

Stability of Sexual Attractions Across Different Timescales: The Roles of Bisexuality and Gender

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Abstract We examined the stability of same-sex and other-sex attractions among 294 heterosexual, lesbian, gay, and bisexual men and women between the ages of 18 and 40 years. Participants used online daily diaries to report the intensity of each day's strongest same-sex and other-sex attraction, and they also reported on changes they recalled experiencing in their attractions since adolescence. We used multilevel dynamical systems models to examine individual differences in the stability of daily attractions (stability, in these models, denotes the tendency for attractions to "self-correct" toward a person-specific setpoint over time). Women's attractions showed less day-to-day stability than men's, consistent with the notion of female sexual fluidity (i.e., heightened erotic sensitivity to situational and contextual influences). Yet, women did *not* recollect larger post-adolescent changes in sexual attractions than did men, and larger recollected post-adolescent changes did not predict lower day-to-day stability in the sample as a whole. Bisexually attracted individuals recollected larger post-adolescent changes in their attractions, *and* they showed lower day-to-day stability in attractions to their "less-preferred" gender, compared to individuals with exclusive same-sex or exclusive other-sex attractions. Our results suggest that both gender and bisexuality have independent influences on sexual fluidity, but these influences vary across short versus long timescales, and they also differ for attractions to one's "more-preferred" versus "less-preferred" gender.

Keywords Sexual orientation · Gender differences · Bisexuality

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Introduction

Over the past several decades, researchers studying sexual orientation have found that many individuals report variability over time in their same-sex and other-sex attractions, raising questions about the nature and expression of sexual orientation over the life course. Initially, research appeared to suggest that women were more likely to undergo such changes than were men, due to their greater sexual *fluidity* or *plasticity*, defined as a sensitivity to situational, interpersonal, and contextual influences which may facilitate shifts in sexual attraction, behavior, and identity (reviewed in Baumeister, 2000; Diamond, 2008b, 2014). The notion of heightened sexual fluidity in women has been suggested by findings showing that women recollect larger changes over time in their sexual attractions than do men (Kinnish, Strassberg, & Turner, 2005; Weinberg, Williams, & Pryor, 1994) and that they tend to show similar levels of genital arousal to sexual stimuli depicting their "nonpreferred" and "preferred" gender, whereas men show substantially more arousal to their preferred than their nonpreferred gender (Chivers & Bailey, 2005; Chivers, Rieger, Latty, & Bailey, 2004; Chivers, Seto, & Blanchard, 2007). Yet one potential explanation for these findings is that women are simply more likely than men to have nonexclusive (i.e., bisexual) patterns of attraction (Chandra, Mosher, Copen, & Sionean, 2011; Copen, Chandra, & Febo-Vazquez, 2016; Gates, 2011; Mosher, Chandra, & Jones, 2005; Savin-Williams, Joyner, & Rieger, 2012), and bisexuality may predispose *both* women and men to contextual shifts in attraction and arousal. Hence, if a lesbian woman's sexual attractions show larger shifts over time than a gay man's attractions, perhaps it is not because she is female, but because her attractions are more bisexual.

The present research introduces a novel approach to examining whether sexual fluidity (defined as an erotic sensitivity to contextual and situational influences) is greater among women and/or greater among individuals with bisexual patterns of attraction.

Specifically, we use dynamical systems multilevel modeling to examine the day-to-day stability of women and men's same-sex and other-sex attractions over a 30-day period. *Stability*, in these models, does not denote the total absence of day-to-day fluctuations in attractions, but rather the degree to which such fluctuations self-correct to maintain an individual's own erotic setpoint. Robust self-correction indicates a resistance to situational perturbations which might disrupt the individual's basic pattern, whereas sexual fluidity implies a heightened sensitivity to such disruptions. Because dynamical systems models of stability in attractions are not conflated with bisexuality, they allow us to examine the *independent contributions* of gender and bisexuality to day-to-day change in attractions, helping to inform our understanding of sexual fluidity.

How Does Sexual Fluidity Differ from Bisexuality?

Sexual fluidity has been defined as a capacity for *change* in attractions which results from an individual's heightened erotic sensitivity to situational and contextual influences (Diamond, 2008b). In contrast, bisexuality is typically defined as the experience of (or capacity for) sexual attractions to both sexes, even if an individual "leans" more strongly toward one sex than the other (Diamond, 2008a; Rosenthal, Sylva, Safron, & Bailey, 2012). Conceptually, the key distinction between sexual fluidity and bisexuality concerns *change* in attractions. The potential for change in attractions is a defining feature of sexual fluidity, but not necessarily of bisexuality. Research indicates that bisexual orientations may be just as enduring and biologically based as exclusive same-sex orientations (Bailey, Dunne, & Martin, 2000; Diamond, 2008a). Yet empirically, it is often difficult to distinguish between sexual fluidity and bisexuality given that the most salient observable manifestation of sexual fluidity is a shift from exclusive to nonexclusive attractions (for example, a heterosexual woman unexpectedly developing same-sex attractions or a lesbian woman developing other-sex attractions, as in Diamond, 2008b). Individuals who describe their sexuality as "fluid" frequently report transitions to bisexual attractions, bisexual behavior, and even bisexual identification (Diamond, 2008b; Katz-Wise, 2015; Kinnish et al., 2005; Weinberg et al., 1994).

How, then, can researchers distinguish between sexual fluidity and bisexuality? Maybe *all* individuals who perceive that their attractions have changed and expanded over time are simply bisexual (without being aware of it). Answering this question is important for informing our basic understanding of gender and sexual orientation. For example, some researchers have argued that bisexual orientations—in *both* men and women—are fundamentally more "open" and flexible than exclusive same-sex or other-sex orientations (Ross, Daneback, & Månsson, 2012; Weinberg et al., 1994). If this is the case, then it might be more accurate to view sexual fluidity as a consequence of bisexual attractions, rather than viewing bisexual attractions as a consequence of fluidity.

