

Sexual Minority Women's Sexual Motivation Around the Time of Ovulation

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Abstract We investigated whether motivation for same-sex sexual contact was related to mid-cycle peaks in estrogen levels (typically associated with ovulation) among women with consistent versus inconsistent patterns of same-sex sexuality. Twenty women (M age = 30 years), all of whom have been providing data on their sexual behavior and identities since 1995, completed daily diaries assessing sexual motivation and provided 10 days of salivary estrogen samples. During the 3 consecutive days on which estrogen levels peaked, women who had consistently identified as lesbian since 1995 ($n = 5$) showed increased motivation for sexual contact with women. This change in same-sex motivation was significantly smaller among women who consistently identified as bisexual ($n = 7$) and women who had given up their lesbian or bisexual identities at some point since 1995 ($n = 8$). Women who ascribed a role for “choice” in their same-sex sexuality also showed smaller increases in same-sex motivation. The findings suggest that women with consistent versus inconsistent patterns of same-sex sexuality might be experiencing different types of same-sex desires influenced by different factors.

Keywords Sexual orientation · Ovulation · Estrogen · Sexual motivation

Introduction

Female same-sex sexuality shows a wide variety of manifestations, and the reasons for such variability remain poorly understood (Baumeister, 2000; Diamond, 2008b). For example, some women report stable and exclusive same-sex attractions and behavior, consistent self-identification as “lesbian,” and feel their sexuality is an intrinsic characteristic over which they have no control (Diamond, 2005, 2008b; Golden, 1996). Yet, many other women report bisexual attractions (Baumeister, 2000; Chivers, Rieger, Latty, & Bailey, 2004; Laumann, Gagnon, Michael, & Michaels, 1994) or gradual shifts in their sexuality, which are ascribed to choice, circumstance, or changes in their environments and relationships (Blumstein & Schwartz, 1990; Diamond, 2003, 2005, 2008b; Weinberg, Williams, & Pryor, 1994).¹ Researchers have long speculated over whether there is a fundamental difference between women with stable and exclusive lesbianism and women with more variable patterns of same-sex sexuality. The present research addressed this question by examining whether women with consistent versus inconsistent patterns of same-sex sexuality (as assessed since 1995 in the context of an ongoing longitudinal study) showed different patterns of change in same-sex sexual motivation around the time of ovulation, suggesting that they may experience different types of same-sex desires influenced by different factors.

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¹ Sample characteristics make it difficult to know the degree to which such findings are generalizable. For example, the study by Weinberg, Williams, and Pryor (1994) sampled openly identified bisexuals who were members of the San Francisco bisexual community, who might arguably be more likely to experience and openly report changes in sexual object choice.

Subtypes of Same-sex Sexuality

The notion that some individuals are “more homosexual” than others has a long history (Bergler, 1954; Defries, 1976, 1978; Goode & Haber, 1977). Consider, for example, the longstanding distinction between “born/essential/primary” lesbians and “political/chosen” lesbians (Burch, 1993; Ettore, 1980; Golden, 1994; Ponse, 1978). “Born” lesbians are presumed to possess an enduring and stable predisposition for same-sex contact, whereas “political/chosen” lesbians are presumed to experience same-sex attractions as a result of transitory environmental or interpersonal factors (Diamond, 1998, 2005, 2008b). Yet, there is no way to verify this distinction because there is no *bona fide* measure of sexual orientation. Even physiological studies (which do not provide such *bona fide* measurement but are nonetheless uniquely informative in revealing patterns of genital sexual arousal independent of self-report) find that lesbian-identified and heterosexually-identified women show similar genital responses to same-sex and other-sex stimuli (Chivers & Bailey, 2005; Chivers et al., 2004; Chivers, Seto, & Blanchard, 2007), and these studies cannot determine *why* a woman might become aroused to same-sex stimuli at a particular moment in time.

One potential strategy for addressing this question takes advantage of the fact that female sexual motivation shows different degrees of biological and environmental influence across the menstrual cycle. Specifically, researchers (going back to Beach, 1976) have distinguished between female proceptivity (i.e., motivation to initiate sexual activity) and female receptivity or arousability (i.e., capacity to become aroused to sexual stimuli). As reviewed by Wallen (1995), proceptivity peaks around the time of ovulation, when women are most likely to conceive, and is manifested in increased sexual initiation, sexual activity, and orgasms among women who are not taking hormonal contraception (Harvey, 1987; Hill, 1988; Matteo & Rissman, 1984). Such mid-cycle increases in sexual motivation were first documented over 50 years ago in seminal longitudinal work by Benedek and Rubenstein (1952). Current research has linked these changes to the increased estrogen levels that accompany ovulation (Adams, Gold, & Burt, 1978; Judd & Yen, 1973; Stanislaw & Rice, 1988). Although a number of other hormones also peak around the time of ovulation, including luteinizing hormone (LH), follicle stimulating hormone (FSH), and testosterone, only testosterone and estrogen have been found to affect women's sexual interest, and research supports a particularly strong role for estrogen in this regard (reviewed in Wallen, 1995).

Evolutionarily speaking, an ovulatory increase in proceptivity makes sense, as it ensures that women are motivated to seek out sexual activity when they are most likely to conceive. In contrast, arousability is independent of hormonal status (Abramson, Repczynski, & Merrill, 1976; Griffith & Walker, 1975; Slob, Ernste, & van der Werff ten Bosch, 1991), and depends instead on situational factors such as exposure to sexual stimuli or direct sexual solicitation. The distinction between proceptivity and

arousability has important implications for interpreting variability in female same-sex sexuality. Because proceptivity specifically motivates reproductive behavior, it should be highly sensitive to “sex of target.” Hence, to the degree that sexual orientation represents an early-developing and enduring predisposition for partners of a particular sex, this predisposition should specifically “orient” proceptivity. In contrast, arousability should be a more flexible system, permitting women to experience a range of sexual desires and behaviors with a variety of partners. In fact, researchers have argued that sexual behavior with non-reproductive (and even same-sex) partners confers multiple advantages, such as social bonding, alliance formation, solicitation of parental care, and simple sexual release (Kirkpatrick, 2000; Vasey, 2006).

