



Patterns of Genital and Subjective Sexual Arousal in Cisgender Asexual Men

Malvina N. Skorska^{a*}, Morag A. Yule^{b*}, Anthony F. Bogaert^c, and Lori A. Brotto^d

^aChild & Youth Psychiatry, Centre for Addiction and Mental Health, Brock University; ^bOntario Sex Therapy; ^cDepartment of Health Services, Brock University; ^dDepartment of Obstetrics & Gynaecology, University of British Columbia

ABSTRACT

Human asexuality has been defined as a lack of sexual attraction to others, although its nature is not well understood. Asexual men's genital and subjective sexual arousal patterns were compared to sexual men's to better understand asexual men's sexual response patterns. Using a penile plethysmograph to measure genital arousal, 20 asexual, 27 heterosexual, and 22 gay cisgender men (M age = 28.28, SD = 9.41) viewed erotic films depicting sexual activity or masturbation, and a subsample engaged in sexual fantasy of their choosing. Questionnaires assessing sexual function and behavior were also completed. Asexual men scored lower on sexual desire and orgasmic function, higher on sexual aversion, and did not differ on overall sexual satisfaction. Compared with gay and heterosexual men, asexual men demonstrated lower genital and subjective sexual arousal to the erotic films but displayed similar sexual arousal when engaging in sexual fantasy. Asexual men's lower levels of sexual excitation rather than their higher levels of sexual inhibition were associated with lower responses to the erotic films. These findings suggest asexual men have preferred sexual stimuli that differ from sexual men and have a similar capacity for sexual arousal as sexual men. Collectively these findings add to a growing literature aiming to understand the nature of asexuality.

Introduction

Human asexuality has generally been described as a lack of sexual attraction to others (Bogaert, 2004, 2012a; Jay, 2011) and asexual individuals often report this to be a lifelong experience (Brotto et al., 2010; Van Houdenhove et al., 2015). A large online community of self-identified asexual individuals (e.g., the Asexuality Visibility and Education Network; AVEN; asexuality.org) is motivated to provide education about asexuality and has liaised with researchers to facilitate access to a large pool of participants for empirical studies of asexuality. Research using participants from AVEN suggests the term *asexuality* describes a heterogeneous group, and that asexuality can represent significant variation in the experience of human sexuality (Brotto & Yule, 2017) as well as in romantic attraction (Antonsen et al., 2020). Self-identification is often used to classify asexual people (Decker, 2014), similar to the use of self-identification to categorize people with more traditionally defined sexual attractions. Prevalence estimates of asexuality range from 0.5% (Aicken et al., 2013) to 3.3% (Bogaert, 2004, 2013; Höglund et al., 2014).


The nature of asexuality is not well understood, but a number of theories have been put forth to explain its development (see Bogaert, 2012a, 2015; Brotto & Yule, 2017; Yule et al., 2017b), including suggestions that asexuality is due to a mental health difficulty or a paraphilia. Asexuality has also been considered to be a unique sexual orientation in that asexual individuals report that they are

not sexually attracted to other people (see Bogaert, 2006, 2012a, 2015; Brotto & Yule, 2017; Yule et al., 2017b). Sexual orientation is generally described as an internal mechanism that directs a person's sexual interests toward men, women, or both (LeVay & Baldwin, 2011). Asexual advocates such as AVEN describe asexuality as "an intrinsic part of who we are, just like other sexual orientations" (asexuality.org; retrieved Feb 27, 2021) and maintain that asexuality is a unique sexual orientation alongside heterosexuality, bisexuality, and same-sex attraction; this position has some recent empirical support (Bogaert, 2004, 2013; Brotto & Yule, 2017; Yule et al., 2014a). Additionally, this position has been put forward by sexuality scholars for decades, beginning with Alfred Kinsey's description of sexual orientation on a rating scale from 0 (i.e., exclusively heterosexual) to 6 (i.e., exclusively homosexual¹), with the lack of sexual inclinations toward others inherent to asexuality defined as an "X" category (denoting "no socio-sexual contacts or reactions"; Kinsey et al., 1948). It has been suggested (e.g., Bogaert, 2004, 2006, 2015) that it may be more accurate to understand asexuality as a lack of sexual orientation, in that the internal mechanism of sexual interest is not directed toward anyone or anything or might not exist at all. Thus, asexuality could still be understood within a sexual orientation framework even if it is best defined as a lack of a traditional sexual orientation.

CONTACT Morag A. Yule  myule@ontariosextherapy.ca  Ontario Sex Therapy

*denotes co-first authors

¹This term has been used in the past to refer to male same-sex attraction but is no longer recommended by the American Psychological Association (American Psychological Association, 2020). We use the term here for historical reasons.

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Sexual Fantasies in Asexual People

Sexual fantasies have long been thought to be a ubiquitous experience and a better indicator of an individual's sexual orientation or underlying attractions than behavior or identity (Ellis & Symons, 1990). There are some important contradictions to this view, such as the high prevalence of fantasies that are based on themes the individual would not want to experience in real life. Fantasies of erotic reluctance, or "rape fantasies," for example, may be experienced by up to 57% of women (Bivona et al., 2012; Clifford, 1978; Critelli & Bivona, 2008), and directly contradict the widely held belief that sexual fantasy is a reflection of one's underlying sexual desires. Given the framing of asexuality as a sexual orientation and the role that sexual fantasies can play in understanding sexual orientation, some research has examined sexual fantasies in asexual individuals.

Yule et al. (2017a) found that 80% of asexual men and 65% of asexual women in their sample reported engaging in sexual fantasy, despite reporting a lack of sexual attraction to other people, with a large proportion of these participants also engaging in masturbation while fantasizing. Asexual men were more likely than a sexual² comparison sample to report never having had a sexual fantasy or to report sexual fantasies in which they are the object of desire or that do not involve themselves at all. Asexual men were equally as likely as sexual men to engage in fantasies of fetishes, BDSM/humiliation, and masturbation, and less likely to fantasize about group sex. None of the asexual men in that sample reported fantasizing about topics such as sex with a specific other person, public sex, or past sexual encounters (Yule et al., 2017a). It is possible that asexual individuals engage in sexual fantasy to facilitate physiological sexual arousal during masturbation, but that the content of their fantasies often do not include themselves or are not directed at other people (Bogaert, 2012b). This is consistent with the notion that asexual people are not sexually attracted to other people. However, if asexual individuals engage in fantasy to facilitate sexual arousal, it is possible that sexual dysfunction related to impaired sexual arousal, sexual avoidance/aversion, or low sexual desire, may underlie the development of asexuality.

Is Asexuality Associated with Impairments in Sexual Function?

Researchers have explored some facets of sexual functioning in asexual individuals. One somewhat understudied area of research is regarding sexual aversion. A person presenting to a clinical setting with no sexual desire might at one point have been given a diagnosis of sexual aversion disorder, which was one of two sexual desire disorders in the previous version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association, 2000). Sexual aversion disorder was defined as an "aversion to, and avoidance of, all, or almost all, genital sexual contact with a sexual partner" (p. 542) causing distress or interpersonal difficulty. Sexual

aversion disorder was removed from the 5th edition of the DSM (DSM-5; American Psychiatric Association, 2013) as the diagnosis had little empirical support and was also deemed to be more appropriately placed within the anxiety disorders as a specific phobia (Brotto, 2010). In one qualitative study, asexual women varied in their reported distinction between sexual disinterest and sexual aversion, with some reporting a clear sense of disgust around sexuality and genitals, whereas others did not experience aversion (Van Houdenhove et al., 2015). Thus, although there is some evidence of sexual aversion in asexual women, it is unknown whether asexual men experience sexual aversion and generally whether low levels of sexual interest necessarily signify sexual dysfunction. Moreover, it is unclear whether asexual people experiencing aversion are distressed by these feelings.

The extent to which asexuality might be explained as a disorder of low sexual desire has also been explored. Although this area of research is scant, there is some evidence that asexuality differs from disorders of sexual desire given significant differences between asexual individuals and those who met diagnostic criteria for a desire disorder (Brotto et al., 2015). Specifically, asexual individuals were less likely to be in a relationship and reported lower levels of sex-related distress, lower sexual desire, and higher levels of alexithymia (inability to express or identify emotions) than sexual participants who met diagnostic criteria for a disorder of sexual desire. Because all sexual dysfunctions require the criterion of clinically significant personal distress (American Psychiatric Association, 2013), and because asexual individuals tend not to report their lack of sexual interest to be problematic for themselves (Gupta, 2017; Prause & Graham, 2007), as opposed to societal stigma (Gupta, 2017; MacInnis & Hodson, 2012), this further strengthens the argument that asexuality is unlikely to be best described as a sexual desire disorder (Brotto et al., 2015).

Sexual Arousal in Asexual People

The sexual arousal patterns of asexual people have only minimally been studied. Classical theories of sexual response, such as the triphasic model of sexual response put forth by Kaplan (1979), depict sexual desire as arising spontaneously and leading to sexual arousal. In contrast, contemporary theories of sexual response posit that desire is secondary to the experience of sexual arousal. The incentive motivation model (IMM; Both et al., 2007; Toates, 2009), for example, proposes that sexual desire is not spontaneous, but rather arises in response to perceived sexual stimuli and a person's co-occurring sexual arousal, which may occur outside of conscious awareness. In other words, desire is the cognitive experience resulting from physiological sexual arousal triggered by a sexual stimulus, which provides motivation to engage in sexual behavior. The IMM posits that parameters such as genital sexual response, a preferred sexual stimulus, and capacity to respond to sexual stimuli, moderate the relationship between arousal and desire.

Sexual arousal is an emotional state that arises in response to external stimuli (e.g., an erotic film) or in response to internal stimuli (e.g., sexual fantasy; Chivers, 2005). In keeping with the IMM, the information processing model of sexual arousal posits that erotic stimuli must be appraised as sexually

²The authors note that there is increasing use of the term "allosexual" to refer to sexual persons as a way to avoid centering or normalizing the experiences of sexual individuals over Ace experiences.

relevant and then processed through a series of cognitive and physiological steps before sexual arousal can occur (Barlow, 1986; Rosen & Beck, 1988). Laboratory measures focus on two types of sexual arousal: genital and subjective (self-reported). Measurement of genital arousal in men is commonly done using a penile plethysmograph, which measures changes in the circumference of the penis with genital arousal, or erection.