The Role of Gender

Given that sexual fluidity and bisexuality are easily conflated, it is possible that the appearance of greater fluidity in women than men results from the fact that women are more likely than men to report bisexual patterns of attraction (Chandra et al., 2011; Copen et al., 2016; Gates, 2011; Mosher et al., 2005; Savin-Williams et al., 2012). One way to disentangle gender, bisexuality, and sexual fluidity is to examine gender differences in longitudinal change in sexual attractions *separately* among individuals with exclusive versus nonexclusive patterns of attraction. Several large-scale longitudinal studies allow for such comparisons, and they suggest that change in attractions is independently associated with bisexuality *and* gender (Dickson, Paul, & Herbison, 2003; Mock & Eibach, 2012; Ott, Corliss, Wypij, Rosario, & Austin, 2011; Savin-Williams et al., 2012; Savin-Williams & Ream, 2007). For example, Savin-Williams et al. (2012) analyzed longitudinal change in sexual attractions among over 12,000 young adults participating in the National Longitudinal Study of Adolescent Health. At the third and fourth waves of data collection, respondents were asked to describe their "sexual orientation identity," defined as the following potential patterns of sexual attraction: "100% heterosexual (straight), mostly heterosexual (straight), but somewhat attracted to people of your own sex; bisexual—that is, attracted to men and women equally; mostly homosexual (gay), but somewhat attracted to the opposite sex; 100% homosexual (gay); or not sexually attracted to either males or females" (p. 105).

Consistent with other large-scale representative studies (Chandra et al., 2011; Copen et al., 2016; Gates, 2011; Mosher et al., 2005), women were disproportionately represented in the "nonexclusive" groups. For example, at Wave 3, more than three times as many women as men described their attractions as "mostly heterosexual" (10.8% of women vs. 3.3% of men), or "bisexual" (2.6% of women vs. .7% of men). In contrast, more than three times as many men than women described their attractions as "exclusively homosexual" (1.2% of men and .4% of women). Which individuals were more likely to undergo change between Wave 3 and Wave 4? If we focus first on the total group of individuals reporting *any* degree of same-sex attractions at Wave 3 (5.7% of men and 13.7% of women), we find that 43% of the men and 50% of the women switched their sexual orientation category 6 years later at Wave 4, consistent with the notion of greater fluidity in women. Yet a different picture emerges when we examine gender differences separately within different attraction groups. Consistent with the notion that nonexclusive orientations may be more fundamentally "open" and flexible than exclusive orientations, rates of changes were highest in the "bisexual" and "mostly heterosexual" groups, and in these groups women were not more likely to report change than men. In the Wave 3 "mostly heterosexual" group, 59% of the men and 47% of the women chose a different sexual orientation category at Wave 4. In the Wave 3 "bisexual" group, 77% of the men and 47% of the women chose

a different category at Wave 4. Changes were far less likely among individuals who initially described themselves as exclusively heterosexual or homosexual, and it was only among these groups that women appeared more likely than men to exhibit changes: Only 3 % of the exclusively heterosexual men changed orientation categories over the next 6 years, compared to 11 % of the exclusively heterosexual women. In the “homosexual” category, 26 % of the women but only 8 % of the men changed categories (although it is important to note that Savin-Williams and colleagues *combined* the Wave 3 “exclusively homosexual” and “mostly homosexual” groups when presenting these statistics, and women were more likely than men to describe themselves as “mostly” versus “exclusively” homosexual).

Ott et al. (2011) assessed longitudinal change in sexual attractions in the “Growing Up Today Study” (GUTS). This study includes over 13,000 youth who were the children of women who participated in the well-known Nurses Health Study II (NHSII), a prospective cohort study of over 116,000 registered nurses. Hence, although this study did not involve a random representative sample of youth, the size and breadth of the sample contribute unprecedented information on longitudinal change in sexuality during young adulthood. Participants were asked to describe their “feelings” as “Completely heterosexual,” “Mostly heterosexual,” “Bisexual,” “Mostly homosexual,” “Completely homosexual,” or “Unsure” (p. 522). Of the 7.5 % of men and 8.7 % of women who chose a nonheterosexual descriptor at age 18–21, 43 % of the men and 46 % of the women chose a different category by age 23. As with the findings from the study by Savin-Williams et al. (2012), changes were more likely among those who initially claimed nonexclusive patterns of attraction than among those who initially claimed exclusive patterns of attraction, and there was no evidence for greater sexual fluidity among women *within* the nonexclusively attracted groups. In the group that initially described themselves as “mostly heterosexual,” 47 % of men and 45 % of women subsequently changed categories. In the “bisexual” group, 67 % of men and 51 % of women showed subsequent change. The only groups in which women showed greater rates of change than men were the “mostly homosexual” group (25 % of men and 50 % of women subsequently changed categories), and the “exclusively homosexual” group (11 % of men and 33 % of women subsequently changed categories).

The number of women *and men* disclosing and acting upon bisexual patterns of sexual attraction has increased notably over the past several decades (Twenge, Sherman, & Wells, 2016), and research suggests that “mostly heterosexual” patterns of attraction may in fact be the most common form of same-sex sexuality in both genders (Copen et al., 2016; Savin-Williams & Vrangalova, 2013). Such developments underscore the importance of understanding how sexual fluidity and bisexuality are related to one another, and how they relate to gender. The present research brings new data to bear on this question.

The Current Study

The present research analyzes the short-term and long-term stability of sexual attractions among 294 heterosexual, bisexual, and gay/lesbian men and women. Participants provided retrospective data on previous changes in sexual attractions as well as daily diary reports of their sexual attractions over a 30-day period. A key contribution of this research is the examination of change across different timescales. All existing large-scale studies of change over time in sexual attraction have assessed changes across the time span of one or more years (reviewed in Diamond & Rosky, 2016). Yet sexual attractions also show notable change at the level of days (Diamond & Wallen, 2011; Farr, Diamond, & Boker, 2014), and we do not yet know how such changes may relate to longer-term changes, and to the phenomenon of sexual fluidity. The day-to-day measure of sexual fluidity used in the present research is based on dynamical systems models (see Diamond, 2007, 2012; Guastello & Gregson, 2012) which conceptualize the stability of a system as the degree to which its fluctuations consistently “self-correct” to a particular homeostatic setpoint (Butner, Gagnon, Geuss, Lessard, & Story, 2015). If a system has a high degree of inherent stability, then *increases* above the setpoint will be followed by subsequent *decreases* which bring the system back down to the setpoint, whereas *decreases* below the setpoint will be followed by subsequent *increases* which bring the system back up to the setpoint. In other words, there will be an inverse relationship between the state of the system at Time 1 and *change* in the system from Time 1 to Time 2. This inverse relationship should be weaker for systems in which contextual perturbations are more capable of disrupting the self-corrective process and moving the system off of its setpoint.