Sexual desires elicited by arousability are situation-dependent, and therefore subject to variation in response to situational and interpersonal changes. Perhaps, then, women with inconsistent patterns of same-sex sexuality are women whose same-sex desires are primarily due to arousability (instead of an early-developing, stable same-sex predisposition). The same might be true of women who claim that “choice” plays a role in their same-sex sexuality (Golden, 1994, 1996; Whisman, 1996). Because arousability is situation-dependent, choices to pursue or avoid certain situations, environments, and relationships should affect the likelihood of experiencing same-sex desires. Women whose same-sex desires are primarily attributable to arousability might take note of these fluctuations and come away with the subjective impression that the desires themselves are somewhat “chosen.”

On a day-to-day basis (or within the context of an experimental study, such as Chivers et al., 2007), women whose same-sex desires are primarily attributable to arousability might be indistinguishable from women with stable and enduring lesbian or bisexual predispositions. But during ovulation, when proceptivity increases, women with stable lesbian or bisexual predispositions should experience significantly greater motivation for same-sex contact. This should not be the case for women whose same-sex desires are primarily attributable to arousability; in fact, they might even show less motivation for same-sex contact during this period, given that proceptivity might supersede arousability during this period. The present research tested this hypothesis.

The Current Study

The participants in the present study have been taking part in a longitudinal study of sexual identity development (Diamond, 1998, 2000, 2003, 2005, 2008a, 2008b), in which they have provided detailed data since 1995 on their sexual attractions, behaviors, and identities. The present study tested for changes in same-sex motivation occurring during the 3-day window surrounding women's peak estrogen level, at which proceptivity is highest. We hypothesized that during this period, significant increases in motivation for same-sex contact should be observed among (1)

women who have consistently identified as lesbian or bisexual since 1995, compared to women who gave up their lesbian or bisexual identities at some point; (2) women who have pursued a greater percentage of their sexual activity with female partners since 1995, and (3) women who reject a role for choice in their same-sex sexuality. We further expected that these types of women would show smaller increases (or even decreases) in motivation for other-sex contact around the time of ovulation, with the exception of women who have been consistently identified as bisexual since 1995. If bisexuality represents a stable sexual predisposition for both sexes, then bisexual women should show increased motivation for both same-sex and other-sex contact around the time of ovulation.

Method

Participants

Participants were 20 women who have undergone five interviews since 1995 as part of a longitudinal study of sexual identity development (more detail on the full range of interview questions and responses can be found in Diamond, 1998, 2000, 2003, 2005, 2008a, 2008b). The original 1995 sample contained 89 non-heterosexual women, 79 of whom were still participants by 2007. Five women in the sample identified as transgendered by 2007 and were living with a male gender presentation, but none of these women were included in the present study. Initial sampling took place in two moderately-sized cities and a number of smaller urban and rural communities, at lesbian, gay, and bisexual community events, youth groups, and classes on gender and sexuality issues taught at local colleges and universities.

Of the original sample, 51 women expressed interest in participating in the present study. Thirteen were taking oral contraceptives, four were pregnant or nursing, and one had had a hysterectomy. Of the remaining 33 eligible participants, 12 provided incomplete data (due to self-reported difficulty adhering to the protocol). One woman's data were not used because her estrogen levels did not vary at all. This left 20 women providing complete data. There were no significant differences in sexual identification, sexual behavior history, or same-sex and other-sex motivation between these women and those who were excluded from participation. The average age of the present participants was 30 years ($SD = 2.0$). 75% had completed at least 1 year of college. 35% described themselves as working-class or lower-middle class, and 65% as middle or upper class. All but one were white. Five women consistently identified as lesbian and 7 consistently identified as bisexual throughout the entire duration of the study. Eight women initially identified as lesbian or bisexual in 1995, but gave up those identities in favor of "no identity" ($n = 6$) or "heterosexual" ($n = 2$) at some point thereafter (two of these women re-adopted a bisexual identity at a later interview). All of these women reported continuing to

experience periodic sexual attractions for women (Diamond, 2008b).

Procedure

During initial recruitment in 1995, the principal investigator described the research as an investigation of women's sexual identity development, explained the selection criteria (rejection or questioning of heterosexual identification), and distributed flyers with contact information. Ninety-five percent of women who received this description volunteered to participate; those who declined to volunteer cited lack of interest as the reason. Response rates for college classes on gender and sexuality were inestimable because it is unknown how many students in each class met the selection criteria. As noted above, each participant has undergone five interviews (conducted by the primary investigator) regarding her sexual attractions, identity, and behavior. The first interview took place in person; all subsequent interviews have taken place over the phone.

Each participant completed an online diary each day before bedtime (described below) assessing daily motivation to act on desires for women and men. They began the diary on the first day of their menstrual period and completed it for 18 days (women were provided a paper calendar to keep track of study procedures). The online diary was maintained through a secure server at the primary investigator's home institution. The participant logged on each day with a unique username and password. Each entry was time- and date-stamped. Women were provided with paper copies of the diary in case they had trouble accessing the internet or if they did not have internet access at home. Approximately 6% of diary entries were provided on paper, and analyses revealed no significant difference between paper and online entries.

