 0.15, p = 0.70, \eta^2_p = 0.01$; women reported equal attraction to men during the follicular phase ($M = 1.42, SD = 1.52$) as during the luteal phase ($M = 1.51, SD = 1.75$). No effect of order was found $F(1, 28) = 0.44, p = 0.51, \eta^2_p = 0.02$. 
Figure 3. Mean score for desire to engage in sexual activity with a current partner or with another man by relationship status. Error bars represent standard errors of the mean.
Effects of Cycle Phase on Patterns of Sexual Arousal

Genital responses.

Women were expected to show increased vaginal vasocongestion to male stimuli during the follicular phase, as well as increases in genital arousal corresponding to the sexual explicitness of the activity presented (increasing arousal from non-sexual nude exercise, to masturbation, to couple sex). Also, fertility status at the time of first exposure was expected to influence arousal patterns such that women who began testing in the follicular phase were expected to show high genital arousal in the first session, and equally high genital arousal in the second (luteal) session, while women who began testing in the luteal phase were expected to show lower genital arousal in the first session, and an increase in the second (follicular) session. To test these hypotheses, a mixed repeated-measures analysis of variance was conducted using standardized mean genital arousal scores as the dependent variable. Within-subject factors were cycle phase (2; follicular, luteal), gender (2; female, male), activity (3; exercise, masturbation, couple sex), and the between-subject factor was order (2; follicular first, luteal first). Means and standard deviations of these data are presented in Table 3.
Table 3

*Genital Arousal Means and Standard Deviations*

<table>
<thead>
<tr>
<th>Category</th>
<th>Standardized Scores</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Follicular (N = 16)</td>
<td>Luteal (N = 12)</td>
</tr>
<tr>
<td><strong>Couple Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gay</td>
<td>0.68 (0.75)</td>
<td>0.32 (0.72)</td>
</tr>
<tr>
<td>Lesbian</td>
<td>0.71 (0.78)</td>
<td>0.69 (0.68)</td>
</tr>
<tr>
<td>Heterosexual</td>
<td>1.02 (0.75)</td>
<td>0.88 (0.91)</td>
</tr>
<tr>
<td><strong>Masturbation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>-0.16 (0.53)</td>
<td>-0.06 (0.69)</td>
</tr>
<tr>
<td>Female</td>
<td>-0.01 (0.61)</td>
<td>-0.00 (0.62)</td>
</tr>
<tr>
<td><strong>Exercise</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>-0.48 (0.60)</td>
<td>-0.52 (0.79)</td>
</tr>
<tr>
<td>Female</td>
<td>-0.51 (0.62)</td>
<td>-0.41 (0.63)</td>
</tr>
<tr>
<td><strong>Non-Sexual</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutral</td>
<td>-0.66 (0.56)</td>
<td>-0.58 (0.55)</td>
</tr>
</tbody>
</table>
Figure 4 presents the mean standardized genital responses for women within the present study. A significant main effect of activity, $F(2, 52) = 58.39, p < 0.01, \eta^2_p = 0.69$, was followed up using pairwise comparisons. Consistent with previous research, stimuli depicting couples having sex ($M = 0.59$) elicited significantly higher levels of genital arousal than masturbation ($M = -0.04$), $p < 0.01$, and masturbation elicited significantly higher levels of genital arousal than exercise stimuli ($M = -0.47$), $p < 0.01$. No significant main effects of gender $F(1, 26) = 1.61, p = 0.22, \eta^2_p = 0.06$, or cycle $F(1, 26) = 0.29, p = 0.60, \eta^2_p = 0.01$ were found.

No main effect of order was found $F(1, 26) = 0.06, p = 0.81, \eta^2_p < 0.01$, and no significant interactions were observed between order and gender ($F(1, 26) = 0.73, p = 0.40, \eta^2_p = 0.03$) or order and activity ($F(2, 52) = 0.35, p = 0.71, \eta^2_p = 0.01$), thus fertility status during the first testing session did not influence women’s genital responses at the first or subsequent session.

The omnibus test revealed no significant cycle by gender interaction, $F(1, 26) = 0.34, p = 0.56, \eta^2_p = 0.01$, indicating that women’s genital responses do not differentiate between male and female stimuli as a function of fertility status.

Unexpectedly, a trend-level interaction between cycle and activity was observed, $F(2, 52) = 2.49, p = 0.09, \eta^2_p = 0.09$. Paired $t$-tests were conducted as a post hoc follow up; women’s genital responses did not differentiate between exercise stimuli based on fertility status $t(27) = 0.39, p = 0.70, d = 0.07$, or masturbation stimuli $t(27) = 0.77, p = 0.45, d = 0.15$; however, women showed significantly higher levels of genital responding to stimuli depicting couple sex in the
category-specificity across the menstrual cycle

folicular phase compared to the luteal phase $t(27) = 2.12, p = 0.04, d = 0.40$ (means and standard deviations presented in Table 3).

An additional repeated-measures mixed ANOVA of the couple sex stimuli included heterosexual couple sex to test whether arousal responses would be greatest to preferred (heterosexual) couple sex compared to non-preferred (lesbian and gay) couple sex in the follicular phase. Cycle phase (2; follicular, luteal) and couple sex type (3; gay, lesbian, heterosexual) were included as the within-subject factors, and order (2; follicular first, luteal first) as the between-subject factor. A main effect of couple type, $F(2, 52) = 3.30, p = 0.03, \eta^2 = 0.13$ revealed that, as expected, women showed highest genital arousal to heterosexual sex ($M = 0.97, SD = 0.14$). Unexpectedly, genital arousal to heterosexual sex was not significantly different than genital arousal to lesbian couple sex ($M = 0.70, SD = 0.11$), $p = 0.14$. Genital response to heterosexual and lesbian couple sex were both significantly higher than gay couple sex ($M = 0.48, SD = 0.12$), $p = 0.01$ (see Table 3). A main effect of cycle was also observed $F(1, 26 = 5.71, p = 0.02, \eta^2 = 0.18$. Pairwise comparisons reveal that women showed higher genital responses to couple sex during the follicular phase ($M = 0.81$) than the luteal phase ($M = 0.62$). There was no main effect of order, $F(1, 26 = 0.19, p = 0.67, \eta^2 = 0.01$, and the cycle by couple type interaction did not reach significance, $F(2, 52) = 0.85, p = 0.43, \eta^2 = 0.03$. 
Figure 4. Mean standardized genital arousal for experimental stimuli. Error bars indicate standard errors of the mean. $E =$ exercise stimuli; $M =$ masturbation stimuli; $CS =$ couple sex stimuli; $N =$ neutral stimuli; $FM =$ heterosexual couple sex.
Identical statistical analyses were performed as above using percent change genital arousal scores as the dependent variable to determine if cycle timing affected magnitude of genital responding. Means and standard deviations of these data are presented in Table 3. There was a significant main effect of activity, $F(2, 52) = 43.38$, $p < 0.01$, $\eta^2_p = 0.63$. Pairwise comparisons revealed that percent change of genital arousal to couple sex stimuli ($M = 36.89$) was significantly greater than to masturbation stimuli ($M = 18.50$) $p < 0.01$, and both were significantly greater than percent change to exercise stimuli ($M = 1.44$), $p < 0.01$. Non-significant main effects of gender ($F(1, 26) = 2.65$, $p = 0.12$, $\eta^2_p = 0.09$) and cycle ($F(1, 26) = 2.37$, $p = 0.14$, $\eta^2_p = 0.08$) were obtained.