The value of this approach for studying sexual fluidity is that it focuses on *patterns* of temporal change, rather than the simple existence or magnitude of single changes. The dynamical systems approach distinguishes between patterns of change which function to maintain an individual’s underlying pattern of attraction versus patterns that suggest disruption from the underlying pattern. It is the latter form of change which appears most representative of sexual fluidity. A strength of our research is that in addition to collecting daily diary data on participants’ sexual attractions, we *also* assess their own recollections of previous changes in attractions (following Kinnish et al., 2005; Weinberg et al., 1994). This allowed us to test whether changes that occur at the level of days are related to changes that are recollected across the level of years, and how each type of change relates to gender and bisexuality.

Another strength of this study is that it separately assesses the day-to-day stability of same-sex versus other-sex attractions. This is relevant because previous research on sexual fluidity suggests that it operates by *increasing* an individual’s attractions to his/her “less-preferred” gender, rather than *decreasing* attractions to one’s

“more-preferred” gender (Diamond, 2008b). Similarly, research on genital arousal has found that the distinguishing characteristic of women *and* bisexuals is the fact that their genital arousal to their “less-preferred” gender is similar to—instead of much lower than—their levels of arousal to the more-preferred gender (Chivers & Bailey, 2005; Chivers et al., 2007; Rosenthal, Sylva, Safron, & Bailey, 2011). Note that the distinction between a “more-preferred” and “less-preferred” gender is just as relevant to bisexuals as it is to gay, lesbian, and heterosexual individuals, since bisexuals typically report that their attractions to one gender are somewhat more intense and/or frequent than their attractions to the other (Rieger, Bailey, & Chivers, 2005; Rosenthal et al., 2011). Hence, if sexual fluidity represents a propensity for context-sensitive change in attractions, and if women and/or bisexuals are more likely to show such a propensity, it should be manifested in greater erotic instability (i.e., greater capacity to be pulled away from one’s setpoint) regarding the “less-preferred” gender. This possibility is directly examined in the present research.

Method

Participants

Participants were 294 men and women: 105 lesbian/gay-identified (52 % male), 88 bisexual-identified (30 % male), and 101 heterosexual-identified (52 % male). Participants were recruited from flyers throughout the Salt Lake City community and advertisements on Facebook. We excluded individuals taking medications known to be associated with subjective sexual desire, such as anti-depressants, as well as women on hormonal birth control. The average age of the participants was 24.4 years (range 18–40, $SD = 4.4$), 66 % had completed at least some college, 45 % reported an annual income of less than \$25,000, and 16 % reported an annual income of over \$55,000. 87 % of participants were white. Among the participants identified as lesbian, gay, or bisexual, the mean age at which they first self-identified as nonheterosexual was 17.0 ($SD = 3.7$) among lesbian/gay participants and 17.9 among those identified as bisexual ($SD = 3.8$).

Procedure

Eligible participants visited our laboratory to complete questionnaire measures assessing their history of sexual attraction and behavior and to receive instructions for the online diary component of the study. Each participant met with a single research assistant who administered informed consent and thereafter maintained regular contact with the participant to remind them to complete the diary and to answer any questions that arose during the study. Participants were instructed to complete the daily diary each day before bedtime for 30 days. Diary entries were made online, and data were maintained through a secure server at the primary investigator’s institution. The participant logged on each day with a unique username

and password, and each entry was time- and date-stamped. Participants 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.

Measures

Upon first being recruited into the study, participants completed the Alderson Sexuality Questionnaire (Brown & Alderson, 2010) to assess their general pattern of sexual attraction, behavior, and identity during adolescence as well as during the past 12 months. The present analyses focused on the magnitude of respondents’ self-reported sexual attraction to each gender. The specific instructions were as follows: “The following questions pertain to the magnitude of your opposite gender and same gender interests. To what extent have you experienced sexual attraction to each gender, defined as feeling aroused by someone whom you find attractive.” Responses categories were “none,” “low,” “moderately,” or “high.” For the online daily diary, participants were asked to “think back over the course of the entire day, from when you woke up to right around now,” and to rate the intensity of the strongest same-sex sexual attraction and the strongest other-sex attraction that they experienced over the day, on a 1–10 scale (we used a 1–10 scale, rather than the more restricted scale of the Alderson measure, because we expected that the intensity of daily attractions would show a broader range of variation, due to the many situational and contextual factors expected to influence the intensity of daily attractions, and we wanted to ensure that we captured such variation. Verbal anchors were not used for this scale, except that “1” was described as “not at all”). We asked about the strongest attraction because we were interested in capturing the full potential range of *variation* in sexual attraction to same-sex and other-sex partners, rather than average levels (and in fact, our multilevel analyses are designed to detect the degree to which both small and large fluctuations tend to converge toward an average level across time). Participants were instructed that if they had experienced no such attractions, they should provide the lowest possible rating. We also assessed participants’ current sexual identity label, and we asked them to list all previous sexual identities they had adopted and the ages at which they adopted them.

Of the 319 respondents originally enrolled in the study, 8 % of these respondents provided less than half of the requested diary days, and we did not include them in our final analyses (comparisons between individuals with missing vs. complete data revealed no systematic differences). Hence, the final sample included 294 respondents who provided at least 15 days of consecutive entries (75 % of these respondents provided at least 24 consecutive entries). Within these entries, less than 1 % of the individual sexual attraction ratings remained missing, and we used the multiple imputation procedures available within SPSS (versions 17.0 and greater) to impute the missing data. SPSS 17.0 uses *fully conditional specification* to specify and generate plausible values for missing data, based on the hypothetical joint distribution of the data. FCM specifies the multivariate model

through a series of conditional models, one for each variable in the model. This results in the production of a number of complete data sets, each of them slightly different, in which the missing values are replaced by values which can be thought of as random draws from a distribution of plausible values. Simulation studies indicate that adequate approximations of the original data are achieved with 3–5 data sets (Schafer, 1999), but that even better approximation is provided by generating larger numbers of data sets (Graham, Olchowski, & Gilreath, 2007), and so we generated ten data sets. Analyses are conducted separately with each data set, and the resulting parameters are pooled across each set. This pooling procedure combines the variation within and across the different imputed data sets, and estimates using this procedure translate the error variation introduced by the missing data into the width of the confidence interval (van Buuren, 2007). These procedures are known to provide more statistically valid results than listwise or casewise deletion (Schafer & Graham, 2002).