On Day 9 of the study, women began providing daily saliva samples. Participants contacted the principal investigator on the first day of her saliva sampling to confirm that she was initiating the sampling on the correct day. Each woman was provided with 10 pre-labeled glass centrifuge tubes (5 ml), in which she passively drooled to provide her samples. Women were instructed to provide their saliva sample at the same time each day and that, during the hour before their sample, they should not eat, drink, smoke, or brush their teeth. To get rid of any food particles, they were instructed to rinse their mouths with plain water 20–90 min before providing the sample. They used plastic straws to passively "drool" into the tube, filling the tube at least one-third full. They then sealed the tube with a screw top and immediately placed it in a freezer. They did this for 10 consecutive days.

Estrogen samples were shipped overnight to Emory University for assay. Because saliva samples for estradiol analysis must remain completely frozen until the time of assay, women were provided with insulated boxes, and packed their samples with 9 lb of dry ice, which they purchased from a local grocery store on the morning of the shipment. Boxes were shipped overnight to

Emory University, where the frozen state of each batch was individually confirmed. Overall within assay variability (determined by replicate determination (16×) of two different control sera in one assay) was 7%. Between assay variability (determined by replicate measurements of three different control sera in two different lots) was 10.4%. The recovery of 50–100–200 pg/ml of estradiol added to “plasma-free” sample gave an average value (\pm SD) of $98\% \pm 6\%$ with reference to the original concentrations. Each participant was paid \$60 to compensate her for her time and for the cost of the dry ice.

Measures

At each interview, participants reported the total number of men and women with whom they engaged in sexual contact (defined as any sexually motivated intimate contact) between T1 and T2, T2 and T3, T3 and T4, and T4 and T5. This information was translated into percentages, so that 100% represents exclusive sexual contact with women and 0% represents exclusive sexual contact with men. In 2003, women were asked to rate their agreement on a 1–5 Likert scale with the statement “I feel my sexuality is something that I chose.”

The items in the online daily diary were modeled after the Sexual Desire Inventory (Spector, Carey, & Steinberg, 1996). Women were asked to “think back over the course of the entire day, from when you woke up to right around now.” To assess generalized daily sex drive (i.e., desire for sexual activity regardless of the gender of the partner), women were asked to rate how often that day they had felt sexually aroused, thought about sex, or had a sexual fantasy, and how often they had found another person attractive (not at all, 1–2 times, 3–4 times, or more than 5 times). Cronbach’s alpha for this index was .79. To assess women’s motives to act on same-sex attractions, they were prompted to reflect on the strongest attraction they had experienced to a woman that day and rate how strongly they were motivated to act on that attraction, on a 1–9 scale. Women were instructed that if they had experienced no such attractions,

they should provide the lowest possible rating for “motivation” (i.e., “none at all”). They answered the same questions with regard to other-sex attractions and motivations, and also indicated whether they had engaged in solitary or partnered sexual activity that day with either female or male partners. Means of all study variables, stratified by identity group, are shown in Table 1.

Results

Data Analysis

Analyses were conducted with multilevel random coefficient modeling (MRCM, employed with WHLM; Bryk & Raudenbush, 1992), to represent the nested nature of the data, in which lower level units (daily estrogen and daily sexual motivation) vary within persons. The Level 1 model calculates within-person associations, and the Level 2 model tests whether these within-person associations vary across different women. Level 1 models used only the 10 days of data on which estrogen data were available. All models used an unrestricted variance structure, which provided a significantly better fit to the data than either a heterogeneous or homogeneous variance structure. Our Level 1 model was structured as follows:

$$\text{Same-sex Motivation}_{\text{day } i, \text{ participant } j} = \beta_0 + \beta_1(\text{Peak Estrogen}) + \beta_2(\text{Sex Drive}) + r$$

This model is analogous to calculating a separate regression model for each women, in which the “sample” comprises her 10 days of data. The sex drive variable was ipsatized, or “group-centered” (i.e., centered around each woman’s 10-day mean), so that it represents the degree to which women’s same-sex motivation increased on days when her sex drive was higher than average for her. The coefficient of interest is “Peak Estrogen,” coded “1” for the day before, during, and after a woman’s peak estrogen level, and “0” for all other days. Hence,

Table 1 Previous sexual behavior, perceptions of choice in sexuality, and current same-sex and other-sex motivation and sex drive among women who maintained stable lesbian identities, stable bisexual identities, or who have given up their lesbian-bisexual identities since 1995

Variable	Stable lesbians <i>M</i> (<i>SD</i>)	Stable bisexuals <i>M</i> (<i>SD</i>)	Gave up lesbian-bisexual identity <i>M</i> (<i>SD</i>)
Percentage of sexual partners who were female, 1995–2005 ^a	73 (30)	38 (21)	48 (34)
Degree of agreement in 2003 that “My lesbianism or bisexuality is something that I chose” ^b	2 (1.7)	1.6 (.63)	1.8 (.71)
Strength of motivation to act on the day’s strongest desire for a woman, averaged across 10 days of assessment ^c	2.8 (1.9)	2.9 (1.3)	2.4 (1.6)
Strength of motivation to act on the day’s strongest desire for a man, averaged across 10 days of assessment ^d	1.7 (1.1)	3.6 (1.9)	2.5 (1.3)
Sex drive, averaged across 10 days of assessment ^e	2.4 (.7)	2.5 (.7)	2.2 (.5)
Estrogen in pg/ml, averaged across 10 days of assessment ^f	1.9 (.5)	1.9 (.7)	2.2 (1.9)