The main effect of order was not significant ($F(1, 26) = 0.11$, $p = 0.75$, $\eta^2_p < 0.01$), and no significant interactions were found for gender and order ($F(1, 26) = 0.92$, $p = 0.35$, $\eta^2 = 0.34$, or activity and order ($F(1, 26) = 0.33$, $p = 0.72$, $\eta^2_p = 0.01$).

Consistent with the standardized genital arousal scores, the omnibus test revealed no significant interaction of cycle by gender, $F(1, 26) = 1.22$, $p = 0.28$, $\eta^2_p = 0.05$. Unlike standardized genital arousal scores, the omnibus cycle by activity interaction was not significant ($F(2, 52) = 0.48$, $p = 0.62$, $\eta^2_p = 0.02$)(see Figure 5).
Figure 5. Mean genital arousal percent change scores for experimental stimuli. Error bars indicate standard errors of the mean. E = exercise stimuli; M = masturbation stimuli; CS = couple sex stimuli; N = neutral stimuli; FM = heterosexual couple sex.
Subjective responses.

Statistical analyses were planned for a continuous self-reported measure of subjective arousal; however, an error in administration of the measure created concerns regarding the construct validity and reliability of the measure. Participants did not receive the same instructions as in previous research, and visual inspection of the data revealed a pattern of responding that is incongruent with past research (Chivers et al., 2007), suggesting that the women in the present study did not use the continuous self-report measure in the same way as past research. Thus, this measure was dropped from the analysis.

Subjective arousal – using post-minus pre-trial ratings only – was subject to the same mixed repeated-measures analysis of variance as the genital data to evaluate the effect of fertility status on women’s self-reported arousal change scores (see Table 4).
Table 4

Subjective Arousal Means and Standard Deviations

<table>
<thead>
<tr>
<th></th>
<th>Post-Pre Self-Report</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Follicular (n = 14)</td>
</tr>
<tr>
<td>Couple Sex</td>
<td></td>
</tr>
<tr>
<td>Gay</td>
<td>1.10 (2.07)</td>
</tr>
<tr>
<td>Lesbian</td>
<td>1.00 (2.01)</td>
</tr>
<tr>
<td>Heterosexual</td>
<td>2.88 (1.28)</td>
</tr>
<tr>
<td>Masturbation</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.38 (1.40)</td>
</tr>
<tr>
<td>Female</td>
<td>0.69 (2.12)</td>
</tr>
<tr>
<td>Exercise</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0.67 (1.37)</td>
</tr>
<tr>
<td>Female</td>
<td>-0.19 (1.12)</td>
</tr>
<tr>
<td>Non-Sexual</td>
<td></td>
</tr>
<tr>
<td>Neutral</td>
<td>-1.92 (3.13)</td>
</tr>
</tbody>
</table>
A significant main effect of activity, $F(2, 48) = 8.03, p < 0.01, \eta^2_p = 0.25$, was found, consistent with genital response findings. Pairwise comparisons revealed that women reported the largest increase in subjective arousal to the couple sex ($M = 1.09$) and masturbation stimuli ($M = 1.04, p = 0.83$), both of which produced significantly larger changes in subjective arousal than the exercise stimuli ($M = 0.12, \text{all } ps < 0.01$).

The omnibus ANOVA revealed a trend-level main effect of gender ($F(1, 24) = 3.54, p = 0.07, \eta^2_p = 0.13$); women reported larger changes in subjective arousal to male stimuli ($M = 1.08$) than to female stimuli ($M = 0.42$) irrespective of cycle phase. No main effect of cycle phase was found ($F(1, 24) = 0.01, p = 0.91, \eta^2_p < 0.01$).

There was no main effect of order ($F(1, 24) = 0.72, p = 0.41, \eta^2_p = 0.03$), or significant interactions for gender by order ($F(1, 24) = 0.50, p = 0.49, \eta^2_p = 0.02$) or activity by order ($F(2, 48) = 0.08, p = 0.92, \eta^2_p < 0.01$).

Interactions between cycle and gender ($F(1, 24) = 0.56, p = 0.46, \eta^2_p = 0.02$), and cycle by activity ($F(1, 24) = 0.44, p = 0.65, \eta^2_p = 0.02$) were not significant. Unexpectedly, a gender by activity interaction showed borderline significance ($F(2, 48) = 3.09, p = 0.06, \eta^2_p = 0.11$). Follow up post hoc paired-sample $t$-tests revealed that women reported higher subjective arousal to male exercise stimuli ($M = 0.72, SD = 1.53$) than female exercise stimuli ($M = -0.47, SD = 0.92$), $t(25) = 3.66, p < 0.01, d = 0.72$ (see Figure 6). No differences in subjective ratings across genders was observed for the masturbation stimuli $t(25) = 1.68, p = 0.11, d = 0.02$ or couple sex stimuli $t(25) = 0.54, p = 0.96, d = 0.19$.
A repeated-measures ANOVA (identical to that performed for standardized genital arousal scores) was conducted using cycle phase (2; follicular, luteal) and couple sex (3; gay, lesbian, heterosexual) as the within-subject variables, and order (2; follicular first, luteal first) as the between-subject variable. A main effect of couple sex was found ($F(2, 50) = 10.30, p < 0.01, \eta^2_p = 0.29$). Pairwise comparisons revealed that women reported a greater increase in subjective arousal following heterosexual couple sex ($M = 2.80$) compared to gay couple sex ($M = 1.12$) $p < 0.01$ and lesbian couple sex ($M = 1.09$) $p < 0.01$, but gay and lesbian couple sex did not significantly differ from one another ($p = 0.96$). The main effect of cycle did not reach significance, ($F(1, 25) = 0.71, p = 0.79, \eta^2_p < 0.01$), neither did the main effect of order ($F(1, 25) = 0.00, p = 0.96, \eta^2_p < 0.01$), or the cycle by activity interaction ($F(2, 50) = 0.15, p = 0.86, \eta^2_p = 0.01$).
Figure 6. Mean self-reported change scores (post - pre) for experimental stimuli. Error bars indicate standard errors of the mean. \( E \) = exercise stimuli; \( M \) = masturbation stimuli; \( CS \) = couple sex stimuli; \( N \) = neutral stimuli; \( FM \) = heterosexual couple sex.
Chapter 4