Cisgender men report that awareness of their own sexual arousal to either same-sex or other-sex persons is an important source of information about their attractions and sexual orientation during early development of sexual identity (Savin-Williams & Diamond, 2000). This sexual arousal in response to preferred targets is thought to be a strong indicator of sexual attraction or interest. Sexual stimuli that correspond with a man's sexual interest are considered to be *preferred* and will elicit genital and subjective sexual arousal (Chivers et al., 2004), at least for heterosexual and gay men. This pattern does not seem to hold for bisexual men, although the evidence is conflicting (Jabbour et al., 2020; Rieger et al., 2005; Rosenthal et al., 2011).³ Any other sexual stimuli are considered *non-preferred* in that they do not correspond with a man's sexual interest and would not elicit sexual arousal to the same degree. The term "category specificity" is used to indicate that sexual arousal in men is highly dependent on internal or external stimuli that matches their target of sexual attraction (Chivers, 2005).

In contrast to the findings among men, research in cisgender women shows a pattern of target nonspecificity whereby women's genital sexual arousal patterns tend not to match their self-reported preferences, on average. For example, women who self-report a preferred attraction to men show the same degree of genital response regardless of the type of sexual stimuli shown (e.g., male or female stimuli; Chivers et al., 2004, 2007, 2010). In line with the finding that women's genital arousal patterns tend to be target nonspecific, asexually-identifying cisgender women did not differ in genital sexual arousal in response to erotic films, compared to sexual women (Brotto & Yule, 2011). Despite their genital arousal response, asexual women reported no increase in desire for sex after viewing the films, whereas sexual women reported increases in desire for sex. These findings challenge claims that asexuality is due to an alteration, or low responsivity, of genital response.

Sexual arousal involves an interaction between sexual excitatory and sexual inhibitory processes according to the Dual Control Model (Bancroft & Janssen, 2000). Using a mixed-methods approach, Prause and Graham (2007) concluded that asexual individuals' lower sexual excitation (SE), rather than a difference in sexual inhibition (SI) explained their lack of sexual attraction. Since SI of sexual arousal was not a strong predictor of asexuality, this suggests that asexual individuals were not motivated by avoidance or fear of sexual contact. How SE and SI relate to genital sexual arousal in asexual individuals has not been investigated.

The present study is a novel investigation of asexual men's genital arousal patterns, as no such study has been published, and it is not possible to generalize findings from genital arousal studies in women to men. Knowledge of such arousal patterns

in asexual men may help to better us understand the nature of male asexuality. For example, given men's category specificity, if asexual men with arousal capacity do not show elevated responses to sexual stimuli featuring either same-sex or other-sex actors, it suggests that asexual men should be viewed as a unique group differing from men with traditionally defined sexual attractions (e.g., gay and heterosexual men). Indeed, it would be consistent with the notion that asexual men lack sexual attraction to both men and women.

Overview of Current Study

To better understand asexual men's sexual responses, we compared genital and subjective sexual arousal of cisgender asexual men to cisgender heterosexual and gay men while exposed to two different types of erotic stimuli: erotic films (male-female, female-female, male-male, male masturbation, and female masturbation) and while engaging in sexual fantasy. We also examined group differences in genital arousal controlling for SE and SI.

Hypotheses:

- (1) Given evidence of category specificity in cisgender men (Chivers, 2005), we predicted that the sexual participants would show higher genital and subjective arousal responses to their preferred stimuli, whereas asexual men would show lower genital and subjective arousal responses to all erotic films.
- (2) Given evidence that asexual men who masturbate and engage in fantasy may do so for the purposes of orgasm relief (Brotto et al., 2010; Yule et al., 2014b; 2017a), we predicted that their sexual arousal patterns to fantasy would not differ from those of sexual men.
- (3) Given evidence that asexual people have lower SE but the same level of SI as sexual people (Prause & Graham, 2007), we predicted lower SE in asexual versus sexual participants, but no difference in SI between asexual and sexual participants. If this were found, we predicted that lower SE (but not SI) would influence group differences in genital arousal in response to erotic stimuli.
- (4) We predicted asexual men versus sexual men to have lower scores on general measures of sexual function and behavior (e.g., masturbation frequency, desire, satisfaction, orgasmic function) and higher scores on a measure of sexual aversion.

Method

Participants

Seventy-one men were recruited from two university sites: Brock University (BU) and the University of British Columbia (UBC). Participants were recruited through several separate and concurrent avenues, including postings on local websites (e.g., Craigslist), on campus, on the AVEN general discussion board, and through advertisements in the community. Advertisements indicated we were looking for cisgender men of each of the sexual orientation groups for a study on sexual arousal. Inclusion criteria were: English-speaking cisgender men between the ages of 18 and 40 who self-identify as

³Given the conflicting results regarding sexual arousal in bisexual men, we did not include bisexual men in the current study.

asexual, heterosexual, or gay, and were not receiving any medication known to affect sexual arousal. Exclusion criteria were: Individuals who have a current diagnosis of sexual dysfunction and who are uncomfortable with viewing erotic films and/or having their genital arousal measured.

A heterosexual man from BU did not complete the psychophysiological testing due to technical difficulties and the psychophysiological data from a gay man from UBC were unusable due to a technical error; their data were removed from further analyses. Thus, final analyses include data from 69 men between the ages of 18 to 66 (mean (M) = 28.28, standard deviation (SD) = 9.41), 35 tested at the UBC site and 34 from BU. Not all participant data were available for all analyses. For example, out of the 69 men who provided psychophysiological data, only 67 data points were available for final erotic film analysis, due to the presence of excessive movement artifacts that could not be cleaned without losing too much data. Only 66 data points were available for subjective arousal analysis for similar reasons, with 64 of these participants also having genital arousal data. Similarly, some men had missing data on questionnaires and the number of participants is provided for each analysis.

All participants identified as cisgender men and had a phallus given the phallogometric testing required to participate. Twenty participants (12 at UBC and eight at BU) met our criteria for asexuality, which required self-identification as asexual or having scores greater than or equal to 40 on the *Asexuality Identification Scale* (AIS, see Measures; Yule et al., 2015). Specifically, participants answered a question (“Which option best describes your sexual orientation?”) with the following options: “Asexual (a lack of sexual attraction to anyone),” “Heterosexual (straight),” “Bisexual (sexually attracted to both men and women),” “Homosexual⁴ (gay),” or “Other” with a space to describe if “Other” was selected. Ten participants grouped as asexual selected the “Asexual” option, including the only asexual-grouped participant scoring less than 40 on the AIS (i.e., this participant scored 38 on the AIS); all other asexual-grouped participants scored 40 or greater on the AIS (Table 1). Three of these participants selected “Asexual” but also provided the following “Other” responses: “asexual heteroromantic,” “either asexual or graysexual,” and “asexual-leaning heterosexual (some sexual attraction, less sexual desire).” One participant selected “Other” and specified, “homoromantic graysexual.” Two participants who scored greater than or equal to 40 on the AIS (and thus were placed into the asexual group) selected “Homosexual” and four selected “Heterosexual.”

All 27 participants grouped as heterosexual self-identified as “Heterosexual” (13 at UBC and 14 from BU). Twenty-two participants were grouped as gay (10 at UBC and 12 from BU), with 20 identifying as “Homosexual,” one selecting “Other” and specifying “Demihomosexual,” and one participant who did not answer the question, but indicated he was gay at screening. All men grouped as heterosexual and gay who completed the AIS scored 31 or lower on the AIS (Table 1). Site was not significantly

Table 1. Scores on the Asexuality Identification Scale (AIS) by group and results of one-way ANOVA.

| | Asexual | Heterosexual | Gay |
|---------------|-----------------|--------------|-------|
| n | 20 | 27 | 21 |
| M | 47.05 | 15.41 | 16.52 |
| SD | 6.69 | 3.67 | 5.21 |
| Lowest score | 38 ^a | 12 | 12 |
| Highest score | 60 | 27 | 31 |

| One-way ANOVA | | | | |
|-----------------------------|----------------|----------|--------|------------|
| | Test statistic | df | p | η_p^2 |
| F | 255.52 | 2, 65 | < .001 | .89 |
| Welch ^b | 185.75 | 2, 36.31 | < .001 | - |
| Brown-Forsythe ^b | 234.41 | 2, 47.06 | < .001 | - |

Note. ^aOne participant had a score of 38. All other participants had a score of 40 or greater.

^bDue to significant Levene’s test ($p = .003$).

related to group of participants ($\chi^2(2) = 1.01, p = .605, \phi_c = .12$). A significant one-way ANOVA (Table 1) with Games-Howell follow-up indicated asexual men scored significantly higher on the AIS than heterosexual men ($p < .001, d = 6.12$) and gay men ($p < .001, d = 5.11$), who did not significantly differ from each other ($p = .685, d = 0.25$), as expected.

Demographics

Demographic information was completed about age, ethnicity, sex, occupation, annual income, student status, education, presence of physical illness, presence of sexual concerns, relationship status, number of sexual and romantic partners, and masturbation frequency with forced-choice response options. Participants also completed questions about sexual orientation (see Participants section above) and romantic orientation and gender that included a free-response option, given asexual individuals respond differently to forced choice versus free response formats in answering these questions (Brotto et al., 2010; Prause & Graham, 2007). For masturbation frequency, participants were asked, “Are you sexually active solitarily (i.e., masturbation)?” Those who answered “No, I do not masturbate” were categorized as not engaging in masturbation (coded 0); those who answered “Yes – once/month,” “Yes – 2-3 times/month,” “Yes – once/week,” “Yes – 2-4 times/week,” “Yes – once/day,” or “Yes – more than once/day” were categorized as engaging in masturbation (coded 1).