^a Range: 8–100, ^b Range: 1–5, ^c Range: 1–5.5, ^d Range: 1–6.3, ^e Range: 1.4–3.4, ^f Range: 1–6.6

in this model β_1 represents the degree to which a woman's same-sex motivation increased during the window of time during which ovulation most likely occurred (although we cannot confirm whether women did, in fact, ovulate during this window of time), controlling for her sex drive. This Level 1 model calculates an estimate of change for each woman, and the Level 2 model examines whether this change varied across women, as a function of the following:

- G_1 : Percentage of sexual partners who have been women since 1995, as assessed every 2 years and centered at the sample mean
- G_2 : Degree to which a woman perceived her sexuality to be a matter of choice, assessed in 2003, and centered at the sample mean
- G_3 : Consistent lesbian group (dummy coded to contrast with the "gave up identity" group)
- G_4 : Consistent bisexual group (dummy coded to contrast with the "gave up identity" group)

Following standard conventions, the Level 2 coefficients were termed "G" to distinguish them from the Level 1 coefficients (β). G coefficients have a straightforward interpretation as unstandardized regression slopes, representing the magnitude of change in the DV (in this case, increased same-sex motivation on Peak Estrogen days) associated with a one-unit change in the independent variable.

Sexual Motivation During Peak Estrogen

Model coefficients are shown in Table 2. Women's motivation for same-sex contact was significantly related to sex drive, $\beta = 1.0, p < .001$. Turning to the Peak Estrogen coefficients,

note that because women in the "gave up identity" group were treated as the base category, the "main effect" coefficient (in the row for "intercept") represents degree of change in same-sex motivation during Peak Estrogen for women in the gave-up identity group. This coefficient was significant and positive, $\beta = .46, p < .001$, indicating that these women showed a significant increase in same-sex motivation during Peak Estrogen, independent of their corresponding increase in sex drive. As predicted, consistent lesbians showed an even larger increase in same-sex motivation during their estrogen peak, $G_{lesbian} = .63, p < .01$. Consistent bisexuals showed *less* of an increase in same-sex motivation during their Peak Estrogen period than did women in the "gave up identity" group, $G_{bisexual} = -.41, p < .01$, contrary to expectation. An additional analysis conducted with consistent lesbians as the base category found that bisexual women also showed smaller increases in same-sex motivation during Peak Estrogen than the consistent lesbian group, $G = -1.0, p = .001$.

As hypothesized, women who endorsed a greater role for choice in their same-sex sexuality showed smaller increases in same-sex motivation during the Peak Estrogen period, $G = -.33, p < .001$. However, women with a history of more predominant same-sex sexual contact since 1995 did not show larger increases in same-sex motivation during Peak Estrogen, $G = -.001$. All of these results were unchanged in ancillary analyses that controlled for whether women had a current sexual partner (women with current partners had greater increases in same-sex motivation during ovulation, $G = .57, p < .001$). Figure 1 displays the estimated changes in women's self-reported ratings of same-sex motivation during woman's peak estrogen period, stratified by identity group and perceptions of choice (contrasting women who disagreed with the notion that choice

Table 2 Results of multilevel models of association between peak estrogen and day-to-day same-sex sexual motivation, other-sex sexual motivation, and overall sex drive

	Intercept	Sex drive	Peak estrogen
Motivation to act on desires for women			
Intercept (main effects)	1.81***	1.0***	.46***
Moderators:			
Average percentage of sexual partners there were female since 1995	–	–	.00
Identity group: Stable lesbians (compared to women who gave up their lesbian or bisexual label after 1995)	–	–	.63***
Identity group: Stable bisexuals (compared to women who gave up their lesbian or bisexual labels after 1995)	–	–	-.41***
Degree to which choice was perceived to play a role in one's sexuality	–	–	-.32***
Motivation to act on desires for men			
Intercept (main effects)	2.24***	.61***	-.67***
Moderators:			
Average percentage of sexual partners that were female since 1995	–	–	.00
Identity group: Stable lesbians (compared to women who gave up their lesbian or bisexual label after 1995)	–	–	.53*
Identity group: Stable bisexuals (compared to women who gave up their lesbian or bisexual labels after 1995)	–	–	.15
Degree to which choice was perceived to play a role in one's sexuality	–	–	-.05

* $p < .05$, ** $p < .01$, *** $p < .001$

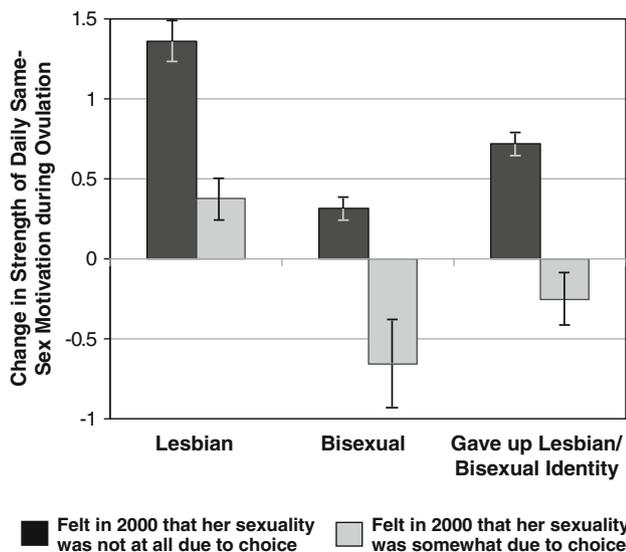


Fig. 1 Magnitude of change in self-reported ratings of daily motivation to act on same-sex desires during the 3-day window when estrogen levels were highest, stratified by identity group and women’s perceptions of whether choice played a role in their same-sex sexuality