Discussion

Summary

The aim of this study was to investigate the role of fertility status on category-specificity of female genital and subjective sexual arousal. The findings from the current study do not support the hypothesis that heterosexual women’s genital and subjective arousal is category-specific when the probability of conception is highest. Unexpectedly, a statistical trend was found suggesting that women’s genital arousal may be sensitive to probability of conception with respect to couple sex stimuli only; slightly higher genital arousal to couple sex was observed during the follicular phase of the menstrual cycle. No effect of cycle phase was observed for subjective arousal.

Menstrual cycle phase at the first testing session did not appear to influence genital or subjective sexual arousal at a second testing session, unlike what has been demonstrated by previous research (Slob et al., 1991; Slob et al., 1996; Wallen & Rupp, 2010). This further evidences the automaticity of genital response (Chivers, 2005; Laan & Everaerd, van der Velde, & Geer, 1995; Suschinsky, et al., 2009; Suschinsky & Lalumière, 2011).

Assessment of preferences for facial-masculinity and sexual desire failed to show a mid-cycle increase at peak fertility. The validity of these measures as
confirmation of menstrual cycle phase is drawn into question. The above results will be discussed in the sections that follow.

Mid-Cycle Shift in Mate-Preference

Consistent with past research, our sample of women favored male faces overall (Keating, 1985); however, no mid-cycle shift in preferences towards masculinized facial features, and no increase in sexual desire at peak fertility were observed. One possibility for this null effect may be that exposure to a variety of sexual stimuli in the psychophysiology portion of the study (just prior to the face-rating task) activated implicit or explicit processes used to ascribe sexual meaning to a stimulus (Janssen, Everaerd, Spiering, & Janssen, 2000; Spiering, Everaerd, & Janssen, 2003), in effect priming the participants to interpret stimuli in the facial-rating task as more attractive, which could have obscured a subtle shift in responding at peak fertility. However, this is unlikely for two reasons: Firstly, Janssen and colleagues (2000) found that the priming effect of sexual stimuli decreased with higher levels of recognition, thus stimuli presented for 90 seconds – as is the case of the audiovisual stimuli presented in the psychophysiological portion of the current study – is not likely to augment participants’ attractiveness ratings of faces in a later task. Secondly, the alternative measure of a mid-cycle shift in this study, which also failed to find an effect (the Report of Behaviour and Feelings (RBF); Gangestad et al., 2002) – was given to participants at the beginning of the experiment, before exposure to any sexual content could take place. Again, simply being in a sexual psychophysiology lab may have induced a priming effect on the
RBF similar to that mentioned above, yet a significant mid-cycle shift obtained by Gangestad and colleagues (2002) using the same questionnaire in a laboratory setting suggests that this is not the case.

Although increases in sexual arousability during the follicular phase have wide spread documentation (Alexander & Sherwin, 1993; Bullivant et al., 2004; Krug, Pietrowsky, Fehm, & Born, 1994; Stanislaw & Rice, 1988; Harvey, 1987; Wilcox, Biard, Dunson, McConnaughey, Kesner, & Weinberg, 2004), it is possible that the RBF questionnaire used in this study is a weak measure of the mid-cycle shift. Three questions of sexual behaviour and feelings may not provide a broad enough measure to obtain a reliable effect. Additionally, self-reported sexual activity and interest is susceptible to social desirability effects (Bancroft, 2003), particularly for partnered women reporting interest in men who are not their current mate. Furthermore, the retroactive nature of the questionnaire is susceptible to recall biases (Graham, Catania, Brand, Duong, & Canchola, 2003). Unfortunately, we were unable to test these hypotheses, but further investigation of mid-cycle shifts in sexual activity should document real-time reports of women's sexual interests, and should provide a more comprehensive measure of sexual desire, including interest in a variety of activities ranging in sexual intensity (e.g., desire to interact with an attractive male, desire to kiss, desire to masturbate, desire to have intercourse, etc).

Research investigating the ovulatory-shift hypothesis has begun to uncover factors that influence a mid-cycle shift in mate preferences in addition to fertility status, such as female-typical attitudes (Johnston et al., 2001), late-follicular phase estrogen levels (Welling et al., 2007), or whether a woman is evaluating the stimuli
on a short-term or a long-term relationship context (Johnston et al., 2001; Penton-Voak et al., 1999). The inconsistencies across mate preference studies mentioned above suggest that the ovulatory-shift hypothesis may be more complex than previous research has implied, thus tasks designed to detect a mid-cycle shift in mate preference should not be used as a reliable confirmation of menstrual cycle phase at this time. Presently, counting techniques (Meuissen & Over, 1992; Regan, 1996) or hormone analyses through salivary, urinary, or blood samples (Moghissi, 1980; Worthman & Stallings, 1997) remain the most reliable methods for confirming menstrual cycle phase.

**Order Effects of Testing**

Based on findings by Slob and colleagues (1991; 1996) and Wallen and Rupp (2010), we predicted that women who were first tested in the follicular phase would experience equally high levels of arousal when later tested in the luteal phase. Conversely, women who were first tested in the luteal phase were expected to show significant increases in arousal when tested again in the follicular phase. In the present study, fertility status at the time of first exposure to sexual stimuli did not impact arousal at a subsequent testing session. Women showed equal levels of genital and subjective arousal to stimuli when tested in the follicular phase first compared to women tested in the luteal phase first, and both measures of arousal remained unaffected by the cycle phase during the first session when tested a second time. This finding coincides with past research demonstrating the automaticity of female genital arousal (Chivers, 2005; Laan & Everaerd, 1995;
Suschinsky, et al., 2009; Suschinsky & Lalumière, 2011). The preparation hypothesis posits that automatic increases of blood flow to vaginal tissue is the precursor to vaginal lubrication (Levin, 2003), and as such, a genital response to sexual stimuli prior to subjective appraisal (Lake Polan, Desmond, Banner, Pryor, McCallum, Atlas, et al., 2003) is adaptive by reducing the likelihood of injury in the event of intercourse, be it consensual or non-consensual (Chivers, 2005; Laan, 1994; Laan & Janssen, 2007; Suschinsky et al., 2009; Suschinsky & Lalumière, 2011). As the threat of unwanted sexual activity was substantial within the Environment of Evolutionary Adaptiveness (Lalumière, Harris, Quinsey, & Rice, 2005), and the majority of rapes are carried out by a known perpetrator (Catalano, 2005), women’s automaticity of genital arousal remains an adaptive feature of female sexual response, and would not be facilitated by a learning effect mediated by fertility status at the first exposure to a sexual stimulus. For example, fertility status at the time of first exposure to a potential rapist does not affect the probability of an unsolicited sexual encounter at a later date. Therefore, if a woman’s genital arousal was inhibited upon seeing a man that she had first met in the luteal phase of her menstrual cycle, this would provide no adaptive advantage, and may in fact be maladaptive should he sexually assault her at a later date.