Measures

Asexuality Identification Scale (AIS)

The AIS (Yule et al., 2015) is a valid and reliable 12-item self-report questionnaire that significantly differentiates asexual from sexual individuals. Each item is answered on a five-point Likert scale from 1 (“Completely False”) to 5 (“Completely True”) for 11 of the items and from 1 (“Always”) to 5 (“Never”) for a twelfth item about experiencing sexual attraction toward another person. Total AIS scores were calculated by summing responses from all 12 questions, given no missing data on any items for participants who completed the AIS. Higher scores indicate greater tendency to endorse traits that may indicate asexuality. A cutoff score of 40/60 has been proposed, such that those participants who score at or

⁴This study was carried out prior to the 7th edition of the American Psychological Association’s publication manual (American Psychological Association, 2020) which recommends against the use of the term “homosexual.”

above 40 on the AIS are likely to experience a lack of sexual attraction (Yule et al., 2015). Cronbach's alpha in the current sample ($n = 68$) was excellent at $\alpha = 0.98$ (95% CI (confidence interval) = 0.97–0.98).

International Index of Erectile Function (IIEF) – Revised

The IIEF-R (Rosen et al., 1997) is a 15-item self-report questionnaire that provides a brief assessment of sexual functioning in men over the previous four weeks. It assesses five domains, but only three were used in the current study, based on evidence from Kiss et al. (2021) that the erectile function and intercourse satisfaction subscales are not recommended for use in gay men. Thus, we included the following subscales: orgasmic function (2 items, $n = 60$, Cronbach's alpha was excellent at $\alpha = 0.89$, 95% CI = 0.81–0.93, Spearman-Brown Coefficient = 0.89), sexual desire (2 items, $n = 68$, Cronbach's alpha was excellent at $\alpha = 0.93$, 95% CI = 0.89–0.96, Spearman-Brown Coefficient = 0.93), and overall satisfaction (2 items, $n = 36$, Cronbach's alpha was very good at $\alpha = 0.85$, 95% CI = 0.71–0.92, Spearman-Brown Coefficient = 0.86), which were supported by Kiss et al.'s (2021) findings. Each item was answered on a five-point Likert scale from one to five, with response options differing depending on the question (e.g., some questions used response options from “Almost never or never” to “Almost always or always,” other questions from “Very low or none at all” to “Very high,” etc.). An additional option was available for relevant items to indicate that there had been no sexual activity over the past four weeks. Scores for each domain were summed and lower scores indicate more sexual dysfunction. Adjustments from the non-revised version were made such that the order of the items was rearranged and any man who had not engaged in sexual activity over the past four weeks received a “missing value code” for items inquiring about sexual response during sexual activity (*vs.* receiving a zero score, which erroneously inflates scores denoting sexual dysfunction; Yule et al., 2011). Given sums were used, participants with any missing data for an item did not have a sum calculated for that subscale. An additional item asked about sexual activity (i.e., “Over the past four weeks, did you engage (or attempt to engage) in sexual activity of any kind with a partner and/or by yourself (masturbation)? Please remember that sexual activity can be any sort of sexual touching, including foreplay, oral”) with response options of “No sexual activity (neither with a partner nor by myself),” “Sexual activity with a partner only,” “Sexual activity by myself only,” or “Sexual activity both with a partner and by myself.” If a participant answered “No sexual activity” they were categorized as having no sexual activity (coded 0), whereas all other responses were categorized as sexual activity (coded 1).

Sexual Aversion Scale (SAS)

The SAS (Katz et al., 1989) is a 30-item questionnaire used to assess sexual fears and avoidance ($n = 68$, Cronbach's alpha was excellent at $\alpha = 0.93$, 95% CI = 0.90–0.95). Respondents were instructed to indicate how true a particular statement was for them from “1 = Not at all like me” to “4 = A lot like me.” Given no missing data on any items for participants who completed the SAS, scores were summed and higher scores indicate higher sexual aversion.

Sexual Inhibition/Sexual Excitation Scales (SIS/SES)

The SIS/SES (Janssen et al., 2002) measure sexual response patterns based on the Dual Control Model (Bancroft et al., 2009; Bancroft & Janssen, 2000). Participants indicated how they would react to a series of statements such as, “When a sexually attractive stranger accidentally touches me, I easily become aroused” or, “If I feel that I am being rushed, I am unlikely to become very aroused,” with response options ranging from “1 = Strongly Agree” to “4 = Strongly Disagree.” The SIS/SES is composed of three factors: sexual excitation (SES; 20 items, $n = 68$, Cronbach's alpha was excellent, $\alpha = 0.95$, 95% CI = 0.93–0.97), sexual inhibition due to the threat of performance failure (SIS-1; 14 items, $n = 68$, Cronbach's alpha was moderate at $\alpha = 0.78$, 95% CI = 0.69–0.85), and sexual inhibition due to the threat of performance consequences (SIS-2; 11 items, $n = 68$, Cronbach's alpha was moderate at $\alpha = 0.78$, 95% CI = 0.70–0.85). Given no missing data on any items for participants who completed the SIS/SES, item scores were summed for each factor. Higher scores indicate higher levels of SI or SE.

Film Scale

The Film Scale (Heiman & Rowland, 1983) is a 34-item self-report questionnaire that taps into sexual and affect-related aspects of experience in response to erotic stimuli. Participants indicated how much they endorsed each item at the present moment on a 7-point Likert scale from “1 = not at all” to “7 = intensely” before and after sexual fantasy. Data from the Film Scale were analyzed for the sexual fantasy portion of the study only.

There are seven subscales, but only six were used in the current study given low Cronbach's alpha levels with the subjective sexual arousal subscale in the present sample⁵; perception of genital sexual arousal (e.g., warmth in genitals, genital pulsing or throbbing; 5 items, $n = 51$; Before fantasy: Cronbach's $\alpha = 0.89$, 95% CI = 0.84–0.93; After fantasy: Cronbach's $\alpha = 0.94$, 95% CI = 0.91–0.96), autonomic arousal (e.g., faster breathing, faster heart beat; 5 items, $n = 51$; Before: Cronbach's $\alpha = 0.93$, 95% CI = 0.89–0.95; After: Cronbach's $\alpha = 0.89$, 95% CI = 0.84–0.93), positive affect (e.g., pleasure, interested, excited; 5 items, $n = 51$; Before: Cronbach's $\alpha = 0.76$, 95% CI = 0.63–0.85; After: Cronbach's $\alpha = 0.87$, 95% CI = 0.80–0.92), negative affect (e.g., worried, angry, disgusted; 10 items, $n = 50$; Before: Cronbach's $\alpha = 0.76$, 95% CI = 0.65–0.85; After: Cronbach's $\alpha = 0.70$, 95% CI = 0.56–0.81), and sensuality-sexual attraction (e.g., sensuous, a desire to be close to someone, sexually attractive; 6 items; Before: $n = 51$, Cronbach's $\alpha = 0.87$, 95% CI = 0.81–0.92; After: $n = 50$, Cronbach's $\alpha = 0.93$, 95% CI = 0.89–0.96). The anxiety domain consisted of a single item. Missing data were present for one participant on one item for the before negative affect subscale, for a different

⁵The subjective sexual arousal subscale consists of two items, “sexually aroused” and “sexually turned off,” with one item reverse coded. The Cronbach's alpha for the Before timepoint was $\alpha = 0.22$, 95% CI = –0.37–0.55, $r = .16$, $p = .266$, and the Cronbach's alpha for the After timepoint was $\alpha = 0.51$, 95% CI = 0.14–0.72, $r = .35$, $p = .012$. Spearman-Brown Coefficients were 0.27 for the Before timepoint and 0.52 for the After timepoint. Given the subscale consists of only two items and there is no current literature to suggest which item would be most representative of the subscale, we removed this subscale from analyses.

participant on a different item for the after negative affect subscale, and for a third participant on a different item for the after sensuality-sexuality subscale. Thus, average scores were computed for all film scale subscales that comprised more than a single item using only the available data. Higher scores indicate higher levels of each subscale.

Sexual Stimuli

Two types of sexual stimuli were used: erotic films and erotic fantasy generation. First, participants viewed a three-minute neutral film (a nature documentary) followed by 10 two-minute erotic film clips, presented with accompanying musical soundtrack, that represented five stimulus categories: female-female intercourse (cunnilingus and digital penetration), female masturbation, male-male intercourse (fellatio and anal intercourse), male masturbation, and female-male intercourse (oral sex and penile-vaginal intercourse). Participants saw two exemplars of each stimulus category. The films were sexually explicit and have previously been found effective in eliciting genital arousal (i.e., some films were acquired from another lab that had published genital arousal findings, and others elicited genital arousal when testing the lab paradigm prior to data collection). Films were presented in one of two sequences, and the order of presentation was randomized across participants. A two-minute “relax” segment was shown between each erotic film, where the word “relax” was displayed on the screen. Participants were instructed to relax to allow their genital arousal to return to baseline and this period was extended if necessary to allow return to baseline before the next erotic film clip began. The entire film sequence lasted a minimum of 41 minutes if extra relaxation time was not required (i.e., if any of the relaxation segments were not extended beyond two minutes). For sexual fantasy generation, participants’ sexual arousal was recorded while they elicited a sexual fantasy of their choosing for a maximum of 10 minutes. Following the psychophysiological recording, participants described the sexual fantasy in a questionnaire in as much or as little detail as they wished.

Psychophysiological Recording

At both sites, men’s genital responses were assessed using a penile plethysmograph (PPG), a mercury-in-rubber strain gauge (DM Davis Inc., New Jersey) that assesses changes in penile circumference (Barlow et al., 1970; Bancroft et al., 1966). The strain gauge was calibrated over six 5-mm steps between each participant session at UBC (Janssen et al., 2007), and over 10-mm steps at BU. After each use, the penile gauge was subjected to high-level disinfection using CidexOPA. Penile plethysmography has been shown to be a reliable and valid measure of men’s sexual arousal (Janssen et al., 2007).