Results

Sexual Attraction Groupings

In order to compare individuals with bisexual versus exclusive patterns of attraction, we categorized individuals based on the pattern of current attractions that they reported on the Alderson measure. We used this approach, rather than categorizing individuals on the basis of self-chosen identity labels, in light of research showing that self-reported sexual identity may not correspond precisely with patterns of sexual attraction (reviewed

in Diamond, 2014). Furthermore, the majority of the nonheterosexual respondents had undergone multiple changes in sexual identity: 82 % of the lesbian/bisexual women and 78 % of the gay/bisexual men reported having switched their sexual identity label at least once *after* having first adopted a nonheterosexual identity, and 45 % of women and 34 % of men reported two or more identity changes. A total of 60 individuals who reported experiencing *only* same-sex attractions over the past 12 months were denoted “same-sex attracted.” This group represented 17 % of the female respondents (all of whom identified as lesbian) and 24 % of the male respondents (all of whom identified as gay). A total of 71 individuals who reported experiencing only other-sex attractions over the past 12 months were denoted “other-sex attracted.” This group represented 16 % of the female respondents and 35 % of the male respondents, all of whom identified as heterosexual. A total of 163 individuals reporting attractions to both sexes over the past 12 months were denoted “bisexually attracted.” This group represented 66 % of the female respondents (57 % of whom identified as bisexual, 21 % as lesbian, and 22 % as heterosexual) and 34 % of the male respondents (47 % of whom identified as bisexual, 35 % as gay, and 18 % as heterosexual). Means, SDs, and ranges for all study variables are shown in Table 1, stratified by attraction group.

Retrospective Change in Attractions Since Adolescence

We calculated change scores (current attractions minus recollected adolescent attractions) to represent the degree to which individuals recalled having experienced changes in their attractions to their

Table 1 Descriptive statistics for study variables

	Same-sex attracted <i>N</i> = 60		Bisexually attracted <i>N</i> = 163		Other-sex attracted <i>N</i> = 71	
	M (SD)	Range	M (SD)	Range	M (SD)	Range
Age (in years)	25.4 (4.8) ^o	18–37	24.8 (4.4) ^o	18–40	22.8 (4.0) ^{sb}	18–34
Degree of attraction to more-preferred gender over past year	4.0 (.2) ^b	3–4	3.8 (.5) ^s	1–4	3.9 (.3)	3–4
Degree of attraction to less-preferred gender over past year	1.0 (0) ^b	1–1	2.6 (.7) ^{so}	1–4	1.0 (0) ^b	1–1
Degree of attraction to more-preferred gender during adolescence	4.5 (.9) ^b	1–5	4.1 (.9) ^{so}	1–5	4.6 (.7) ^b	1–5
Degree of attraction to less-preferred gender during adolescence	2.4 (1.2) ^{bo}	1–5	3.5 (1.2) ^{so}	1–5	1.2 (.5) ^{bs}	1–3
Raw change in attraction to more-preferred gender since adolescence	.5 (.9)	0–4	.7 (1.0) ^o	–1 to 4	.3 (.8) ^b	–1 to 4
Absolute change in attraction to more-preferred gender since adolescence	.5 (.9) ^b	0–4	.9 (.8) ^s	0–4	.4 (.7) ^b	0–4
Raw change in attraction to less-preferred gender since adolescence	–1.3 (1.2) ^{ob}	–4 to 0	.07 (1.1) ^s	–2 to 3	–.07 (.5) ^s	–2 to 1
Absolute change in attraction to less-preferred gender since adolescence	1.3 (1.2) ^{ob}	0–4	.8 (.8) ^{so}	0–3	.2 (.5) ^{sb}	0–2
Intensity of the day’s strongest attraction to more-preferred gender, averaged across the daily diary assessment	6 (1.8)	2–10	5.9 (1.6)	1–9.6	5.6 (1.8)	1.2–10
Intensity of the day’s strongest attraction to the less-preferred gender, averaged across the daily diary assessment	1.3 (.5) ^b	1–3.8	3.4 (1.8) ^{so}	1–8.7	1.5 (.7) ^b	1–5

The subscripts s, b, and o indicate which measures differ between the (s) same-sex attracted, (b) bisexually attracted, and (o) other-sex-attracted groups, *p* < .05 after Bonferroni correction

more-preferred and less-preferred gender since adolescence. For participants in the “same-sex attracted” group, the preferred gender is the same sex; for participants in the “other-sex attracted” group, the preferred gender is the other sex. For participants in the “bisexually attracted” group, we determined their more-preferred gender based on their ratings of the magnitude of their sexual attractions to the same-sex and the other sex. For 54% of individuals in this group, the magnitude of their same-sex attractions was greater; for 27%, the magnitude of their other-sex attractions was greater. The remaining 19% gave equal ratings of the magnitude of their same-sex and other-sex attractions, and so we examined their responses to an additional item on the Alderson measure which assessed the magnitude of their desire to engage in sexual behavior with each sex, and we used these ratings to determine their more-preferred gender. Hence, in the total “bisexual” group, approximately two-thirds preferred the same sex and one-third preferred the other sex (this distribution did not differ for men and women).

Figures 1, 2 and 3 display the distributions of raw post-adolescent change scores for attractions to the more-preferred and less-preferred gender among each of the attraction groups, stratified by gender. A multivariate analysis of variance found no gender differences in these change scores, $F_{\text{more-preferred}}(1, 290) < 1$, partial eta-squared = .002, $F_{\text{less-preferred}}(1, 290) < 1$, partial eta-squared = .001, but there were significant differences across sexual attraction groups, $F_{\text{more-preferred}}(2, 290) = 4.2$, $p < .05$, partial eta-squared = .03, $F_{\text{less-preferred}}(2, 290) = 40.5$, $p < .001$, partial eta-squared = .21. Bonferroni-corrected follow-up tests found that bisexually attracted individuals reported larger increases in attractions to the more-preferred gender than did other-sex attracted individuals ($p < .01$). Same-sex attracted individuals reported larger decreases in attractions to the less-preferred gender than did bisexually attracted and other-sex attracted

individuals (both p values $< .001$). We then tested for differences in *absolute* change scores. Again, there were no significant gender differences, $F_{\text{more-preferred}}(1, 290) < 1$, partial eta-squared = .001, $F_{\text{less-preferred}}(1, 290) < 1$, partial eta-squared = .003, but there were differences by attraction group, $F_{\text{more-preferred}}(2, 290) = 8.1$, $p < .01$, partial eta-squared = .05, $F_{\text{less-preferred}}(2, 290) = 30.8$, $p < .001$, partial eta-squared = .18. Bonferroni-corrected follow-up tests found that bisexually attracted individuals reported larger changes in attractions to the more-preferred gender and to the less-preferred gender than did the other two groups (all p values $< .05$), and same-sex attracted individuals reported larger changes in attractions to the less-preferred gender than did other-sex attracted individuals, $p < .01$).