Slob and colleagues (1991; 1996) obtained an order effect of sexual arousal using labial temperature, not VPP. It is possible that vaginal vasocongestion, as measured by VPP, is resistant to a cycle phase-mediated learning effect, while labial temperature is not. Naturally cycling women, compared to women using oral contraceptives in the studies by Slob and colleagues (1991; 1996), had lower labial
temperatures in the follicular phase, and experienced smaller changes in temperature during erotic videos. Furthermore, basal body temperature changes as a function of hormonal status (women's temperature increases by at least four tenths of a degree at the time of ovulation; see Royston & Abrams, 1980). Changes observed in labial and basal body temperature mediated by fertility status suggest that labial temperature may in fact be more responsive to changes across the menstrual cycle than VPP. Although vaginal pulse amplitude (measured by VPP) and labial thermography are correlated with one another (Henson, et al., 1979), more research is needed to understand why cycle phase during the first testing session in the present study failed to produce an effect in genital arousal to sexual stimuli similar to that observed in studies using alternative measures of sexual arousal or interest (Slob et al., 1991; Slob et al., 1996; Wallen & Rupp, 2010). Replication of the present study using different psychophysiology methodology, such as thermography, a reliable measure of genital arousal which assesses precise changes in skin temperature (Kukkonen, Binik, Amsel, & Carrier, 2007), may prove more sensitive to an order effect in genital response than VPP.

Subjective arousal was also unaffected by cycle phase at the time of first exposure to the erotic stimuli, which is interesting given that Wallen and Rupp (2010) observed such an effect on sexual interest using a viewing-time paradigm. One possible explanation for our failure to replicate this finding is that sexual interest, or one’s willingness to engage in a sexual act, is not the same construct as sexual arousal for women. For example, women reported some subjective arousal to audio stimuli portraying non-consensual sex of a violent and non-violent nature,
which by definition lacks the element of willingness to participate (Suschinsky & Lalumière, 2011). Therefore, although fertility status at the time of a stimuli’s first exposure may influence one’s interest in that stimuli at a later date, subjective arousal appears to remain unaffected. Furthermore, the stimuli used by Wallen and Rupp (2010) were still images, which are less potent than audiovisual stimuli used within the present study (Chivers et al., 2007; Heiman, 1980; Julien & Over, 1988). The high intensity of the audiovisual stimuli may have overwhelmed the possible influence of fertility status on subjective arousal at first exposure; however, this is not a likely explanation for the lack of a significant effect as the low intensity stimuli used within this study – males and females exercising – also failed to produce the same results as Wallen and Rupp (2010). The influence of hormonal status on the meaning attributed to sexual stimuli requires further investigation, and attention should be drawn to discerning whether this phenomenon is specific to sexual interest and not sexual arousal.

**Mid-Cycle Shifts in Sexual Arousal**

*Genital arousal.*

Using the same audiovisual stimuli as Chivers and colleagues (2007), this study obtained a similar non-specific pattern of genital response using a different sample of heterosexual women. The present study further supports the validity of the growing body of literature demonstrating category-nonspecificity in heterosexual women’s genital responding (Chivers, et al., 2004; Chivers & Bailey, 2005; Chivers, et al., 2007; Petersen, et al., 2009; Suschinsky, et al., 2009), and
provides evidence that this phenomenon is robust against the influence of hormonal status, as mediated by menstrual cycle phase at the time of testing.

Category-specificity of women’s genital arousal did not appear to be influenced by fertility status; women’s genital arousal did not increase for male stimuli only when the probability of conception was at its peak. This finding suggests that female genital arousal and mate preference may be governed by two distinct mechanisms. The latter is used to increase inclusive fitness by choosing an appropriate sexual partner based on her probability of conception, while the former ensures that genital vasocongestion and vaginal lubrication make intercourse possible in the presence of sexual activity cues.

Although gender appears to be less important to women’s genital arousal than activity, this study provides some evidence that differentiation occurred across couple type, specifically with respect to the couple sex stimuli; however, the observed pattern of response was not in the direction predicted. Women were expected to show significantly greater arousal to heterosexual sex compared to lesbian and gay stimuli regardless of fertility status. Indeed, women’s genital responses were highest to heterosexual couple sex, but genital response did not appear to differentiate between heterosexual and lesbian couple sex. Inconsistent with previous research that shows no differentiation in genital arousal to couple sex stimuli (Chivers et al., 2007), both heterosexual and lesbian couple sex stimuli elicited higher arousal than gay couple sex overall. It is possible that, within the current sample of women, the heterosexual and lesbian couple stimuli elicited a ceiling effect of vaginal vasocongestion. If this is the case, it remains unclear why a
ceiling effect would not have occurred for gay couple sex, which is equally potent in its sexual explicitness (Chivers et al., 2007).

One concern raised by the observation of a potential ceiling effect is that maximum genital responses may have obscured a mid-cycle shift in genital responding to heterosexual and lesbian couple sex stimuli. This is especially pertinent to the heterosexual stimuli, as higher arousal to the male actor within the heterosexual stimuli was expected during the follicular phase. However, it is unlikely that a mid-cycle shift was obscured, as no changes in category-specificity to less potent sexual stimuli (masturbation) were observed. Furthermore, genital arousal to the gay couple sex stimuli did not increase during the follicular phase. The lack of a mid-cycle shift in category-specificity to masturbation or gay couple sex stimuli suggests that women in the present study were less sexually aroused by the gay couple sex than by the heterosexual or lesbian couple sex stimuli.