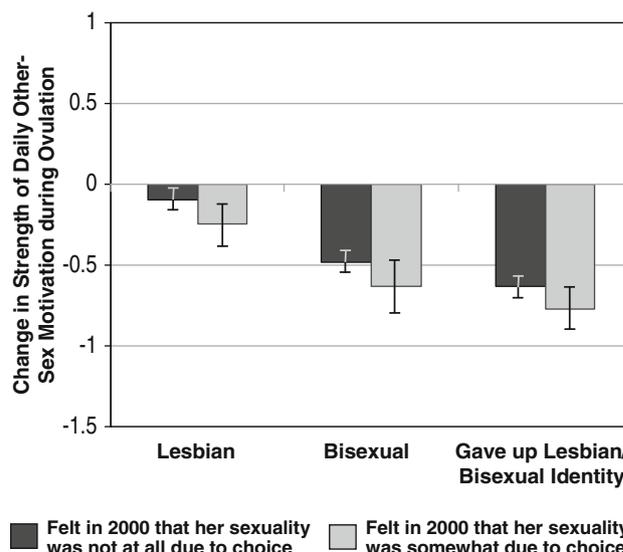


Fig. 2 Magnitude of change in self-reported ratings of daily motivation to act on other-sex desires during the 3-day window when estrogen levels were highest, stratified by identity group and women’s perceptions of whether choice played a role in their same-sex sexuality

played any role in their sexuality, corresponding to a rating of “1” on a 1–5 scale, with women who agreed that it played some role, corresponding to a rating of “4”). The women who showed the largest increases in same-sex motivation were consistent lesbians who disavowed any role for choice. Non-lesbian women who felt that choice played a role in their sexuality actually showed declines in same-sex motivation during this period.

Figure 2 displays the estimated changes in women’s other-sex motivation on the day before, during, and after their peak estrogen level, stratified by perceptions of choice as in Fig. 1. As shown in the figure (and presented in Table 2), all groups showed declines in other-sex motivation during this period, which were most pronounced in the gave-up identity group, $G = -.67, p < .001$. Contrary to expectation, consistent lesbians showed less of a decline in other-sex motivation during this period than the gave-up identity group, $G = .53, p < .05$. There was no significant difference between the bisexual women and the gave-up identity group, $G = .15$, and ancillary analyses conducted with the consistent lesbian group as the base category detected no significant difference between the lesbians and the bisexuals, $G = -.34$. Neither a woman’s history of sexual behavior nor her perceptions of “choice” moderated changes in other-sex motivation on the day before, during, and after a woman’s peak estrogen level. When the same model was run with generalized sex drive as the dependent variable, the only significant effect was that lesbians showed significantly larger increases in generalized sex drive during this period than did women who gave up their sexual identity (Table 2).

Discussion

This research demonstrated that women with consistent versus variable patterns of same-sex sexuality experience different patterns of change in same-sex motivation around the time of ovulation. During women’s peak estrogen levels, when ovulation most likely occurs, women who had consistently identified as lesbian since 1995 reported a significant increase in their motivation to act on same-sex desires. This increase was significantly larger than that observed among consistent bisexuals and among women who had given up their lesbian or bisexual identities in favor of unlabeled or heterosexual identities since 1995. We also found that women who ascribed a role for “choice” in their sexuality showed smaller increases in same-sex motivation around the time of ovulation. Because we controlled for generalized sex drive, these changes represent shifts in sexual motivation that were specific to same-sex partners.

Subtypes of Same-sex Sexuality

Our findings concord with the notion that women with consistent versus variable patterns of same-sex sexuality over the life course may represent different “subtypes” of sexual minority women, whose same-sex desires might be influenced by different factors. Previous researchers have framed this possibility in terms of constitutional versus facultative same-sex sexuality (Bell, Weinberg, & Hammersmith, 1981). Constitutional same-sex sexuality is supposedly attributable to a stable and enduring

predisposition for the same sex, whereas facultative same-sex sexuality is supposedly attributable to situational and environmental factors. Kirkpatrick (2000) has critiqued this distinction as overly simplistic, noting that social behaviors are always jointly determined by “a range of constitutional propensities interacting with a range of facultative opportunities” (p. 390). Accordingly, we might replace the notion of distinct constitutional/facultative subtypes with the notion of a continuum representing different combinations of constitutional and situational influence.²

Do women’s proceptive sexual desires (i.e., those experienced around ovulation) provide a window into the “constitutional” component of her sexuality, and hence a mechanism for determining where she falls on the constitutional/facultative continuum? Our study cannot definitively answer this question, but the findings suggest that examining cyclic variation in women’s same-sex and other-sex desires is a promising approach for determining whether some women’s same-sex desires have different underlying influences. We expected that women with stable patterns of same-sex sexuality since 1995 would show distinct increases in same-sex motivation around the time of ovulation, similar to the mid-cycle increases in other-sex motivation that have been observed among heterosexual women (Harvey, 1987; Hill, 1988; Matteo & Rissman, 1984), and we expected that these increases would be greater than those observed among women with inconsistent patterns of identification.

These hypotheses were confirmed, with one important exception. We had predicted that consistent bisexuals would show increases in same-sex motivation similar to those of the consistent lesbians, and that both groups would show greater increases than the “gave up identity” group. We found instead that only the stable lesbian group showed greater peak-estrogen increases in same-sex motivation than the “gave up identity” group; stable bisexual women actually showed the smallest increases of all, significantly smaller than both the stable lesbian group and the “gave up identity” group. When the additional effect of “perceived choice” was taken into account, we found that the largest peak-estrogen increases in same-sex motivation were observed among lesbians who perceived that choice played no role in their sexuality, whereas bisexual women who granted a role for choice in their sexuality actually showed the largest declines in same-sex motivation around the time of ovulation.