At UBC, PPG was recorded on a personal computer (HP Pentium M Laptop), which collected, converted (from analog to digital, using a Model DA100C data acquisition unit [BIOPAC Systems, Inc.]), and transformed data, using the software program AcqKnowledge III, Version 3.8.1 (BIOPAC Systems, Inc., Santa Barbara, CA). The signal was low-pass filtered (10 Hz) and a sampling rate of 100 samples/second was used for PPG collection, and transformed into millimeters in circumference. At BU, PPG responses were sampled and

recorded continuously with a Limestone Technologies Data Pac USB system and PrefTest Suite software, Version 9.9 (Limestone Technologies Inc., Odessa, ON, Canada) on a personal computer (HP G62 Notebook PC). The signal was sampled at a rate of 10 samples/second, low-pass filtered (to 0.5 Hz), digitized (40 Hz), and transformed into millimeters in circumference.

Continuous Subjective Arousal

Continuous subjective sexual arousal was measured during the films using an “arousometer.” At UBC, this device was modeled after the one described by Rellini et al. (2005) and consisted of a computer optic mouse mounted on a plastic track with 10 intervals. The arousometer was affixed to the armrest of the recliner so that the participant could easily move the mouse while reclining and watching the erotic film clips. Participants were instructed to move the mouse up and down the track over the course of the film to indicate their level of subjective sexual arousal ranging from 7 (*highest level of sexual arousal*) to -2 (*sexually turned off*), with 0 representing no arousal at all.

At BU, participants were provided with a keypad, which was placed on the arm of the chair and was attached by a long cord to the Data Pac USB system. Participants saw a green bar on the left side of the television screen. Participants continuously raised and lowered the level of the green bar by pressing the + and – keys on the keypad to correspond to their sense of subjective sexual arousal throughout each film clip. They were instructed that the bottom of the bar represented 0% arousal, or “no arousal at all.” The top of the bar represented 100% arousal, or “very high sexual arousal, the most sexual arousal you have ever experienced or can imagine.”

Because subjective sexual arousal was measured on different scales at the two sites, values were standardized so that the data could be compared. Any scores of -1 or -2 (indicators of being sexually turned off) at UBC, were recoded to a “0,” which indicated no sexual arousal. Given participants at BU were not provided the option to indicate negative subjective sexual arousal values, we expected they would have indicated “0” arousal if they were experiencing negative subjective sexual arousal. The remaining arousometer values at UBC, which now ranged from 0–7, were transformed to a 100-point scale, to align with the BU scale.

Procedure

The UBC Clinical Research Ethics Board (REB) and the BU REB approved all procedures. Participants responded to advertisements and took part in a telephone screening process with trained research assistants at each site. Participants were told that the purpose of the study was to gain more information about sexual arousal in asexual men, that they would be watching a number of erotic films, and that they would be given the option to participate in a second phase of the study in which they would be engaging in a sexual fantasy task. Participation in the second phase was optional due to concerns that we were burdening the participants given the lengthy genital arousal film clip session. No participants withdrew after the phone screen.

The psychophysiology set-up at each site was very similar, and each room contained a comfortable reclining chair, a large screen TV, an intercom, and a sink with a small cupboard unit. A thin blanket or sheet was placed over the seating area of the chair. Following written consent, participants were tested by a male researcher at UBC, or by a female or male researcher (of the participants' choosing) at BU.

Participants completed the questionnaires on an iPad (UBC) or laptop (BU) in a private psychophysiology room. Participants were provided with further instructions about the penile plethysmograph and the remainder of the study procedures. Following this, the researcher left the room, and participants placed the strain gauge on their (flaccid) penis in private. They then informed the researcher of their readiness via intercom. The researcher controlled the videos from a room adjacent to the testing room.

To habituate to the testing environment, participants were encouraged to relax on the comfortable reclining chair for a 10-minute period once the strain gauge was in place before watching the films. Subjective sexual arousal and affect were assessed during the adaptation period using the Film Scale to reflect their baseline experience. Following the completion of the Film Scale, the video sequence began. The audio component was delivered via wireless headphones. Immediately following the erotic film clips, participants completed a second Film Scale, which asked them to evaluate their sexual arousal and affect after watching the erotic films.

The fantasy portion occurred either directly following the erotic film portion (UBC and BU) or on a different day (BU) for those who consented, and participants were instructed to allow their arousal to return to baseline, and then completed a third Film Scale to assess sexual arousal and affect prior to eliciting the sexual fantasy. Participants were then instructed to imagine a sexual fantasy of their own choosing, one that they found particularly arousing (see Supplemental Materials for instructions), and genital and subjective arousal were measured as they engaged in this sexual fantasy using the same method described earlier. Participants were allowed 10 minutes to engage in a fantasy but were told to let the researcher know when the sexual fantasy had run its course, which was less than 10 minutes in 63% of cases. They then completed a fourth Film Scale to reflect their sexual arousal and affect after engaging in fantasy. Immediately afterward, participants typed the content of their sexual fantasy on an iPad (UBC) or laptop (BU). Participants were debriefed and provided with \$50 remuneration for the erotic film portion and \$25 for the optional sexual fantasy portion.

Statistical Analyses

SPSS version 27 was used for statistical analyses. A two-tailed critical α of .05 was used, except where specified. Correlations were Pearson r for associations between two continuous variables, point biserial for associations between a dichotomous and a continuous variable, and the phi coefficient for associations between two dichotomous variables. Group comparisons for continuous variables used analysis of variance (ANOVA), followed by Fisher's Least Significant Difference (LSD) pairwise comparison tests or Games-Howell pairwise comparison

tests when Levene's test was significant. For categorical variables, group comparisons used Chi-square analyses or Fisher's Exact Test if a cell size was smaller than 5. For follow-up, tests of Bonferroni-corrected column proportions were used, but note that exact p -values are not provided with this test in SPSS and thus are not reported.

Data Cleaning, Reduction, and Analysis for Genital Sexual Arousal Data

We detected and deleted movement artifacts (i.e., sudden, drastic changes) in the PPG data by visual inspection prior to data analysis. Because we were primarily interested in the potential for sexual arousal in asexual men, maximum genital response to each stimulus category was used in the analyses. Change in penile circumference in millimeters was calculated by subtracting the mean circumference of the penis at baseline (i.e., during the neutral video) from the maximum circumference of the penis during each film and sexual fantasy.⁶ A 5 (stimulus, repeated measures) \times 3 (group) multivariate analysis of variance (MANOVA) was used to compare the magnitude of genital responses to erotic films. A one-way ANOVA was used to compare genital response to sexual fantasy. Pairwise comparisons were conducted with Fisher's LSD tests or, in the presence of a significant Levene's test, Games-Howell tests.

Continuous Subjective Sexual Arousal Data

Maximum values for self-reported continuous sexual arousal, expressed as a percentage increase in arousal from baseline (which was generally zero arousal), were used, such that each stimulus yielded one maximum value per participant.⁶ A 5 (film stimulus, repeated measures) \times 3 (group) MANOVA was used to compare the magnitude of continuous subjective arousal responses. A one-way ANOVA was used to compare genital response to sexual fantasy. Pairwise comparisons were conducted with Fisher's LSD tests or, in the presence of a significant Levene's test, Games-Howell tests.

Discrete Self-reported Sexual Arousal to Sexual Fantasy

Film Scale responses for each subscale were analyzed with a repeated-measures ANOVA, such that before and after scores were within-subjects independent variables, group was a between-subjects independent variable, and the interaction between change in film scale scores and group was a third independent variable. Pairwise comparisons were conducted with Fisher's LSD tests or, in the presence of a significant Levene's test, Games-Howell tests.

Genital Sexual Arousal Controlling for Sexual Inhibition and Sexual Excitation

A 5 (stimulus, repeated measures) \times 3 (group) MANCOVA statistically controlling for SES, SIS-1, and SIS-2 was used to compare genital arousal to erotic films. Follow-ups were conducted with univariate ANCOVAs and LSD pairwise comparisons. Given the addition of variables to statistically control,

⁶We also conducted analyses with raw change scores converted into z-scores (to take into account differences in penis size and sexual responsivity, and allow for comparisons between participants and sites; Murphy et al., 2015) and results did not differ (results not shown).

corrections for a significant Levene's test were not possible. Instead, a more conservative Bonferroni pairwise comparison test was selected to be used in the presence of a significant Levene's test. To determine which specific SI or SE variable was impacting group differences, MANCOVAs were repeated three times with each of SES, SIS-1, or SIS-2 included individually. A one-way ANCOVA (statistically controlling for SES, SIS-1, or SIS-2) was repeated with each of these variables included separately to follow-up the MANCOVAs.

Effect Sizes

Given the novelty of this study combined with the challenges in recruiting asexual men for an in-person laboratory-based study, we focused on effect sizes in discussing the results, although we still reported details relevant to null hypothesis significance testing. Effect sizes for ANOVAs/ANCOVAs and MANOVAs/MANCOVAs were calculated with eta-squared (η^2) or the partial eta-squared (η_p^2), where η^2/η_p^2 below 0.01 indicates a small effect, η^2/η_p^2 between .0101 and .06 indicates a moderate effect, and η^2/η_p^2 between .0601 and .14 indicates a large effect size (Cohen, 1988). Cohen's d was calculated for pairwise comparisons using formulas 2.15 and 2.16 in Field (2013) (see pp. 80–81), where $d = 0.20$ indicates a small effect, $d = 0.50$ indicates a medium effect, and $d = 0.80$ indicates a large effect. For ANCOVAs, the means and standard errors adjusted for variables that were statistically controlled were used. For Chi-square analyses or Fisher's Exact Test, effect sizes were calculated using Cramer's V (ϕ_c), where ϕ_c between .10 and .30 indicates a small effect, .301 and .50 indicates a moderate effect, and .501 and 1.0 indicates a large effect size (Cohen, 1988).