Multilevel Modeling of Day-to-Day Stability

We used multilevel random coefficient modeling, implemented with HLM (Bryk & Raudenbush, 1992) to analyze the stability of participant’s daily attractions to their more-preferred and less-preferred gender across the 30-day diary period. In these models, *change* in attractions from day_t to day_{t+1} is the outcome variable and is predicted at by the magnitude of attractions at day_t (Butner et al., 2015; Queen, Butner, Wiebe, & Berg, 2016). At this level of the model (Level 1), a regression equation is calculated for each separate individual, and the Level 1 slope coefficient for attractions at day_t is then interpretable as the stability of the attraction system, with a steeper negative slope indicating a stronger tendency of the system to stabilize to its own homeostatic setpoint. Figure 4 provides an illustration. The plot on the left side of the figure shows a time series of self-reported attractions from a single participant (in this case, a gay-identified man). The plot on the right side shows *change* in his attractions from day_t to day_{t+1} on

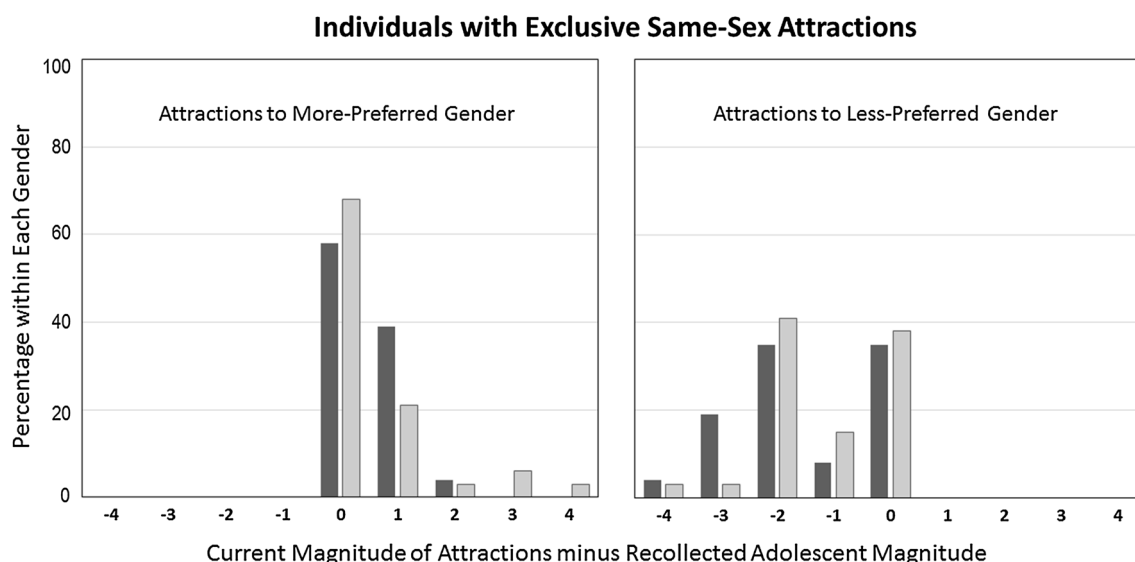


Fig. 1 Post-adolescent change in attractions to the more-preferred and less-preferred gender among individuals with exclusive same-sex attractions

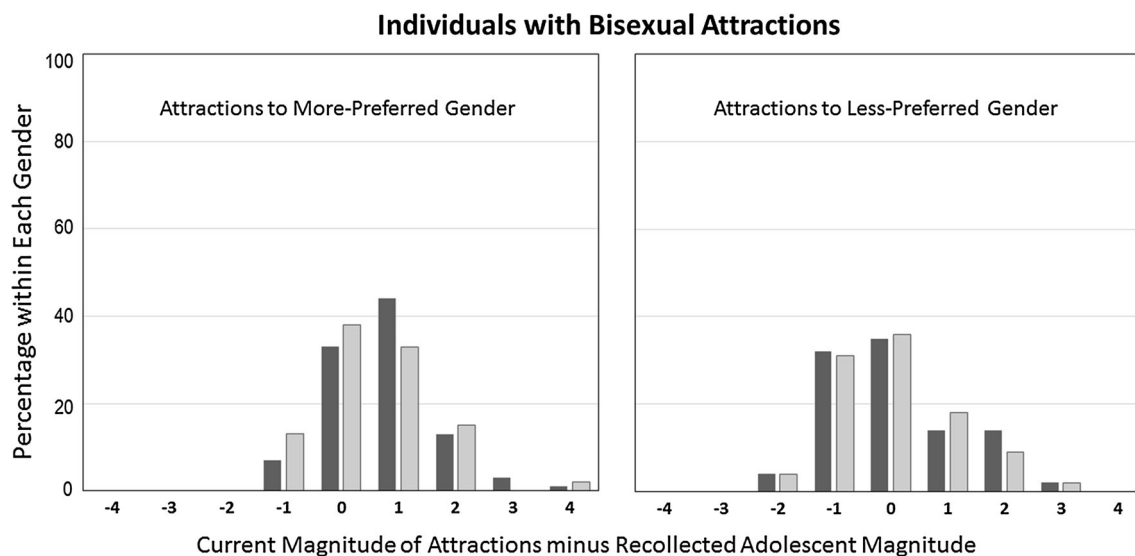


Fig. 2 Post-adolescent change in attractions to the more-preferred and less-preferred gender among individuals with bisexual attractions