These findings raise important questions about the nature of bisexuality as both a sexual predisposition and as a sexual

identity. Many researchers have argued that bisexuality is a less constitutional and more situationally-variable form of same-sex sexuality (reviewed in Diamond, 2008a; Rust, 2000). According to these views, bisexually-identified women should more closely resemble women in the “gave up identity” group than women in the “consistent lesbian” group. However, previous research on the present sample (Diamond, 2008a) has provided evidence that bisexuality appears to be a stable sexual predisposition on par with lesbianism, rather than a transitional stage or a permanent state of sexual flexibility (although there is obviously significant variability among bisexual women regarding degrees of stability in sexual desire as well as sexual identification, as shown in Diamond, 2008b). The pattern of results that we found for bisexual women was actually closer to what we originally expected for the “gave up identity” group, suggestive of a relatively greater role for arousability in their day-to-day same-sex attractions. Clearly, increases in same-sex motivation around the time of ovulation do not provide clear-cut markers for overall stability in sexual identification; rather, they appear to be specifically associated with stability in lesbian identification. Future research should devote additional attention to investigating the experiences of a diverse range of bisexual women, and how their mixed patterns of attraction are made manifest in bisexual identification. Multiple factors (in addition to same-sex and other sex desires) influence sexual minority women’s decisions to adopt bisexual, lesbian, or “unlabeled” identities at different points along the life course, and future research should attempt to determine whether women with different patterns of cyclic change in same-sex and other-sex desire weigh these factors differently in selecting a sexual identity. For example, might bisexual women with other-sex sexual partners show different patterns of change in other-sex and same-sex motivation than bisexual women with same-sex partners? Such questions should be explored in future research.

Perceptions of “Choice” and Other-sex Motivation

We found smaller peak-estrogen increases in same-sex motivation among women who granted a role for choice in their same-sex sexuality. However, we are cautious in interpreting these findings, given that women’s ratings of the role of choice in their same-sex sexuality clustered around the low end of the Likert scale (Table 1). Hence, our findings represent contrasts between women who unequivocally rejected *any* role for choice and women who ambivalently granted *some* potential role for choice. It also bears noting that women interpret questions of “choice” in diverse ways. For example, many women with bisexual patterns of attraction believe that such attractions necessarily create a context of “choice,” since they allow women the possibility of actively pursuing relationships with women versus men (Diamond, 2008b). One potential interpretation of the present study is that same-sex desires generated by arousability “feel different” from those generated by proceptivity, and that the situational and

² Freud (1905/1961) actually articulated a similar notion with respect to homosexuality, noting that the evidence for “intermediate examples” of homosexuality suggested that “we are dealing with a connected series” (p. 138). Freud (1895/1961) drew upon the notion of “complemental series” to explain the etiology of these types; this notion, which he originally developed to explain the etiology of pathology more generally, maintains that neither endogenous, hereditary factors nor experiential factors are sufficient to produce pathology in and of themselves. Rather, Freud maintained that they exerted inverse and complementary influences on psychological development (i.e., the stronger “press” from one, the weaker “press” from the other).

environmental dependence of arousability may be subjectively interpreted by women as indicating a role for “choice.” However, in order to examine whether this is the case, we need more research on women who strongly endorse a role for choice in their same-sex sexuality, and on whether attractions triggered by arousability are, in fact, interpreted differently from other attractions. This is an important direction for future study, especially among heterosexual as well as sexual minority women.

Notably, the effects we detected for same-sex sexual motivation were not “reversed” for other-sex motivation. Rather, all women showed declines in other-sex motivation during their peak estrogen period, controlling for sex drive. Unexpectedly, these declines were smaller among the lesbian women than among the bisexual women and the “gave up identity” group. The findings for the bisexual women were particularly notable, given that we expected that these women would show peak-estrogen increases in other-sex motivation. One potential explanation for the mixed pattern of findings among the bisexual and the “gave up identity” groups is that both of these groups were more heterogeneous than the lesbians, containing a mix of heterosexual-leaning and lesbian/bisexual-leaning women. We might have detected estrogen-related increases in other-sex motivation during ovulation if we had had a comparison group of “typical” heterosexual women in our sample; examining this possibility is an important direction for future research. Clearly, research on larger and more diverse samples of sexual minority and heterosexual women is necessary to fully examine this possibility. It also bears noting that contrary to expectation, we did not find an association between women’s peak-estrogen increases in same-sex motivation and the percentage of their sexual behavior that had been pursued with women since 1995. We believe that this is likely attributable to the fact that the range of variability in same-sex behavior which is probably most strongly related to variation in peak-estrogen same-sex motivation is that which completely overlaps with the distinction between stable lesbians and the other two groups: Namely, between predominant same-sex behavior and behavior which is divided more evenly between same-sex and other-sex partners.

Limitations and Future Directions

The present sample was extremely small, containing only 20 women. The collection of multiple data points from each woman and the use of MRCM to model within-person and between-person effects simultaneously increase the overall power of the analyses, but replication of the present findings with a larger sample of women is a priority for future research. Similarly, the sample was relatively self-selected, comprising a group of women who have been long-term participants in a longitudinal study of sexual identity development and who were willing to endure the intrusive, time-intensive nature of the study procedures. Yet by the same token, the availability of longitudinal data on these women’s patterns of sexual behavior and identification stretching back to

1995 was a unique strength of the study. The longitudinal study in which the present participants are currently taking part is the first and only long-term prospective investigation of sexual minority women’s sexual attractions, behaviors, and identities. Hence, the downside of our reliance on this small and self-selected sample is outweighed by the benefits afforded by the availability of long-term longitudinal data on their sexual identifications and histories.