Results

Differences in Demographics

Only significant differences in demographics are presented here (for other details see Supplemental Materials). A one-way ANOVA with group as the independent variable was significant, ($F(2, 66) = 6.89, p = .002, \eta_p^2 = .17$), including the Welch ($4.41, df = 2, 38.04, p = .019$) and Brown-Forsythe ($6.17, df = 2, 32.09, p = .005$) corrections for a significant Levene's test. Games-Howell post-hoc tests indicated asexual men were significantly older than gay men ($p = .018, d = 0.95$), with no other significant pairwise comparisons ($ps > .067$). Across sites, 25% of asexual men, 81.5% percent of heterosexual men, and 50% of gay men indicated that they were currently in a relationship. These proportions differed significantly by group, such that asexual men differed significantly from heterosexual men, but neither differed significantly from gay men, both in terms of being single and in terms of being in a relationship ($p < .05$, based on tests of Bonferroni-corrected column proportions in SPSS; Table 2). Furthermore, gay men at UBC were significantly more likely to be in a relationship and less likely to be single than the gay men at BU ($p < .05$, based on tests of Bonferroni-corrected column proportions in SPSS) with no other significant differences in relationship status by site within asexual or heterosexual men (Table 2).

Evaluating Potential Covariates

Age, ethnicity, education, relationship status, film order, and site were evaluated as potential covariates given some group differences on these variables. Details are presented in the Supplemental Materials. Analyses were carried out with and without controlling for relationship status for the sexual aversion dependent variable because this was the only significant covariate with variability across the groups. No other variables were statistically controlled in analyses.

Sexual Behavior and Sexual Functioning

Group differences on several aspects of sexual behavior and sexual functioning were examined. Descriptive statistics and omnibus tests are provided in Table 3. Asexual participants reported engaging in masturbation significantly less than heterosexual men ($p < .05$, based on tests of Bonferroni-corrected column proportions in SPSS), but not significantly less than gay men, who also did not differ from heterosexual men. Twenty-five percent of asexual men stated that they "never" engaged in masturbation, compared with 0% of heterosexual men and 4.8% of gay men. According to the IIEF-R, 15 of 20 (75%) asexual men had been sexually active, either alone or with a partner, in the past four weeks, which was significantly different compared with 100% of heterosexual and gay men (who did not differ significantly from each other). There was a negative correlation between age and being sexually active ($r = -.51, p < .001, n = 68$), such that no sexual activity was associated with an older age. This was influenced entirely by the asexual men ($r = -.49, p = .027, n = 20$) given no variance within the heterosexual and gay men (i.e., all had sexual activity).

There were no significant differences on the IIEF-R overall satisfaction subscale and no significant pairwise comparisons ($ps > .082$; Table 3).⁷ There was a significant ANOVA on the IIEF-R orgasmic function subscale (including after Welch and Brown-Forsythe corrections for Levene's test). Asexual men had lower orgasmic function scores than heterosexual men ($p = .048, d = 1.07$), but not gay men ($p = .064, d = 0.93$); heterosexual and gay men did not differ from each other ($p = .992, d = 0.03$). There was also an overall significant ANOVA on the IIEF-R sexual desire subscale. Asexual men had significantly lower desire scores than heterosexual ($p < .001, d = 2.75$) and gay men ($p < .001, d = 2.90$), who did not significantly differ from each other ($p = .054, d = 0.57$).

Regarding sexual excitation and inhibition, there were significant group differences on all three subscales of the SES/SIS (Table 3). Asexual men displayed lower SES and higher SIS-1 compared to heterosexual men (SES: $p < .001, d = 2.20$; SIS-1: $p < .001, d = 1.39$) and gay men (SES: $p < .001, d = 2.43$; SIS-1: $p < .001, d = 1.34$), who did not differ from each other (SES: $p = .296, d = 0.32$; SIS-1: $p = .969, d = 0.01$). Asexual men also displayed higher SIS-2 compared to heterosexual men ($p = .001, d = 0.94$), but not compared to gay men ($p = .073, d = 0.55$). Gay men also did not differ from heterosexual men on SIS-2 ($p = .127, d = 0.51$).

⁷LSD pairwise comparisons were conducted for IIEF Sexual Desire, IIEF Overall Satisfaction, SAS, SES, SIS-1, and SIS-2. Games-Howell pairwise comparisons were conducted for IIEF Orgasmic Function due to a significant Levene's test.

Table 2. Demographic characteristics and results of analyses comparing demographics, by group and by site.

| | Age | | | With post-secondary education ^a | | | In a relationship ^b | | | With White ethnicity ^c | | | | |
|----------------------------|-----------|-----------|----------|--|----------------------------------|-----------------|--------------------------------|---------------------|--------------------|-----------------------------------|---------------------|-------------------|----------|-----------------|
| | Asex. | Het. | Gay | Asex. | Het. | Gay | Asex. | Het. | Gay | Asex. | Het. | Gay | | |
| Descriptive Statistics | | | | | | | | | | | | | | |
| Across sites | <i>n</i> | 20 | 27 | 22 | <i>n</i> | 14 ^d | 23 | 19 ^d | 5 | 22 | 11 ^d | 13 | 21 | 14 ^d |
| | <i>M</i> | 34.65 | 27.04 | 25.27 | % | 70 | 85.2 | 86.4 | 25 | 81.5 | 50 | 65 | 77.8 | 63.6 |
| | <i>SD</i> | 13.38 | 6.45 | 4.90 | - | - | - | - | - | - | - | - | - | - |
| UBC | <i>n</i> | 12 | 13 | 10 | <i>n</i> | 7 | 10 | 10 | 2 | 11 | 9 | 9 | 10 | 8 |
| | <i>M</i> | 35.08 | 30.62 | 24.70 | % | 58.3 | 76.9 | 100 | 16.7 | 84.6 | 90 | 75 | 76.9 | 80 |
| | <i>SD</i> | 11.36 | 5.36 | 2.45 | - | - | - | - | - | - | - | - | - | - |
| BU | <i>n</i> | 8 | 14 | 12 | <i>n</i> | 7 ^d | 13 | 9 ^d | 3 | 11 | 2 ^d | 4 | 11 | 6 ^d |
| | <i>M</i> | 34.00 | 23.71 | 25.75 | % | 87.5 | 92.9 | 75 | 37.5 | 78.6 | 16.7 | 50 | 78.6 | 50 |
| | <i>SD</i> | 16.80 | 5.65 | 6.36 | - | - | - | - | - | - | - | - | - | - |
| Results of Analyses | | | | | | | | | | | | | | |
| Two-way ANOVA ^e | | | | | Fisher's Exact Test ^f | | | Fisher's Exact Test | | | Fisher's Exact Test | | | |
| | <i>F</i> | <i>df</i> | <i>p</i> | η_p^2 | FET | <i>p</i> | ϕ_c | FET | <i>p</i> | ϕ_c | FET | <i>p</i> | ϕ_c | |
| ME G | 6.65 | 2, 63 | .002 | .17 | All | 2.02 | .374 | .18 | 15.02 ^g | .001 | .47 | 1.13 ^g | .569 | .13 |
| ME S | 1.21 | 1, 63 | .276 | .02 | Asex. | - | .106 | .46 | - | .347 | .24 | - | .356 | .26 |
| INT | 1.41 | 2, 63 | .252 | .04 | Het. | - | .326 | .22 | - | 1.00 | .08 | - | 1.00 | .02 |
| - | - | - | - | - | Gay | - | .476 | .31 | - | .002 | .72 | - | .361 | .27 |

Note. UBC: University of British Columbia, BU: Brock University, Asex. = asexual, Het. = heterosexual, ME G = main effect of group, ME S = main effect of site, INT = interaction between group and site, FET = Fisher's Exact Test value.

^aFrequency and % of participants with a post-secondary education are presented, across sites and by site.

^bFrequency and % of participants who are in a relationship are presented, across sites and by site.

^cFrequency and % of participants with a White ethnicity are presented, across sites and by site.

^dData were missing for 1 participant.

^eResults of a two-way ANOVA for age, with group, site, and the interaction between group and site as independent variables. Levene's test was significant ($p < .001$).

^fResults of Fisher's exact test, across groups (demographic variable by group), and within group (demographic variable by site).

^gResults of Chi-square analysis are presented with *df* of 2 given no cell sizes were less than 5.

Table 3. Sexual behavior and sexual function among asexual, heterosexual, and gay male participants.

| Measure | Asexual | Heterosexual | Gay | <i>df</i> | Test statistic | | Effect Size |
|--|------------------------------|------------------------------|------------------------------|-----------|---------------------|-------------------|-------------|
| | <i>n</i> (%) | <i>n</i> (%) | <i>n</i> (%) | | Fisher's Exact Test | <i>p</i> | ϕ_c |
| Masturbation | | | | | | | |
| Never | 5 (25%) | 0 (0%) | 1 (4.8%) | - | 7.88 | .007 | .38 |
| Once/month or more | 15 (75%) | 27 (100%) | 20 (95.2%) | | | | |
| Sexually Active | | | | | | | |
| No sexual activity | 5 (25%) | 0 (0%) | 0 (0%) | - | 9.60 | .001 | .44 |
| Sexual activity (past four weeks) | 15 (75%) | 27 (100%) | 21 (100%) | | | | |
| | <i>M</i> (<i>SD</i>) | <i>M</i> (<i>SD</i>) | <i>M</i> (<i>SD</i>) | | <i>F</i> | | η^2 |
| IIEF Orgasmic Function ^a | 6.93 (3.05) <i>n</i> = 14 | 9.15 (1.32) <i>n</i> = 26 | 9.10 (1.68) <i>n</i> = 20 | 2, 57 | 6.80 | .002 ^f | .19 |
| IIEF Overall Satisfaction ^a | 6.00 (2.55) <i>n</i> = 5 | 7.26 (2.21) <i>n</i> = 19 | 8.17 (2.25) <i>n</i> = 12 | 2, 33 | 1.68 | .203 | .09 |
| IIEF Desire ^a | 3.25 (1.37) | 6.85 (1.26) | 7.67 (1.65) | 2, 65 | 56.47 | <.001 | .64 |
| SES ^b | 36.60 (9.39) | 55.85 (8.23) | 58.52 (8.68) | 2, 65 | 39.23 | <.001 | .55 |
| SIS-1 ^c | 36.50 (7.70) | 27.74 (5.08) | 27.81 (5.09) | 2, 65 | 15.09 | <.001 | .32 |
| SIS-2 ^d | 31.65 (6.69) | 26.22 (4.97) | 28.62 (4.21) | 2, 65 | 5.95 | .004 | .16 |
| SAS ^e | 67.45 (16.08) | 48.33 (10.58) | 53.33 (14.39) | 2, 65 | 11.79 | <.001 | .27 |

Note. Sample sizes differing from $n = 20$ asexual men, $n = 27$ heterosexual men, and $n = 21$ gay men are specified for each relevant analysis. SES = sexual excitation, SIS-1 = sexual inhibition due to the threat of performance failure, SIS-2 = sexual inhibition due to the threat of performance consequences, SAS = sexual aversion scale. Absolute scale ranges:

^a2-10; ^b20-80; ^c14-56; ^d11-44; ^e30-120

^fA significant Levene's test ($p < .001$) warrants reporting of the robust tests of equality of means via the Welch test statistic (2, 27.07) = 3.36, $p = .050$, and the Brown-Forsythe test statistic (2, 24.18) = 5.21, $p = .013$.