Although statistical analyses did not produce a significant cycle by gender interaction, visual inspection of the data revealed that gay couple stimuli appeared to elicit lower levels of genital arousal during the luteal phase compared to the follicular phase. It remains unclear whether a difference in response to male couple sex across the menstrual cycle can account for the inconsistency in genital arousal to couple sex stimuli between women in previous research – who showed no differentiation across couple sex (Chivers et al., 2007) – and women in the present study – who showed lower levels of genital arousal to gay couple stimuli compared to heterosexual and lesbian couple stimuli.
Although strictly speculative, one possible explanation for lower genital responses to gay sex during the luteal phase is male avoidance. It has been hypothesized that unsolicited sexual activity was a common occurrence within the Environment of Evolutionary Adaptiveness (Lalumière, Harris, Quinsey, & Rice, 2005). Women’s interpretation of sexual stimuli containing only males and reproductively-relevant stimuli (i.e., sexual activity that can result in conception, such as sex) may differ depending on fertility status. When fertile, women more readily interpret stimuli as sexual (Krug et al., 1994); however, in the luteal phase, the stimuli may be more readily interpreted as threatening without the presence of a consenting female actor. Although research has documented increases in sexual interest (Alexander & Sherwin, 1993; Krug, Pietrowsky, Fehm, & Born, 1994; Stanislaw & Rice, 1988) and sexual activity (Bullivant et al., 2004; Harvey, 1987; Wilcoxon et al., 2004) at peak fertility, none have investigated inhibition of sexual activity when the probability of conception is low.

One problem with the male avoidance hypothesis proposed here is that women failed to show inhibited sexual responses to stimuli depicting solitary males masturbating in the luteal phase. Similar to the gay sex stimuli, the male masturbation stimuli contain a male actor engaged in sexual activity with no females present. If women’s genital responses were inhibited to sexual stimuli containing men to avoid unsolicited sexual contact when not fertile, the same inhibition of genital arousal to gay sex as well as the solitary male (masturbation) stimuli would be expected. Why inhibition of genital arousal would occur only to the most potent sexual activity (sex) is not clear. Further research should directly
investigate whether genital arousal experiences a decrease to only stimuli containing a sexual component as well as male but not female actors when women are in the luteal phase.

Research documenting that women’s genital arousal is highly responsive to the intensity of sexual cues is extensive (Both, Boxtel, Stekelenburg, Everaerd, & Laan, 2005; Chivers et al., 2004; Chivers, 2005; Chivers et al., 2007; Laan, Everaerd, van der Velde, & Geer, 1995). Consistent with this literature, women within the present study experienced highest genital arousal for stimuli depicting couple sex, followed by masturbation and exercise. The large amount of variance in genital response accounted for by activity lends support to the robust nature of this phenomenon.

Unexpectedly, women demonstrated a trend towards higher genital arousal to all couple sex stimuli (heterosexual, lesbian, and gay) versus solitary stimuli during the follicular phase. Because the probability of conception may be the driving force behind the trend-level differences in genital response across menstrual cycle phase, perhaps couple sex stimuli only would be affected because it is interpreted as reproductively-relevant, unlike masturbation, for example, which is sexual but cannot result in conception. However, two of the three couple sex stimuli contain same-sex actors, and thus could not result in conception. This draws into question what, if not gender cues, are women responding to in the couple sex. It is possible, for example, that women’s genital arousal is influenced by fertility status with respect to a penetrative or thrusting action only (e.g., the thrusting motion of one actor’s torso, and potentially the presence and reciprocal thrusting motion of a
second actor), while her genital responses remain nonspecific with respect to gender (Chivers & Bailey, 2005). The stimuli used within the present study are far too complex to deduce what particular variables within each stimulus lead to higher genital arousal to the couple sex stimuli when fertile. Future research should parse out individual components of sexual stimuli that cause female sexual responding (e.g., interpersonal cues, actor attractiveness, prepotent versus non-prepotent stimuli, etc.) to pinpoint what factors result in sexual arousal, and what specific factors, if any, account for increased genital responding when fertile.

Although women’s genital arousal did not demonstrate a mid-cycle shift in preferences for gender cues relevant to reproduction (male stimuli) when fertile, a trend towards increased sensitivity to sexual activity cues (couple sex) emerged when the probability of conception was at its highest. Vaginal vasocongestion induced by genital arousal increases vaginal lubrication from engorged capillaries in the vaginal epithelium and labial minora (Levin, 1998), thus allowing for painless and vigorous penile penetration (Levin, 2002). Furthermore, increased blood flow to the vaginal capillaries facilitates the oxygenation of vaginal lubrication, acting as a buffer to neutralize its normally acidic pH, which facilitates spermatozoal metabolism, mobility, and survival (Levin, 2003). Therefore, the sensitivity of women’s genital arousal to stimuli depicting sex when fertile would likely represent an adaptation designed to facilitate conception.

It should be noted that an effect of cycle phase on genital arousal to couple sex stimuli was not mirrored in genital arousal percent change scores. The magnitude of genital vasocongestion may be more strongly related to vaginal
lubrication than the relative pattern of genital responding (as measured by standardized scores), although a direct link between magnitude of genital responding and vaginal lubrication has not been documented. Future research could investigate whether the production of vaginal lubrication is directly correlated with magnitude of genital arousal. Although the hypothesis that specificity of sexual arousal would increase during the follicular phase of the menstrual cycle was not supported, this study provides some evidence that women’s genital arousal may be influenced by fertility status, specifically with respect to couple sex, but not gender.

**Subjective arousal.**

Consistent with genital arousal findings, women did not experience greater category-specificity of subjective arousal during the follicular phase. However, women’s subjective arousal appeared somewhat category-specific throughout the menstrual cycle; women reported more subjective arousal to their preferred (male) stimuli overall, although they still reported some arousal to their non-preferred (female) stimuli. This trend-level effect is in the opposite direction to findings reported by Chivers and colleagues (2007), who used the same experimental stimulus set, but found that women reported greater subjective arousal to female stimuli overall. One possible explanation for the difference in the patterns of subjective response between studies is the different measures used; Chivers and colleagues (2007) used a continuous self-report measure, while the present study used a post-pre difference score. It is unclear why these two studies produced different results; however, previous research has demonstrated somewhat
category-specific responses in women’s subjective arousal consistent with the findings obtained within the present sample of women (Chivers et al., 2004; Suschinsky et al., 2009). Further research is warranted to investigate the psychological experience of women watching erotic stimuli in an attempt to explain the inconsistent pattern of heterosexual women’s subjective arousal across studies.