Another limitation was our inability to identify the specific mechanism through which a gender-specific form of sexual motivation would increase as a function of rising estrogen levels. Previous research on estrogen and sexual desires clearly indicates a linkage between generalized sexual motivation and estrogen (Wallen, 2001), consistent with the fact that we found an overall link between estrogen and generalized sex drive (Table 2), yet the biopsychological processes through which a specifically gender-targeted form of sexual desire might be linked to changes in estrogen levels is as yet unknown. Also, by isolating the portion of women’s cycles during which estradiol peaks, we were also inadvertently isolating the portion of women’s cycles during which testosterone peaks (Abraham, 1974), and hence the design of our study cannot determine whether some portion of the observed effects are attributable to changes in testosterone. We also did not measure progesterone, which shows a small mid-cycle peak at the time of the estradiol peak (Hoff, Quigley, & Yen, 1983). We think it unlikely that increased progesterone explains any variance in our observed effects, but we cannot rule it out.

Given these ambiguities, one important direction for future research is to incorporate more extensive assessments of variation in women’s subjective experiences of different types of desires, informed by a psychodynamic and phenomenological approach. This might help to clarify a number of intriguing and unresolved questions in the present study, such as the reasons for which women with current sexual partners experienced greater peak-estrogen increases in same-sex motivation altogether. This finding is consistent with previous research on associations between partnered sexual activity and hormonal variation (van Anders & Watson, 2006), yet the present research lacked sufficient sample size to explore these linkages in greater depth. In particular, future research might investigate whether bisexual women with male partners show different patterns of estrogen-related change in same-sex and other-sex motivation than bisexual women with female partners, and whether the subjective quality of a woman’s intimate partnership plays a role in these changes. Another important issue to consider is the degree to which women with different sexual identifications, and different types of sexual partners, might consciously or unconsciously inhibit different forms of sexual motivation, in response to perceptions of the “acceptability” of different types of desire. Along the same lines, future research should also consider whether the patterns detected in the present study might differ among women who are more sensitive to the subtle changes in their bodies that occur across the menstrual cycle, and who might therefore have a general idea of when ovulation occurs.

Conclusion

The present study makes an important contribution to contemporary research on female sexuality by providing the first empirical evidence that differences between consistent versus variable histories of sexual identification and behavior have biological correlates, specifically regarding the extent to which women's same-sex motivation changes during the phase of the menstrual cycle during which ovulation most likely occurs. These findings suggest that researchers assessing the potential existence and etiology of different subtypes of female same-sex sexuality may consider cyclic changes in sexual motivation as one of the (many) variables informing differences between such subtypes. Although the present findings require replication with a larger and more diverse sample, they suggest new directions for future research on the conceptualization and measurement of variability in female same-sex sexuality.