There was also a significant difference between groups regarding sexual aversion, both not controlling for relationship status (Table 3) and controlling for relationship status, $F(2,64) = 5.89$, $p = .004$, $\eta_p^2 = .16$. In both analyses (i.e., not controlling and controlling for relationship status), asexual participants had significantly higher sexual aversion than heterosexual men ($p < .001$, not controlling

for relationship status; $p = .002$, controlling for relationship status; $d = 1.45$) and gay men ($p = .001$, not controlling for relationship status; $p = .007$, controlling for relationship status; $d = 0.93$), who did not significantly differ from each other ($p = .210$, not controlling for relationship status; $p = .537$, controlling for relationship status; $d = 0.40$).

Genital Sexual Arousal

Some participants chose not to participate in the sexual fantasy portion, with more asexual men participating than heterosexual or gay men. After data cleaning, data were available for 67 participants (19 asexual, 26 heterosexual, and 22 gay men) for the erotic films, and for 46 participants (17 asexual, 15 heterosexual, and 14 gay men) for sexual fantasy. At the UBC site, erotic film data were available for 34 participants (11 asexual, 13 heterosexual, and 10 gay men) and sexual fantasy data were available for 30 participants (11 asexual, 11 heterosexual, and eight gay men). At the BU site, erotic film data were available for 33 participants (eight asexual, 13 heterosexual, and 12 gay men), and sexual fantasy data were available for 16 participants (six asexual, four heterosexual, and six gay men).

Evaluating Potential Non-responders

Details are provided in the Supplemental Materials. There was a low rate of non-responders and there were no significant group differences in numbers of non-responders. Thus, all available genital arousal data were included in subsequent analyses.

Genital Response to Erotic Film

Figure 1 presents maximum genital arousal (MGA) responses for asexual ($n = 19$), heterosexual ($n = 26$), and gay ($n = 22$) men in response to watching the erotic films. The overall 5 (film stimulus, repeated measures) \times 3 (group) MANOVA was significant, $F(10,122) = 4.87$, Pillai's Trace = .57, $p < .001$, $\eta_p^2 = .29$. Descriptive statistics and results of follow-up univariate tests are shown in Table 4.⁸ There were significant group differences for each of the erotic films. For the female-female film clip heterosexual men showed significantly greater MGA than asexual ($p = .005$, $d = 0.95$) and gay ($p < .001$, $d = 1.28$) men, with no significant difference between gay and asexual men ($p = .606$, $d = 0.31$). For the male-male film clip, gay men showed significantly greater MGA than asexual ($p = .003$, $d = 0.94$) and heterosexual men ($p = .003$, $d = 0.86$), with no significant difference between heterosexual men and asexual men ($p = .803$, $d = 0.08$). For the female-male film clip, heterosexual men showed significantly greater MGA than gay ($p = .006$, $d = 0.85$) and asexual men ($p = .028$, $d = 0.67$), with no significant difference between gay and asexual men ($p = .641$, $d = 0.14$). For the female masturbation film clip, heterosexual men showed significantly greater MGA than asexual ($p = .017$, $d = 0.83$) and gay men ($p = .001$, $d = 1.09$), with no significant difference between gay and asexual men ($p = .776$, $d = 0.22$). For the male masturbation film clip, gay men showed significantly greater MGA than asexual ($p = .001$, $d = 1.11$) and heterosexual men ($p = .002$, $d = 0.90$), with no significant difference between heterosexual and asexual men ($p = .487$, $d = 0.23$).

Genital Response to Fantasy

A one-way ANOVA on MGA in response to sexual fantasy in 17 asexual, 15 heterosexual, and 14 gay men revealed no significant difference between groups and thus pairwise

⁸LSD pairwise comparisons were conducted for the male-male, male-female, and male masturbation film clips. Games-Howell pairwise comparisons were conducted for the female-female and female masturbation film clips due to a significant Levene's test.

comparisons were not performed (Figure 1). Descriptive statistics and the result of the omnibus test are shown in Table 4. The mean, minimum, and maximum levels of genital arousal during the sexual fantasy suggest that the lack of group differences on MGA were not due to a floor effect.

Generally, sexual men (heterosexual and gay men) were more likely than asexual men to fantasize about sexually intimate (e.g., penetrative intercourse or oral sex) encounters with other people. Asexual men were more likely to describe activities or scenarios that did not include sexual intercourse, fantasizing more about a romantic bond rather than sexual desire, or fantasizing more about physical intimacy they described as non-sexual. Two asexual participants and none of the sexual participants stated that they fantasized about "nothing." One asexual, one gay, and one heterosexual participant described being distracted during the fantasy. Group was not significantly related to describing "nothing" or being distracted during the fantasy, Fisher's Exact Test statistic = 1.16, $p = .600$, $\phi_c = .17$.

Subjective Sexual Arousal

Continuous Subjective Arousal

Figure 2 presents maximum continuous subjective sexual arousal (MCSSA) responses for asexual ($n = 18$), heterosexual ($n = 25$), and gay ($n = 21$) men (who also had genital arousal data) in response to watching the erotic films. The 5 (film stimulus, repeated measures) \times 3 (group) MANOVA was significant, $F(10,116) = 9.60$, Pillai's Trace = .91, $p < .001$, $\eta_p^2 = .45$. Descriptive statistics and results of follow-up univariate tests are shown in Table 4.⁹ There were significant group differences for each of the erotic films. For the female-female film clip, heterosexual men experienced significantly greater MCSSA than asexual men ($p < .001$, $d = 1.46$) and gay men ($p < .001$, $d = 1.22$), with no significant difference between asexual and gay men ($p = .890$, $d = 0.04$). For the male-male film clip, gay men experienced significantly greater MCSSA than asexual men ($p < .001$, $d = 1.73$) and heterosexual men ($p = .001$, $d = 1.10$), with no significant difference between asexual and heterosexual men ($p = .535$, $d = 0.31$). For the female-male film clip,¹⁰ heterosexual men experienced significantly greater MCSSA than asexual men ($p = .001$, $d = 1.16$) and gay men ($p = .001$, $d = 1.00$), with no significant difference between asexual and gay men ($p = .718$, $d = 0.11$). For the female masturbation film clip, heterosexual men experienced significantly greater MCSSA than asexual men ($p = .016$, $d = 0.78$). Differences between heterosexual and gay men did not reach statistical significance ($p = .063$, $d = 0.53$) and there was no significant difference between gay and asexual men ($p = .526$, $d = 0.22$). For the male masturbation film clip, gay men experienced significantly greater MCSSA than asexual men ($p < .001$, $d = 2.02$).

⁹LSD pairwise comparisons were conducted for the female-female, male-female, female masturbation, and male masturbation film clips. Games-Howell pairwise comparisons were conducted for the male-male film clip due to a significant Levene's test.

¹⁰Six asexual participants (out of 20) identified as gay or heterosexual (see Participants subsection in the Method). In a one-way ANOVA within the asexual participants, those asexual participants who identified as asexual were less likely to be subjectively aroused to the female-male film clip than those who identified as heterosexual or gay ($F(1,16) = 6.57$, $p = .021$).

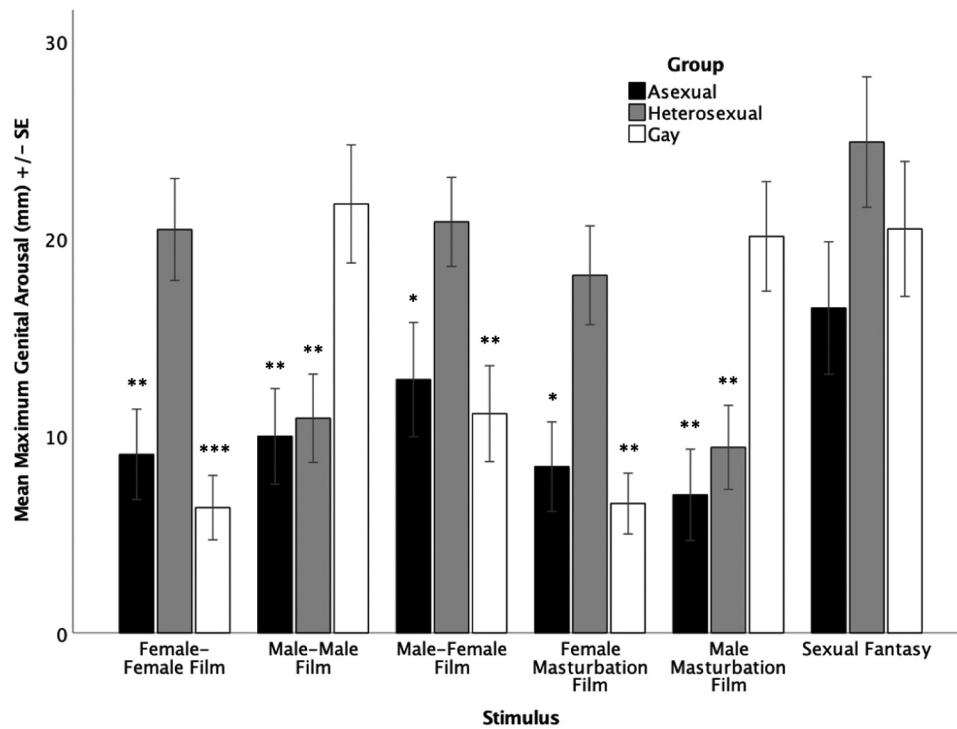


Figure 1. Maximum genital arousal, in mm, to erotic stimuli by orientation group. Note that the first five sets of bars are in response to audio-visual erotica, and the final set of bars is in response to sexual fantasy. Error bars indicate ± 1 standard error, * $p < .05$, ** $p < .01$, *** $p < .001$. Asterisks reflect group differences between the group indicated and the group with the highest genital arousal for that film type.