Subjective reports of arousal by heterosexual women within the present study support the hypothesis that women’s subjective arousal mirrors their genital arousal’s responsivity to cues of sexual explicitness (Chivers et al., 2007). Women reported highest arousal to couple sex, followed by masturbation, and least arousal to exercise stimuli. There was some evidence to suggest that women’s sensitivity to activity was influenced by the gender of the actor for the exercise stimuli. There was a trend towards higher reported subjective arousal to male exercisers compared to female exercisers, which is opposite to that reported by Chivers and colleagues (2007) who used the same exercise stimuli. Again, it is unclear why women in the present study reported slightly greater category-specific subjective arousal to exercise stimuli than past research (Chivers et al., 2007). Rating one’s experience of sexual arousal following the presentation of the stimulus (consistent with the present study), as opposed to rating it concurrently (Chivers et al., 2007), may prompt more socially desirable responses from heterosexual women, thus accounting for the higher ratings of arousal to male compared to female exercise stimuli. Low concordance between women’s subjective and genital reports has been documented across a number of studies (see Chivers et al., 2010 for a review) so it is
not surprising that the pattern of response for genital arousal is not identical to that observed for subjective responses.

**Limitations**

Determining fertility status without independent confirmation of LH peak was a limitation to this study. The lack of a mid-cycle shift in facial masculinity and mating behaviour is not an uncommon finding (Harris, 2011); however, the use of study paradigms that have been replicated a number of times (Frost, 1994; Johnston, Hagel, Franklin, Fink, & Gammer, 2001; Penton-Voak & Perrett, 2000; Penton-Voak et al., 1999) did not confirm menstrual cycle phase within the present study. Salivary samples to test levels of estrogen, progesterone, and testosterone would allow exact hormonal status to be determined with a high degree of accuracy (Regan, 1996), and would provide a more direct measure of variation in hormonal concentrations and their role in female sexual responses. However, errors in the estimated number of days until the LH surge, transformed to a 28 day cycle ($D_{LH(28)}$) are more likely to introduce noise rather than contribute to significant findings (Puts, 2006). Although salivary samples were collected at the time of testing, hormonal analyses are not reported in this study.

A continuous self-report measure was excluded from analyses due to an error in administration of the measure, thus subjective arousal analyses included only post-pre difference scores. Research has shown that both subjective arousal measures are highly correlated (Steinman, Wincze, Sakheim, Barlow & Mavissakalian, 1981; Suschinsky et al., 2009) and provide similar concordance
estimates (Chivers et al., 2010; Suschinsky et al., 2009). It is possible that the post-pre trial change scores used within this study provided a less accurate measure of women's experienced arousal due to the basic nature of the question. Participants were instructed to simply rate how aroused they felt during the stimulus presentation, which likely resulted in a loss of information. It is unclear how participants interpret the instructions, and whether they are reporting a self-calculated average of their arousal throughout the trial, the highest level of arousal they experienced during the stimulus, how aroused they feel at the time of rating, after the stimulus presentation was complete, or whether self-reports were influenced by impression management. Real-time subjective arousal responses, much like genital responses, are dynamic and changing, thus it has been argued that continuously reported subjective arousal is a more appropriate measure of subjective arousal than post-pre scores (Wincze, et al., 1977).

A selection bias exists for the participants in sexual psychophysiological research. Compared to the general population, participants in sexual psychophysiological research report greater numbers of sexual partners, lower sexual inhibition, more liberal sexual attitudes, more experience with sexually explicit materials, and masturbate more frequently (Morokoff, 1986; Wolchik, Braver, & Jensen, 1985; Strassberg & Lowe, 1995; Wolchik, Spencer, & Lisi, 1983). More liberal attitudes and more sexual experiences among participants who choose to participate in sexuality studies is an issue inherent within sexual psychophysiology research. Furthermore, the majority of the women in this study came from a subpopulation that may not be representative of the population as a
whole: University and college students. However, a study of this selection bias on specificity of sexual arousal was tested by Chivers and colleagues (2004), who found no association between variables that differentiate women who chose to participate in sexual psychophysiology research and those who did not, and sexual response, thus the results obtained in this study are likely not the results of the particular group of women who participated in this study.

Conclusions

Previous research investigating the role of menstrual cycle phase in women's genital and subjective arousal has provided mixed findings (Hoon et al., 1982; Meuwissen & Over, 1992; Schreiner-Engel et al., 1981; Slob et al., 1991; Slob et al., 1996). By parsing out individual aspects of erotic stimuli (gender, potency of sexual activity), this study suggests that including women at different points in the menstrual cycle is not likely an explanation for the lack of category-specificity observed in women's genital arousal in previous research. There was a trend-level effect suggesting that genital arousal may show some sensitivity to fertility status with respect to sexual activity (specifically couple sex) – but not gender – which may represent an adaptation to increase the likelihood of conception when most fertile. Subjective arousal, in contrast, did not appear to be influenced by fertility status, suggesting that the experience of sexual arousal and mate preference may not be a homogeneous phenomenon. Further research is needed to clarify the exact relationship between hormonal status and women's pattern of sexual arousal.
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CATEGORY-SPECIFICITY ACROSS THE MENSTRUAL CYCLE


CATEGORY-SPECIFICITY ACROSS THE MENSTRUAL CYCLE


CATEGORY-SPECIFICITY ACROSS THE MENSTRUAL CYCLE

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CATEGORY-SPECIFICITY ACROSS THE MENSTRUAL CYCLE

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CATEGORV-SPECIFICITV ACROSS THE MENSTRUAL CYCLE


Appendix A

Participant Screening Procedure

Participants will respond by email or telephone to study ads. A research assistant will respond to the individual by whatever means they contacted the lab. We have used both means of communicating with prospective participants in the past and found that using email can facilitate the screening procedure, particularly when both parties have conflicting schedules, so we offer participants this option.

The following will be read/emailed to the individual to provide initial information about the study.

Thanks for your call and your interest in the study. How did you find out about the study?

I’m going to read a brief description of the study to help you decide if you are interested in participating:

The purpose of this study is to understand how the menstrual cycle is related to sexual arousal and to women’s sexual preferences. If you decide to participate in this study, you will come to the Sexuality and Gender laboratory located at the Psychology Department at Queen’s University at two points in your menstrual cycle. The desired times in your menstrual cycle will be assessed by the experimenter. You will be informed of the days in which you will be in the desired menstrual cycle phase to participate, and the appointment to visit the lab will be scheduled. In the laboratory, you will be asked to provide three saliva samples, answer questionnaires, rate pictures of faces for attractiveness, and watch sexual videos while your genital sexual arousal is measured using medical instruments.

Upon your arrival to the Sexuality and Gender Lab, you will first be asked to provide two saliva samples, which you will deposit into a small vial. You will next be asked to complete a questionnaire, in private, asking about your personal information, sexuality, and personality.