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References

- Abraham, G. E. (1974). Ovarian and adrenal contribution to peripheral androgens during the menstrual cycle. *Journal of Clinical Endocrinology and Metabolism*, *39*, 340–346.
- Abramson, P. R., Repczynski, C. A., & Merrill, L. R. (1976). The menstrual cycle and response to erotic literature. *Journal of Consulting and Clinical Psychology*, *44*, 1018–1019.
- Adams, D. B., Gold, A. R., & Burt, A. D. (1978). Rise in female-initiated sexual activity at ovulation and its suppression by oral contraceptives. *New England Journal of Medicine*, *299*, 1145–1150.
- Baumeister, R. F. (2000). Gender differences in erotic plasticity: The female sex drive as socially flexible and responsive. *Psychological Bulletin*, *126*, 347–374.
- Beach, F. A. (1976). Sexual attractivity, proceptivity, and receptivity in female mammals. *Hormones and Behavior*, *7*, 105–138.
- Bell, A. P., Weinberg, M. S., & Hammersmith, S. K. (1981). *Sexual preference: Its development in men and women*. Bloomington: Indiana University Press.
- Benedek, T., & Rubenstein, B. B. (1952). The sexual cycle in women. In T. Benedek (Ed.), *Psychosexual functions in women* (pp. 3–325). New York: Ronald Press.
- Bergler, E. (1954). Spurious homosexuality. *Psychiatric Quarterly Supplement*, *28*, 68–77.
- Blumstein, P., & Schwartz, P. (1990). Intimate relationships and the creation of sexuality. In D. P. McWhirter, S. A. Sanders, & J. M. Reinisch (Eds.), *Homosexuality/heterosexuality: Concepts of sexual orientation* (pp. 307–320). New York: Oxford University Press.
- Bryk, A. S., & Raudenbush, W. W. (1992). *Hierarchical linear models: Applications and data analysis methods*. Newbury Park, CA: Sage.
- Burch, B. (1993). *On intimate terms: The psychology of difference in lesbian relationships*. Chicago: University of Illinois Press.
- Chivers, M. L., & Bailey, J. M. (2005). A sex difference in features that elicit genital response. *Biological Psychology*, *70*, 115–120.
- Chivers, M. L., Rieger, G., Latty, E., & Bailey, J. M. (2004). A sex difference in the specificity of sexual arousal. *Psychological Science*, *15*, 736–744.
- Chivers, M. L., Seto, M. C., & Blanchard, R. (2007). Gender and sexual orientation differences in sexual response to sexual activities versus gender of actors in sexual films. *Journal of Personality and Social Psychology*, *93*, 1108–1121.
- Defries, Z. (1976). Pseudohomosexuality in feminist students. *American Journal of Psychiatry*, *133*, 400–404.
- Defries, Z. (1978). Political lesbianism and sexual politics. *Journal of the American Academy of Psychoanalysis*, *6*, 71–78.
- Diamond, L. M. (1998). Development of sexual orientation among adolescent and young adult women. *Developmental Psychology*, *34*, 1085–1095.
- Diamond, L. M. (2000). Sexual identity, attractions, and behavior among young sexual-minority women over a two-year period. *Developmental Psychology*, *36*, 241–250.
- Diamond, L. M. (2003). Was it a phase? Young women's relinquishment of lesbian/bisexual identities over a 5-year period. *Journal of Personality and Social Psychology*, *84*, 352–364.
- Diamond, L. M. (2005). A new view of lesbian subtypes: Stable vs. fluid identity trajectories over an 8-year period. *Psychology of Women Quarterly*, *29*, 119–128.
- Diamond, L. M. (2008a). Female bisexuality from adolescence to adulthood: Results from a 10 year longitudinal study. *Developmental Psychology*, *44*, 5–14.
- Diamond, L. M. (2008b). *Sexual fluidity: Understanding women's love and desire*. Cambridge, MA: Harvard University Press.
- Ettore, E. M. (1980). *Lesbians, women, and society*. London: Routledge.
- Freud, S. (1895/1961). A reply to criticism of my paper on anxiety neurosis. In J. Strachey (Ed. and Trans.), *The standard edition of the complete psychological works of Sigmund Freud* (Vol. 3, pp. 119–138). London: Hogarth Press.
- Freud, S. (1905/1961). Three essays on the theory of sexuality. In J. Strachey (Ed. and Trans.), *The standard edition of the complete psychological works of Sigmund Freud* (Vol. 7, pp. 123–243). London: Hogarth Press.
- Golden, C. (1994). Our politics and choices: The feminist movement and sexual orientation. In B. Greene & G. M. Herek (Eds.), *Lesbian and gay psychology: Theory, research, and clinical applications* (pp. 54–70). Thousand Oaks, CA: Sage.
- Golden, C. (1996). What's in a name? Sexual self-identification among women. In R. C. Savin-Williams & K. M. Cohen (Eds.), *The lives of lesbians, gays, and bisexuals: Children to adults* (pp. 229–249). Fort Worth, TX: Harcourt Brace.
- Goode, E., & Haber, L. (1977). Sexual correlates of homosexual experience: An exploratory study of college women. *Journal of Sex Research*, *13*, 12–21.
- Griffith, M., & Walker, C. E. (1975). Menstrual cycle phases and personality variables as related to response to erotic stimuli. *Archives of Sexual Behavior*, *4*, 599–603.
- Harvey, S. M. (1987). Female sexual behavior: Fluctuations during the menstrual cycle. *Journal of Psychosomatic Research*, *31*, 101–110.
- Hill, E. M. (1988). The menstrual cycle and components of human sexual behavior. *Journal of Social Biological Structures*, *11*, 443–455.
- Hoff, J. D., Quigley, M. E., & Yen, S. S. (1983). Hormonal dynamics at midcycle: A reevaluation. *Journal of Clinical Endocrinology and Metabolism*, *57*, 792–796.
- Judd, H. L., & Yen, S. S. C. (1973). Serum androstenedione and testosterone levels during the menstrual cycle. *Journal of Clinical Endocrinology and Metabolism*, *36*, 475–481.
- Kirkpatrick, R. C. (2000). The evolution of human homosexual behavior. *Current Anthropology*, *41*, 385–413.
- Laumann, E. O., Gagnon, J. H., Michael, R. T., & Michaels, S. (1994). *The social organization of sexuality: Sexual practices in the United States*. Chicago: University of Chicago Press.
- Matteo, S., & Rissman, E. F. (1984). Increased sexual activity during the midcycle portion of the human menstrual cycle. *Hormones and Behavior*, *18*, 249–255.

- Ponse, B. (1978). *Identities in the lesbian world: The social construction of self*. Westport, CT: Greenwood Press.
- Rust, P. C. R. (2000). Alternatives to binary sexuality: Modeling bisexuality. In P. C. R. Rust (Ed.), *Bisexuality in the United States* (pp. 33–54). New York: Columbia University Press.
- Slob, A. K., Ernste, M., & van der Werff ten Bosch, J. J. (1991). Menstrual cycle phase and sexual arousability in women. *Archives of Sexual Behavior*, 20, 567–577.
- Spector, I. P., Carey, M. P., & Steinberg, L. (1996). The Sexual Desire Inventory: Development, factor structure, and evidence of reliability. *Journal of Sex and Marital Therapy*, 22, 175–190.
- Stanislaw, H., & Rice, F. J. (1988). Correlation between sexual desire and menstrual cycle characteristics. *Archives of Sexual Behavior*, 17, 499–508.
- van Anders, S. M., & Watson, N. V. (2006). Social neuroendocrinology: Effects of social contexts and behaviors on sex steroids in humans. *Human Nature*, 17, 212–237.
- Vasey, P. L. (2006). The pursuit of pleasure: An evolutionary history of female homosexual behaviour in Japanese macaques. In V. Sommer & P. L. Vasey (Eds.), *Homosexual behaviour in animals: An evolutionary perspective* (pp. 191–219). New York: Cambridge University Press.
- Wallen, K. (1995). The evolution of female sexual desire. In P. R. Abramson & S. D. Pinkerton (Eds.), *Sexual nature/sexual culture* (pp. 57–79). Chicago: University of Chicago Press.
- Wallen, K. (2001). Sex and context: Hormones and primate sexual motivation. *Hormones and Behavior*, 40, 339–357.
- Weinberg, M. S., Williams, C. J., & Pryor, D. W. (1994). *Dual attraction: Understanding bisexuality*. New York: Oxford University Press.
- Whisman, V. (1996). *Queer by choice: Lesbians, gay men, and the politics of identity*. New York: Routledge.