Table 4. Mean, minimum, and maximum genital arousal (in mm) for each group by stimulus and results of group comparisons.

| Stim. | M | SD | Min. | Max. | M | SD | Min. | Max. | M | SD | Min. | Max. | F | p | η^2 |
|-------------------------------|------------------|-------|-------|-------|-----------------------|-------|-------|-------|--------------|-------|-------|-------|-------|---------------------|----------|
| Genital Arousal | | | | | | | | | | | | | | | |
| | Asexual (n = 19) | | | | Heterosexual (n = 26) | | | | Gay (n = 22) | | | | | | |
| FF | 9.05 | 9.98 | -0.15 | 39.50 | 20.45 | 13.17 | 0.05 | 43.81 | 6.35 | 7.65 | 0.37 | 26.63 | 11.74 | < .001 ^a | .27 |
| MM | 9.96 | 10.54 | 0.34 | 34.04 | 10.88 | 11.40 | -1.35 | 42.80 | 21.74 | 14.03 | 0.80 | 56.48 | 6.41 | .003 | .17 |
| FM | 12.84 | 12.63 | -5.22 | 39.50 | 20.83 | 11.49 | 1.14 | 41.76 | 11.11 | 11.39 | -0.40 | 34.92 | 4.66 | .013 | .13 |
| F | 8.43 | 9.90 | -4.67 | 31.59 | 18.13 | 12.78 | -0.53 | 38.72 | 6.56 | 7.23 | -0.55 | 22.16 | 8.56 | .001 ^b | .21 |
| M | 7.00 | 10.08 | -4.27 | 31.23 | 9.41 | 10.86 | -1.97 | 34.79 | 20.10 | 13.01 | 0.99 | 48.38 | 8.02 | .001 | .20 |
| Fant. | 16.47 | 13.83 | -2.35 | 39.80 | 24.88 | 12.80 | 0.47 | 44.38 | 20.47 | 12.79 | 0.17 | 37.91 | 1.62 | .210 | .07 |
| Continuous Subjective Arousal | | | | | | | | | | | | | | | |
| | Asexual (n = 18) | | | | Heterosexual (n = 25) | | | | Gay (n = 21) | | | | | | |
| FF | 22.67 | 23.71 | 0 | 71.43 | 58.52 | 25.00 | 10.97 | 100 | 23.88 | 31.79 | 0 | 99.73 | 12.87 | < .001 | .30 |
| MM | 21.34 | 23.27 | 0 | 85.71 | 30.73 | 34.00 | 0 | 100 | 64.68 | 26.41 | 0 | 100 | 12.69 | < .001 ^c | .29 |
| FM | 28.45 | 28.10 | 0 | 100 | 60.34 | 26.91 | 14.29 | 100 | 31.76 | 30.51 | 0 | 99.73 | 8.59 | .001 | .22 |
| F | 17.39 | 23.10 | 0 | 85.71 | 39.58 | 31.64 | 0 | 99.73 | 23.33 | 30.09 | 0 | 99.73 | 3.48 | .037 | .10 |
| M | 14.07 | 16.59 | 0 | 57.14 | 11.41 | 20.43 | 0 | 91.76 | 60.19 | 27.08 | 8.98 | 99.73 | 33.38 | < .001 | .52 |
| Fant. | 47.96 | 36.88 | 0 | 100 | 62.35 | 27.51 | 24.93 | 100 | 46.41 | 27.69 | 0 | 92.75 | 1.12 | .336 | .05 |

Note. Stim. = Stimulus, FF = female-female film clip, MM = male-male film clip, FM = female-male film clip, F = female masturbation film clip, M = male masturbation film clip, Fant. = Fantasy, Min. = minimum, Max. = maximum. Mean, minimum, and maximum indicate the difference in genital arousal between each stimulus and the mean of the neutral film in mm. For example, in the mean column, this is the difference between average genital arousal for each stimulus and average arousal to the neutral film. Note that the number of participants in each group are smaller for sexual fantasy. Two-tailed p -values are shown.

Degrees of freedom for genital arousal for the film clips (FF, MM, FM, F, and M): 2, 64; for genital arousal for fantasy: 2, 43; for continuous subjective arousal for the film clips: 2, 61; and for continuous subjective arousal for fantasy: 2, 41.

^aA significant Levene's test ($p = .009$) warrants reporting of the robust tests of equality of means via the Welch test statistic (2, 40.59) = 10.60, $p < .001$, and the Brown-Forsythe test statistic (2, 58.24) = 12.45, $p < .001$.

^bA significant Levene's test ($p = .005$) warrants reporting of the robust tests of equality of means via the Welch test statistic (2, 40.19) = 7.73, $p = .001$, and the Brown-Forsythe test statistic (2, 57.56) = 9.05, $p < .001$.

^cA significant Levene's test ($p = .035$) warrants reporting of the robust tests of equality of means via the Welch test statistic (2, 40.52) = 15.60, $p < .001$, and the Brown-Forsythe test statistic (2, 60.16) = 13.55, $p < .001$.

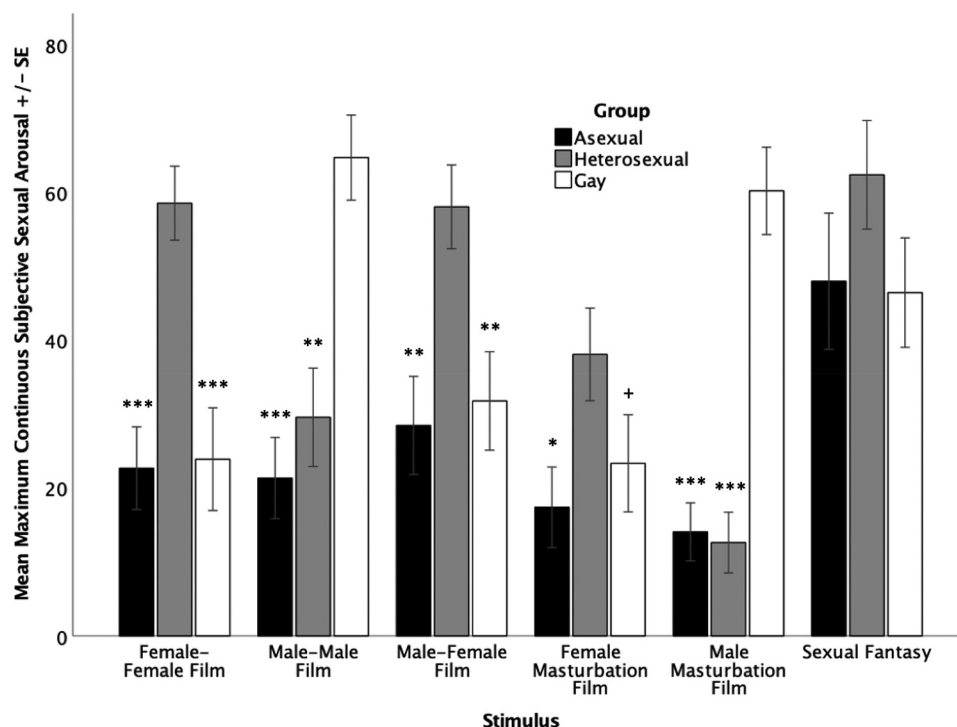


Figure 2. Maximum continuous subjective sexual arousal response (potential range 0–100), to erotic stimuli by orientation group. Note that the first five sets of bars are in response to audio-visual erotica, and the final set of bars is in response to sexual fantasy. Error bars indicate ± 1 standard error, * $p < .05$, ** $p < .01$, *** $p < .001$, + $p = .063$. Asterisks reflect group differences between the group indicated and the group with the highest subjective arousal for that film type.

and heterosexual men ($p < .001$, $d = 2.06$), with no significant difference between asexual and heterosexual men ($p = .696$, $d = 0.14$).

MCSSA was analyzed separately for sexual fantasy for 16 asexual, 14 heterosexual, and 14 gay men (corresponding to the same set of participants who had genital arousal fantasy data, although not all of these had usable MCSSA data). There was no significant difference in MCSSA between groups for the sexual fantasy, with all groups experiencing a statistically similar level of MCSSA while engaging in sexual fantasy. Thus, pairwise comparisons were not performed (Figure 2). Descriptive statistics and results of the omnibus test are shown in Table 4.

Discrete Self-reported Sexual Arousal to Sexual Fantasy

Data from 17 asexual, 15 heterosexual, and 14 gay participants (corresponding to the participants who had genital arousal fantasy data) were analyzed. We found a significant main effect of change in Film Scale scores on four of the six self-report subscales: perceived physical sexual arousal, sensuality-sexuality, positive affect, and autonomic arousal, such that scores on these subscales significantly increased after engaging in sexual fantasy for each group (Table 5). There was also a significant main effect of group for sensuality-sexuality and autonomic arousal.¹¹ Gay men had greater scores than asexual men for sensuality-sexuality ($p = .002$, $d = 1.07$), but there were no significant differences between the groups for autonomic arousal ($ps > .066$). There was no significant interaction between change in Film Scale scores and group

for these four subscales (Table 5). There were no significant main effects of change in negative affect scores or group and there was no significant interaction.