We will measure your genital sexual arousal while you watch videos with an instrument called a vaginal gauge. This instrument is a small, plastic, tampon-shaped device about 5cm long and 1.2 cm wide. In a private room, you will undress from the waist down and insert the gauge into your vagina yourself. Most women say the probe is not uncomfortable and that they can’t tell they are using the gauge once they have inserted it.
The videos will show consensual sexual interactions between women and men. There are sixteen videos. In between each video, you will answer questions asking about your emotional and sexual reactions to the stories.

When you’ve finished watching all the videos, you will be asked to provide a final saliva sample. Lastly, you will complete a face and voice preference task, in which you will see pairs of faces on a computer screen and pick which one you find most attractive. You will also listen to voices speaking a neutral sentence and you will rate how attractive the voice is. Finally, the second appointment will be scheduled at the end of the session. Similar procedures will be followed for your second visit to the Sexuality and Gender Laboratory, with the exception of the first questionnaire, which will be reduced in length.

Even if you agree to participate and come to our lab, you are free to change your mind at any point. The procedure takes about 3 hours per session. You will be paid $72 when you complete the study (that is $36 each session). Upon completing the second testing session, your name will be entered into a draw to win a gift basket, containing adult friendly toys, valued at $200. All the information that you provide during the study is strictly confidential and we have safeguards in place to protect your anonymity.

If you are interested in participating in the study, the next step is to assess your eligibility to participate. This involves answering some questions by phone in a short (10-15 minute) interview. Please let me know of some dates and times that you would be available to participate in this short phone interview. If you have any questions, please feel free to e-mail them or call (my contact #s are listed below).

In your response, please let me know how you learned about the study.

The following will be read to the individual if they indicate interest in participating in the study:

The next step is to determine whether you are eligible to participate in the study. I’m going to read a list of things that would exclude you from participating in this study. If one or more of these things apply to you, then you are not eligible to participate in this study. You don't need to tell me which of these applies to you, just let me know if you are eligible.

1. You are younger than 18 or older than 40.
2. You do not speak or write English fluently.
3. You have a history of mental illness.
4. You have a history of substance abuse.
5. You are regularly taking any of the following types of medications: medications to treat a mental illness, medications to treat high blood pressure, cold or allergy medications (daily use & you cannot go without it).
6. You have a sexually transmitted infection.
7. You are pregnant, or have been pregnant in the last 6 months.
8. Your menstrual cycle is irregular (shorter than 24 days or longer than 32 days).
9. You have difficulty becoming sexually aroused (lubricated or "wet") more than half of the time.
10. You experience pain during sexual activity. Pain, in this context, is defined as superficial pain during more than 50% of any sexual activity or insertion.
11. You are equally or about equally sexually attracted both to women and men.
12. You are exclusively attracted to women.
13. You have never experienced vaginal penetration during sexual activity, used menstrual tampons, or undergone a pelvic examination.

Are you eligible to participate?

If not, the individual is thanked for their interest.

If an individual asks why they are not eligible, and discloses the criterion that they did not meet, the following will be read:

1. We are restricting the age of participants to over 18 because minors cannot participate in this research and to reduce the likelihood that women who participate are menopausal.
2. Participating in the study requires watching sexual videos and completing several questionnaires in English.
3. We are excluding people with mental illness or substance abuse because these conditions may influence the sexual responses we are studying.
4. These medications are known to influence physical sexual responding therefore we exclude individuals using them.
5. People with sexually transmitted infections are excluded because these infections may interfere with sexual response.
6. People with sexual response problems are excluded because these problems may interfere with sexual response in the laboratory.
7. Women who are about equally attracted to both genders, or who are exclusively attracted to women are excluded because of the nature of the study design.
8. Participating in the study involves inserting a vaginal gauge. If a woman has not experienced vaginal penetration (not had sexual intercourse, never used menstrual tampons, or never had an internal pelvic exam) inserting the gauge may be difficult or painful.

If the individual indicates that they are eligible, the following will be read:

The next step is to determine when you can come in to the lab.
(First session) For the first session, women will need to be in a certain phase in their menstrual cycle.

(Second session) For the second session, women will need to be in a different phase in their menstrual cycle from the first session.

Please answer the following questions about your menstrual cycle so we may determine when you will be in this phase and able to participate in the study.

1. Do you currently use a contraceptive pill?
   
   ___ Yes  (Which one? _________________________)
   ___ No

2. When did your last menstrual period begin? That is, what was the first day of menstrual flow during your last period? Please state the precise date, if possible. Consult a calendar to identify the date if it is helpful. (If you are currently menstruating, list the date your current menstruation began.)

   ______________________________________

3. What is the usual length of your menstrual cycle? That is, what is the typical time span between the first day of menstrual blood flow one month to the first day of menstrual blood flow the next month? (highlight/bold one.)

   In days:  
   <22  22  23  24  25  26  27  28  29  30  
            31  32  33  34  35  36  37  38  >38

4. How much does the length of your cycle vary from month to month?
   
   ___ My cycle is almost always the same length month to month
   ___ My cycle is practically always within a day or two of the same length each month
   ___ My cycle is usually within a week of the same length each month
   ___ My cycle length is highly irregular; I never know when I’ll begin menstruating

Once menstrual cycle information has been received, and proper menstrual phase has been determined:

According to our calculations, you will be in the proper phase of the menstrual cycle (the luteal/follicular phase) during this time XXXX. We have testing times available XXXX. The next available time is XXXX. If that does not work for you, please suggest a few other dates and times.
Once a date and time has been agreed upon, the following will be read:

Your appointment is booked for XXXX. I will send you an email on XXX reminding you of your appointment.

There are a couple of things I have to ask you not to do before the testing session. Please refrain from partnered sex and masturbation for 24 hours prior to coming in to the lab. As well, we ask that you refrain from high-level exercise (aerobic exercise) for three hours prior to coming in. Please also refrain from using any alcohol/drugs or cold medications on the day you participate in the study.

If you must cancel or reschedule your appointment, please call the lab as soon as possible to let us know. We ask that you give us at least 24 hours notice. If you develop a cold with a cough, or any vaginal irritation that would interfere with participating comfortably in the study, such as from a yeast infection, please reschedule your appointment. Similarly, if you get your period unexpectedly, please call and reschedule your appointment.

Please send me a phone number where you can be reached at on the day of testing, should we need to contact you to reschedule.