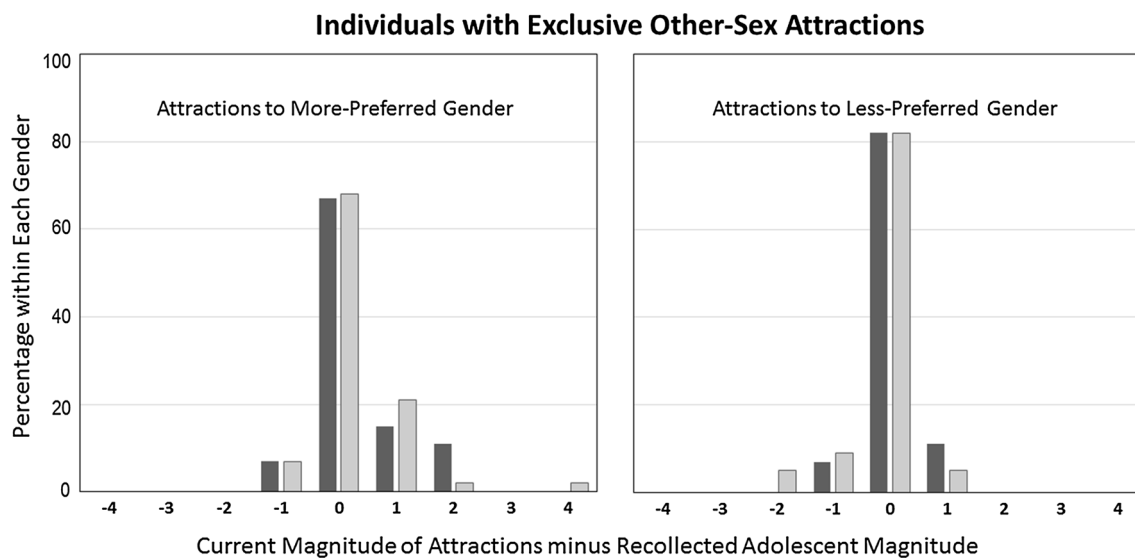


Fig. 3 Post-adolescent change in attractions to the more-preferred and less-preferred gender among individuals with exclusive other-sex attractions

the Y -axis, with attractions at day $_t$ on the X -axis. A fit line is added to demonstrate the negative slope, and the steepness of the slope represents the stability of his attractions.

Hence, Level 1 of the model (the within-person level) calculates a slope coefficient for each participant, representing the stability of their attractions (separate analyses are conducted to estimate slopes for the more-preferred vs. the less-preferred gender). This model takes the following form:

$$\begin{aligned} \text{Change in attractions day}_t \text{ to day}_{t+1} \\ = \beta_0 + \beta_1(\text{attractions at day}_t) + \text{residual} \end{aligned}$$

Then, Level 2 of the multilevel model (the between-person level) predicts β_1 , which is the parameter representing the *stability* of each individual's attractions, from his/her gender, attraction

group (exclusive same-sex, exclusive other-sex, or bisexual, represented with dummy codes), and the absolute magnitude of his/her *retrospected change* in attractions as recollected since adolescence. Hence, Level 2 of the model allows us to test whether the stability of day-to-day attractions is lower among women, bisexuals, and those who recall having experienced greater changes in their attractions since adolescence. Hence, the Level 2 model takes the following form (G represents a between-person slope, which would normally be denoted b in a conventional regression model).

$$\begin{aligned} \beta_1 = & G_{10} + G_{11}(\text{gender}) + G_{12}(\text{exclusively same-sex attracted}) \\ & + G_{12}(\text{exclusively other-sex attracted}) \\ & + G_{13}(\text{absolute magnitude of recollected} \\ & \text{change in attractions since adolescence}) + \text{error} \end{aligned}$$

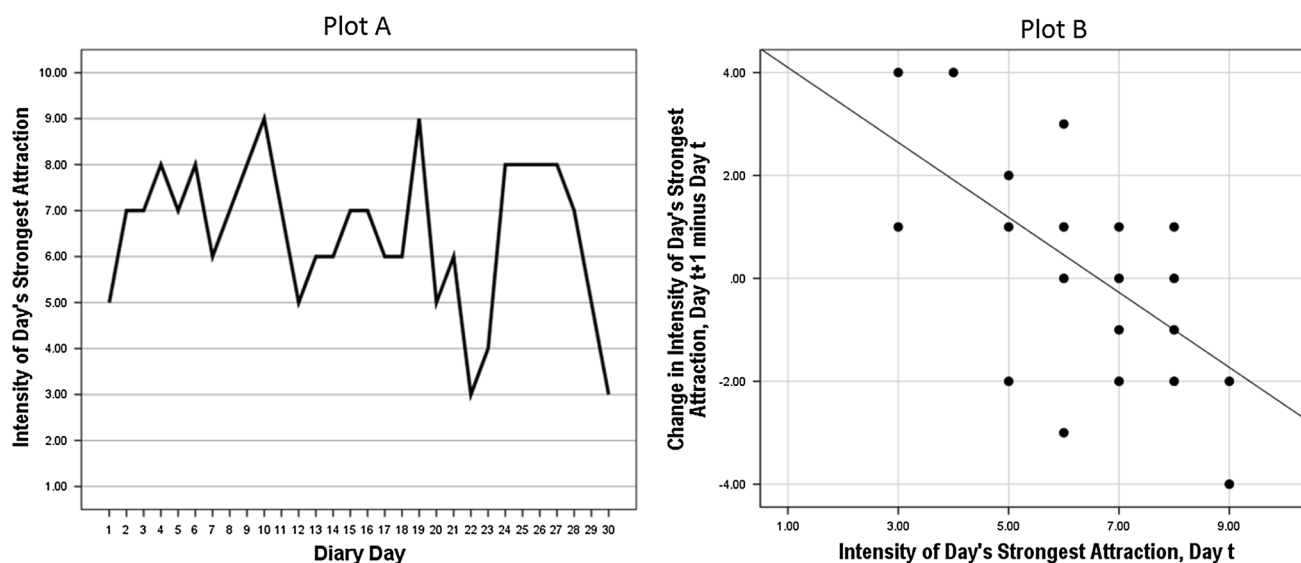


Fig. 4 Example of dynamical systems model of within-person change; **Plot A** shows the raw time series of sexual attraction ratings over 30 days, whereas **Plot B** displays day-to-day change in attractions (day_{t+1} minus

day_t) on the Y-axis, plotted against day_t attractions on the X-axis. The fit line demonstrates the negative slope indicating high stability (i.e., temporal self-correction to an internal setpoint) within the system

Note that we use bisexuals as the base category, and hence this model includes two dummy codes to represent differences between the bisexually attracted group and both of the exclusively attracted groups (we ran additional models with the other-sex attracted group as the base category to test for differences between the same-sex and other-sex attracted groups). Gender was effect-coded as $-.5$ and $.5$, and the absolute magnitude of recollected change was centered around the total sample mean. We tested for interactions among the Level 2 variables, and none were significant. We also computed ancillary analyses to determine whether participant age was related to daily stability or to retrospective change, or whether it interacted with the other variables, and it did not. The age at which nonheterosexual individuals first adopted a nonheterosexual identity was also unrelated to these variables. Finally, we conducted additional analyses among female respondents to determine whether daily stability was related to menstrual cycle phase, and it was not.