If you have any questions before you come in for your appointment, please do not hesitate to contact me.
Appendix B

Report of Behaviour and Feelings

For the following items, please indicate the extent to which you have engaged in the behaviour or had the feeling in the past 2 days (48 hours). Use the following scale:

<p>| | | | |</p>
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<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Not at all</td>
<td>Once</td>
<td>A few times</td>
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1. Felt happy for no good reason
2. Felt sad for no good reason
3. Felt afraid of strangers
4. Worried about my safety
5. Spent time with a current romantic partner
6. Went out with friends
7. Went out alone at night
8. Felt guilty for something I did
9. Worried that I had offended someone
10. Became angry with someone
11. Felt insecure
12. Felt jealous of other women
13. Competed with another woman for a man’s attention
14. Felt like “breaking the rules”
15. Felt like doing something risqué
16. Acted impulsively and without caution
17. Felt sexy
18. Dressed in a sexy outfit
19. Tried to make a current partner jealous
20. Felt irritated by a primary partner
21. Felt “suffocated” by a primary partner
22. Had strong feelings of sexual desire
23. Felt strong sexual attraction toward my primary current partner
24. Felt strong sexual attraction toward someone other than a current partner
25. Felt sexually aroused by the sight of a very physically attractive person (other than a primary current partner)
26. Felt sexually aroused by the scent of someone (other than a primary current partner)
27. Flirted with someone other than a current partner
28. Fantasized about sex with a stranger or acquaintance
29. Fantasized about sex with a current partner
____ 30. Fantasized about sex with a past partner
____ 31. Had sex with a primary current partner
____ 32. Had sex with someone other than a primary current partner
____ 33. Experienced orgasm with a primary current partner
____ 34. Experienced orgasm with someone other than a primary current partner
____ 35. Initiated sex (was the partner who was sexually assertive)
Appendix C

Kinsey Scales of Sexual Orientation

The following questions ask about your romantic and sexual attractions, sexual contacts, and sexual identity, in adulthood (since age 18). Please read each question carefully and read the options presented after each question. Please check the circle next to the response that best describes you. Remember, all of your answers are completely confidential.

1. Please think about the people you have typically been romantically attracted to. By “romantically” attracted we mean a deep emotional connection that is more than friendship. Would you say that your romantic attractions are toward:

- Women only
- Women mostly, but men occasionally too
- Women mostly, but men frequently (but not more than toward women)
- Women and men about equally
- Men mostly, but women frequently (but not more than toward men)
- Men mostly, but women occasionally too
- Men only

2. Please think about the people you have typically been sexually attracted to. By “sexually” attracted we mean you experience sexual desire or interest in someone. Would you say that your sexual attractions are toward:

- Women only
- Women mostly, but men occasionally too
- Women mostly, but men frequently (but not more than toward women)
- Women and men about equally
- Men mostly, but women frequently (but not more than toward men)
- Men mostly, but women occasionally too
- Men only

3. Please think about the people you typically have sexual fantasies about. By a “sexual fantasy” we mean sexual scenarios or daydreams you think about, and may use when masturbating and/or having sex with a partner. Would you say your sexual fantasies are about:

- Women only
- Women mostly, but men occasionally too
- Women mostly, but men frequently (but not more than about women)
- Women and men about equally
- Men mostly, but women frequently (but not more than about men)
- Men mostly, but women occasionally too
- Men only
Appendix D

Pre- & Post-Stimulus Questions

Prestimulus questions:

1. How sexually aroused do you feel?  
   (0 = not sexually aroused at all; 9 = most sexual arousal I’ve ever felt/sexual arousal associated with orgasm)

2. How strong are your genital sensations?  
   (0 = no genital sensations; 9 = most genital sensations I’ve ever felt)

3. How strong is your desire for sex with a partner?  
   (0 = no desire; 9 = most desire I’ve ever felt)

4. How strong is your desire to masturbate?  
   (0 = no desire; 9 = most desire I’ve ever felt)

5. How interested do you feel?  
   (0 = not interested at all; 9 = extremely interested/most interested I’ve ever felt)

6. How happy do you feel?  
   (0 = not happy at all; 9 = extremely happy/happiest I’ve ever felt)

7. How relaxed do you feel?  
   (0 = not relaxed at all; 9 = extremely relaxed/most relaxed I’ve ever felt)

8. How bored do you feel?  
   (0 = not bored at all; 9 = extremely bored/most bored I’ve ever felt)

9. How anxious do you feel?  
   (0 = not anxious at all; 9 = extremely anxious/most anxious I’ve ever felt)

10. How disgusted do you feel?  
    (0 = not disgusted at all; 9 = extremely disgusted/most disgusted I’ve ever felt)

Post-stimulus questions

1. How high was your sexual arousal during the video?  
   (0 = not sexually aroused at all; 9 = most sexual arousal I’ve ever felt/sexual arousal associated with orgasm)
2. How strong are your genital sensations?
   \[0 = \text{no genital sensations}; \ 9 = \text{most genital sensations I’ve ever felt}\]

3. How strong is your desire for sex with a partner?
   \[0 = \text{no desire}; \ 9 = \text{most desire I’ve ever felt}\]

4. How strong is your desire to masturbate?
   \[0 = \text{no desire}; \ 9 = \text{most desire I’ve ever felt}\]

5. How much attention did you pay to the video?
   \[0 = \text{did not pay any attention to the story}; \ 9 = \text{paid 100% attention to the story}\]

6. How sexually attractive did you find the actor(s) in the video?
   \[0 = \text{not attractive at all}; \ 9 = \text{extremely attractive/most attractive I’ve ever seen}\]

7. How happy did you feel during the video?
   \[0 = \text{not happy at all}; \ 9 = \text{extremely happy/happiest I’ve ever felt}\]

8. How interested did you feel during the video?
   \[0 = \text{not interested at all}; \ 9 = \text{extremely interested/most interested I’ve ever felt}\]

9. How relaxed did you feel during the video?
   \[0 = \text{not relaxed at all}; \ 9 = \text{extremely relaxed/most relaxed I’ve ever felt}\]

10. How bored did you feel during the video?
    \[0 = \text{not bored at all}; \ 9 = \text{extremely bored/most bored I’ve ever felt}\]

11. How anxious did you feel during the video?
    \[0 = \text{not anxious at all}; \ 9 = \text{extremely anxious/most anxious I’ve ever felt}\]

12. How disgusted did you feel during the video?
    \[0 = \text{not disgusted at all}; \ 9 = \text{extremely disgusted/most disgusted I’ve ever felt}\]

13. How high was the quality of the video?
    \[0 = \text{poorest quality possible}; \ 9 = \text{best quality I’ve ever heard}\]

14. How sexually arousing was the video?
    \[0 = \text{not sexually arousing at all}; \ 9 = \text{extremely sexually arousing}\]

15. How much did you enjoy the video?
    \[0 = \text{did not enjoy at all}; \ 9 = \text{most enjoyment I’ve ever felt}\]

16. How “turned off” did you feel during the video?
    \[0 = \text{not turned off at all}; \ 9 = \text{extremely turned off/most turned off I’ve ever felt}\]