The results of our multilevel analyses are presented in Table 2, which displays coefficients representing the degree to which the stability of individuals' day-to-day attractions to their more-preferred and less-preferred gender is associated with their gender, their overall pattern of exclusive versus bisexual attractions, and their recollected post-adolescent change in sexual attractions. The intercept in each model represents the average change in attractions from one day to the next, and the slope coefficient for *Attractions at Day_t* represents the average stability in sexual attractions for the base category (which in this case is bisexually attracted individuals). The fact that this slope is significant and negative indicates that bisexual individuals (across gender and with average levels of retrospectively recollected change in attractions) show significant day-to-day stability in their attractions, meaning that their attrac-

tions gravitate to a person-specific setpoint over time. Yet as predicted, there was notable interindividual variability in stability, indicated by the Level 2 moderating effects. Women showed less stability than did men in their daily attractions to both the more-preferred and less-preferred gender ($G_{\text{more-preferred}} = .05$, $p < .05$; $G_{\text{less-preferred}} = .10$, $p < .01$). Note that for these analyses, positive slopes at Level 2 represent *lower* stability, since stability is indicated by a *more negative* Level 1 slope for attractions on day_t (Butner et al., 2015; Queen et al., 2016), as shown in Plot B in Fig. 4.

We also found, as expected, that individuals who described their current attractions as exclusively same-sex or exclusively other-sex showed significantly *greater* day-to-day stability in attractions to the less-preferred gender than did bisexually attracted individuals, $G_{\text{same-sex attracted}} = -.33$, $p < .001$; $G_{\text{other-sex attracted}} = -.20$, $p < .001$). Same-sex-attracted individuals also showed a trend toward greater stability in attractions to the less-preferred gender than other-sex-attracted individuals, $G = -.13$, $p < .10$. Notably, a different pattern of results was observed for the stability of attractions to the more-preferred gender (consistent with our expectation that bisexual individuals' capacity for fluidity should be specifically manifested in attractions to the less-preferred gender, rather than the more-preferred gender). There was no significant difference between bisexually attracted individuals and either same-sex- or other-sex-attracted individuals in the stability of their attractions to the more-preferred gender ($G_{\text{same-sex}} = -.01$, $G_{\text{other-sex}} = -.04$). Finally, the stability of day-to-day attractions to the less-preferred gender was not significantly associated with the magnitude of absolute recollected change in these attractions since adolescence, $G = .004$. To determine whether this result was based on our use of absolute change scores (rather than raw scores,

Table 2 Results of multilevel models predicting change in attractions from previous day's attractions

Model term	Coefficient
<i>DV: change in attraction (day_t minus day_{t-1}) to more-preferred gender</i>	
Intercept	4.8***
Attraction to more-preferred gender on day _{t-1}	−.8.0***
Moderator: gender	.05*
Moderator: same-sex attraction (compared to bisexually attracted group)	−.05
Moderator: other-sex attraction (compared to bisexually attracted group)	−.05 [†]
Moderator: absolute recollected post-adolescent change in attractions to more-preferred gender	−.02 [†]
<i>DV: change in attraction (day_t minus day_{t-1}) to less-preferred gender</i>	
Intercept	2.2***
Attraction to less-preferred gender on day _{t-1}	−.8.3***
Moderator: gender	.10**
Moderator: other-sex attraction (compared to bisexually attracted group)	−.33***
Moderator: same-sex attraction (compared to bisexually attracted group)	
Moderator: absolute recollected post-adolescent change in attractions to less-preferred gender	−.16**

[†] $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

which incorporate information about the direction of change), we recomputed these analyses using raw change scores, and the results were not different. Regarding attractions to the more-preferred gender, we found marginally *greater* stability among individuals who reported greater absolute recollected change in more-preferred attractions ($G = -.02$, $p = .09$), but this effect was only at the trend level; there was no association between recollected change and day-to-day stability when we re-tested this association with directional (rather than absolute) recollected change scores. Hence, these results provide no evidence that individuals who recollect greater stability at the year-by-year level show greater stability at the day-to-day level.

Discussion

Our research shows that *both* gender and bisexuality have independent associations with temporal change in sexual attractions, but these associations vary for different types of change and different types of attractions. Women showed lower day-to-day stability than men in their attractions (meaning that their attractions were less likely to “self-correct” to a stable setpoint from day to day), but women did *not* retrospectively report having undergone greater overall changes in their attractions since adolescence. Hence, women do not appear to be uniformly “more fluid” than men; rather, gender differences in the capacity for change in sexual attractions depend on the timescale assessed.

In contrast, bisexuality was associated with greater change in sexual attraction across both short and long timescales. Men and women with bisexual patterns of attraction showed lower stability than exclusively attracted individuals in day-to-day attractions to

their less-preferred gender (although not to their more-preferred gender), and they also reported larger retrospective changes in their attractions since adolescence. Overall, this pattern of results suggests that gender and bisexuality make *different and independent* contributions to the phenomenon of temporal change in sexual attraction across different timescales, opening up provocative new lines for future research on gender, bisexuality, and sexual fluidity.

Stability, Change, and Sexual Fluidity

A key contribution of this study is its introduction of a novel conceptual and analytical approach to assessing individual differences in sexual fluidity, based on dynamical systems theory (Butner et al., 2015; Guastello & Gregson, 2012; Queen et al., 2016). This approach focuses on the degree to which fluctuations in a phenomenon (in this case, the intensity of same-sex and other-sex attractions) consistently gravitate to their own setpoint, despite the potentially disruptive influences of external factors. From this perspective, it is not the simple existence of change which matters, but the form and direction of change. This analytical approach is particularly well suited to investigating sexual fluidity, given that sexual fluidity has been defined as a heightened erotic sensitivity to contextual influences, which can draw individuals toward altogether novel sexual patterns (Diamond, 2007, 2008b). According to this perspective, the sexual attractions of individuals with greater sexual fluidity should be more easily disrupted from their regular setpoint, whereas individuals with lower sexual fluidity should have attractions that consistently stabilize toward their setpoint. The dynamical systems models used in this study are precisely designed to test for such differences, and they converge with the findings of

previous research on sexual fluidity by showing that *both* women and bisexuals show lower stability in day-to-day attractions, meaning a greater sensitivity to contextual perturbations. Given that all previous studies of change in sexual attraction (both retrospective and prospective) have focused on large-scale changes in attractions at the level of years (Dickson, Roode, Cameron, & Paul, 2013; Ott et al., 2011; Savin-Williams & Ream, 2007), the present study's findings regarding *day-to-day* stability represent a notable advance.

An important question raised by the current research is whether sexual fluidity at the level of years is really the same phenomenon as sexual fluidity at the level of days, given that the individuals who recollected larger post-adolescent changes in their attractions did *not* show lower day-to-day stability in their attractions. One possible explanation for this pattern of results is that the phenomenon of day-to-day stability yielded by a dynamical systems approach—self-correction to a person-specific setpoint—is fundamentally different from a single “Time 2 minus Time 1” change. As discussed earlier, the dynamical systems approach focuses on the direction and temporal patterning of multiple sequential fluctuations over time, whereas “Time 2 minus Time 1” measures can only reveal the magnitude and direction of a single shift. In order to create comparable dynamical systems analyses of change at the level of years, we would need a large number of sequential assessments of change at the level of one or more years, permitting analysis of whether changes at these longer timescales tend to self-correct to a person-specific setpoint.

The collection of prospective versus retrospective data is obviously indispensable for this purpose. Unlike longitudinal assessments of change in attractions (Dickson et al., 2013; Ott et al., 2011; Savin-Williams & Ream, 2007), the present study assessed long-term change in sexual attractions retrospectively, by asking respondents to rate the magnitude of their sexual attractions as they experienced them currently *and* as they recalled experiencing them during adolescence (similar to Kinnish et al., 2005; Weinberg et al., 1994). Hence, our assessments are best interpreted as indexing individuals' *subjective perception* of post-adolescent change in sexual attractions, especially because the process of providing separate ratings for adolescent versus current attractions is likely to prompt respondents to consciously reflect on whether their attractions “feel the same.” This does not mean that measures of retrospective change have no utility, only that they must be interpreted differently from prospective measures of change. Yet this is precisely why the findings of the present study prove interesting, since they show that individuals who *perceive themselves* to have had less stable patterns of attraction since adolescence are not the same individuals whose attractions show less prospective stability at the level of days.

This raises the intriguing possibility that changes across different timescales might have wholly different determinants. For example, shifts in sexual attractions from adolescence to adulthood might reflect *developmental* transitions related to normative social and biological maturation, rather than (or in addition to) sexual fluidity. Such developmental transitions would not be expected

to influence day-to-day measures of temporal stability. Hence, future research should examine how day-to-day stability in sexual attractions relates to year-to-year changes which transpire *entirely after* adolescence has concluded (as captured, for example, by Dickson et al., 2013). It would also be ideal to collect data on change in sexual attraction at timescales that fall between the extremes of *years* and *days*. Might self-correction processes occur at the levels of weeks or months? Collecting measures of sequential change across multiple overlapping timescales is the best way to accurately capture the underlying dynamics of sexual fluidity, and the degree to which individuals' patterns of sexual attraction consistently maintain their own setpoint in the face of external perturbations.

Attractions to the More-Preferred versus the Less-Preferred Gender

Another contribution of the present research is its differentiation between change processes that occur for attractions to one's “more-preferred” versus “less-preferred” gender. All of the existing large-scale longitudinal studies of changes in sexual attractions have focused on changes in individual's *relative ratio* of same-sex and other-sex attraction—for example, shifts from “mostly heterosexual” to “bisexual,” or from “bisexual” to “mostly homosexual” (Dickson et al., 2003; Mock & Eibach, 2012; Ott et al., 2011; Savin-Williams et al., 2012; Savin-Williams & Ream, 2007). Yet a shift from “bisexual” to “mostly heterosexual” could occur through a variety of pathways: an increase in other-sex attractions, an increase in same-sex attractions, or both. Differentiating between such pathways is important for determining whether some types of change in sexual attraction, in some populations, are more likely than others.

We found that women showed lower day-to-day stability than men for attractions to *both* the “more-preferred” and “less-preferred” gender, suggestive of a generalized gender difference in erotic sensitivity to context. Yet individuals with bisexual patterns of attraction only showed lower day-to-day stability in their attractions to the “less-preferred” gender. This finding is consistent with other research arguing that a fundamental difference between individuals with bisexual versus exclusive patterns of attraction concerns the nature of their attractions to the “less-preferred” gender. As summarized by Rieger et al. (2005), bisexuals as a group show *stronger* attractions to their less-preferred gender than do exclusively attracted individuals, and hence smaller gaps between the magnitude of their more-preferred and less-preferred attractions. The present research expands this characterization by showing that the “less-preferred” attractions of bisexual individuals are also less stable (at a day-to-day level) than those of exclusively attracted individuals, showing less of a tendency to gravitate toward a person-specific “setpoint.”

Yet when it came to the day-to-day stability of attractions to the more-preferred gender, bisexually attracted individuals showed

as much stability as did exclusively attracted individuals. Hence, these findings do not support a notion of bisexuals as *globally* flexible and variable in their attractions. Rather, it is their daily attractions to the less-preferred gender that render them distinct from exclusively attracted men and women. They also proved distinct from exclusively attracted individuals in their retrospective changes: Bisexually attracted individuals recalled larger post-adolescent changes in attractions to both the more-preferred and less-preferred gender. As noted earlier, such changes may have different determinants than day-to-day changes, underscoring the importance of future research incorporating measures of both short-term and long-term changes in attractions, and which differentiates between assessments of the magnitude versus the temporal patterning of change.

Conclusion

The present research concurs with a growing body of research suggesting a complex pattern of associations among gender, bisexuality, and sexual fluidity. Consider, for example, the groundbreaking studies on gender-specific patterns of sexual arousal in men and women (Bouchard, Timmers, & Chivers, 2015; Chivers & Bailey, 2005; Chivers et al., 2004, 2007; Chivers & Timmers, 2012). The earliest of these studies (Chivers & Bailey, 2005) suggested that women were generally “nonspecific” in their genital response (i.e., both lesbian and heterosexual women showed genital arousal to both same-sex and other-sex stimuli), whereas men showed “category-specific” patterns (i.e., only showing genital arousal to depictions of sexual activity that showed their more-preferred gender). Yet subsequent research (Chivers, Bouchard, & Timmers, 2015; Chivers et al., 2007; Spape, Timmers, Yoon, Ponseti, & Chivers, 2014) has found *varying* degrees of gender-specificity among women, often depending on the nature and intensity of the stimuli *and* a woman’s specific degree of nonexclusive attractions. Hence, it appears increasingly unlikely that there exist broad-based, *uniform* differences between women and men—and between bisexuals and nonbisexuals—regarding the flexibility of their sexual desires. Rather, different conditions appear to give rise to short-term and long-term variability in sexual attraction among both men and women across the full range of sexual orientations, and our task in future research is to identify these boundary conditions. Such research holds great potential for expanding our understanding of the basic nature of sexual orientation in men and women and its expression over the life course.

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Compliance with Ethical Standards

Conflict of interest The first author, second author, and third author declare that they have no conflicts of interest.

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