There were no significant main effects of change in anxiety scores or group, but there was a significant interaction. To follow-up the interaction, repeated-measures ANOVAs were conducted within each group, examining change in anxiety scores. None of the repeated-measures ANOVAs were significant (within asexual men, $F(1,16) = 1.66$, $p = .216$, $\eta^2 = .09$; within heterosexual men, $F(1,14) = 1.31$, $p = .271$, $\eta^2 = .09$; within gay men, $F(1,13) = 2.60$, $p = .131$, $\eta^2 = .17$). Thus, one-way ANOVAs for anxiety scores before and after fantasy were also conducted to examine group differences in these measures, but these were also not significant (before fantasy, $F(2,43) = 1.54$, $p = .227$, $\eta^2 = .07$; after fantasy, $F(2,43) = 0.66$, $p = .523$, $\eta^2 = .03$).¹²

Genital Sexual Arousal Controlling for Sexual Inhibition and Sexual Excitation

Controlling for SE and both domains of SI, a MANCOVA was conducted on data from 19 asexual, 26 heterosexual, and 21 gay participants. This analysis still showed a significant multivariate main effect of group on

¹¹LSD pairwise comparisons were conducted for sensuality-sexuality. Games-Howell pairwise comparisons were conducted for subjective sexual arousal and autonomic arousal due to a significant Levene's test.

¹²A significant Levene's test for anxiety before fantasy ($p = .005$) warrants reporting of the robust tests of equality of means via the Welch test statistic (2, 27.82) = 1.44, $p = .255$, and the Brown-Forsythe test statistic (2, 28.08) = 1.71, $p = .200$.

Table 5. Discrete self-reported subjective sexual arousal to fantasy as measured by the Film Scale, among asexual, heterosexual, and gay male participants.

| | Sexual arousal subscales | | | | Affect subscales | | | | Autonomic arousal subscale | | | | | | |
|---------------------------------|-----------------------------------|-----------------------|----------------------------------|-----------|------------------|------------|-----------------|-----------|----------------------------|-----------|-----------------------|------------|----------|-----------------------|------------|
| | Perceived physical sexual arousal | | Sensuality/ sexual attraction | | Positive affect | | Negative affect | | Anxiety | | Autonomic arousal | | | | |
| | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | | | |
| Descriptive statistics | | | | | | | | | | | | | | | |
| Asexual (<i>n</i> = 17) | | | | | | | | | | | | | | | |
| Pre | 1.29 | 0.41 | 1.35 | 0.39 | 1.75 | 0.70 | 1.69 | 0.76 | 2.06 | 1.64 | 1.36 | 0.38 | | | |
| Post | 2.67 | 1.69 | 2.03 | 1.41 | 2.62 | 1.41 | 1.65 | 0.75 | 1.82 | 1.51 | 2.14 | 1.03 | | | |
| Heterosexual (<i>n</i> = 15) | | | | | | | | | | | | | | | |
| Pre | 1.53 | 0.54 | 1.82 | 0.75 | 1.92 | 0.80 | 1.39 | 0.49 | 1.60 | 0.74 | 1.71 | 1.11 | | | |
| Post | 2.84 | 1.56 | 2.47 | 1.14 | 2.55 | 1.21 | 1.41 | 0.38 | 1.40 | 0.74 | 2.59 | 1.02 | | | |
| Gay (<i>n</i> = 14) | | | | | | | | | | | | | | | |
| Pre | 2.23 | 1.21 | 2.39 | 0.97 | 2.56 | 1.04 | 1.50 | 0.46 | 1.36 | 0.63 | 2.23 | 1.23 | | | |
| Post | 3.36 | 1.85 | 3.42 | 1.77 | 3.44 | 1.64 | 1.59 | 0.54 | 1.86 | 1.23 | 3.23 | 1.80 | | | |
| Repeated measures ANOVA results | | | | | | | | | | | | | | | |
| | <i>F</i> | <i>p</i> ^a | η_p^2 | <i>F</i> | <i>p</i> | η_p^2 | <i>F</i> | <i>p</i> | η_p^2 | <i>F</i> | <i>p</i> ^a | η_p^2 | <i>F</i> | <i>p</i> ^a | η_p^2 |
| ME Δ | 32.55 | < .001 | .43 | 24.14 | < .001 | .36 | 20.12 | < .001 | .32 | 0.16 | .695 | .00 | 0.03 | .869 | .00 |
| ME G | 2.26 | .116 | .10 | 5.51 | .007 | .20 | 3.01 | .060 | .12 | 0.95 | .395 | .04 | 0.71 | .496 | .03 |
| INT | 0.11 | .898 | .01 | 0.56 | .577 | .03 | 0.22 | .802 | .01 | 0.49 | .617 | .02 | 3.29 | .047 | .13 |

Note. Degrees of freedom for ME Δ (main effect of the change in film scale score) are 1, 48; for ME G (main effect of group) they are 2, 43; and for INT (interaction between change in film scale score and group) they are 2, 48. Absolute scale range for all subscales is 1–7.

^aSignificant Levene's test, but corrections are not provided for the omnibus effects.

maximum genital arousal $F(10,114) = 3.71$, Pillai's Trace = 0.49, $p < .001$, $\eta_p^2 = .25$. The multivariate effects were not significant for SES, $F(5,56) = 1.08$, Pillai's Trace = 0.09, $p = .379$, $\eta_p^2 = .09$, SIS-1, $F(5,56) = 0.67$, Pillai's Trace = 0.06, $p = .649$, $\eta_p^2 = .06$, or SIS-2, $F(5,56) = 0.32$, Pillai's Trace = 0.03, $p = .897$, $\eta_p^2 = .03$.

Univariate ANOVAs and pairwise comparisons¹³ revealed significant group differences for each of the erotic films: female-female film clip, $F(2,60) = 9.92$, $p < .001$, $\eta_p^2 = .25$ with heterosexual men showing significantly greater MGA than gay men ($p < .001$, $d = 1.22$), but not asexual men ($p = .757$, $d = 0.40$); male-male film clip, $F(2,60) = 4.02$, $p = .023$, $\eta_p^2 = .12$, with gay men showing significantly greater MGA than heterosexual men ($p = .007$, $d = 0.77$), but not asexual men ($p = .097$, $d = 0.61$); female-male film clip, $F(2,60) = 3.53$, $p = .036$, $\eta_p^2 = .11$, with heterosexual men showing significantly greater MGA than gay men ($p = .011$, $d = 0.73$), but not asexual men ($p = .351$, $d = 0.33$); female masturbation film clip, $F(2,60) = 6.80$, $p = .002$, $\eta_p^2 = .19$, with heterosexual men showing significantly greater MGA than gay men ($p = .002$, $d = 1.01$), but not asexual men ($p = .787$, $d = 0.39$); and male masturbation film clip, $F(2,60) = 5.26$, $p = .008$, $\eta_p^2 = .15$, with gay men showing significantly greater MGA than heterosexual men ($p = .006$, $d = 0.79$) and asexual men ($p = .011$, $d = 0.95$). All other comparisons were not significant ($ps > .191$). Thus, controlling for SE and SI, most of the previous differences between asexual participants and gay or heterosexual men who watched a clip of a preferred target were no longer

significant. Across three MANCOVAs with each of the three variables included individually we found that the SE variable was responsible for the lack of difference between asexual men and heterosexual or gay men (that viewed a clip of their preferred target) because the lack of difference generally held with SE, but not with the two SI variables. Exceptions are the male masturbation clip (gay men were still significantly higher than asexual men for all SE and SI variables) and the female masturbation clip (the difference between heterosexual and asexual men was not significant for both SES and SIS-1) (see Table 6).

A univariate ANCOVA on MGA in response to sexual fantasy controlling for SE and both domains of SI showed there were still no significant differences between groups, $F(2,39) = 2.06$, $p = .141$, $\eta_p^2 = .10$. This result was also evident in separate ANCOVAs with each of these variables included individually (SES, $F(2,41) = 0.91$, $p = .412$, $\eta_p^2 = .04$; SIS-1, $F(2,41) = 1.14$, $p = .331$, $\eta_p^2 = .05$; SIS-2, $F(2,41) = 1.67$, $p = .201$, $\eta_p^2 = .08$).

Discussion

Overview of Findings

We found that heterosexual (ds ranged from 0.67 to 0.95 for genital, 0.78 to 1.46 for subjective) and gay (ds are 0.94 and 1.11 for genital, 1.73 and 2.02 for subjective) men showed higher genital and subjective sexual arousal to their preferred erotic film clips than asexual men to any of the film content. Asexual men did not significantly differ from gay or heterosexual men's genital and subjective arousal when viewing non-preferred erotic film clips (ds ranged from 0.08 to 0.31 for genital, 0.04 to 0.31 for subjective) (supportive of Hypothesis 1). Asexual men did not differ significantly from sexual men in genital ($\eta^2 = 0.05$) or

¹³LSD pairwise comparisons were conducted for the male-male, male-female, and male masturbation film clips. Bonferroni pairwise comparisons were conducted for the female-female and female masturbation film clips due to a significant Levene's test.

Table 6. Results of three MANCOVAs on genital sexual arousal controlling for sexual excitation and sexual inhibition.

| Multivariate Effect | | | Univariate Effect | | | | | | | | | | | |
|---------------------|----------|--------------------|-------------------|-------|------------------|---------------------|----------|----------|-----------------------|----------|-----------|------------|----------|------|
| MANCOVA | <i>F</i> | <i>p</i> | η^2 | Stim. | <i>F</i> | <i>p</i> | η^2 | Stim. | <i>p</i> | <i>d</i> | Stim. | <i>p</i> | <i>d</i> | |
| MANCOVA 1 | SES | $F(5,58) = 1.09$ | .378 | .09 | FF | $F(2,62) = 11.13^a$ | < .001 | .26 | Het.-Gay ^b | < .001 | 1.29 | Het.-Asex. | .544 | 0.46 |
| | | PT = 0.09 | | | MM | $F(2,62) = 4.00$ | .023 | .11 | Het.-Gay | .007 | 0.77 | Gay-Asex. | .108 | 0.59 |
| | Grp. | $F(10,118) = 4.10$ | < .001 | .26 | MF | $F(2,62) = 3.96$ | .024 | .11 | Het.-Gay | .007 | 0.77 | Het.-Asex. | .370 | 0.31 |
| | | PT = 0.52 | | | F | $F(2,62) = 7.68^a$ | .001 | .20 | Het.-Gay | .001 | 1.07 | Het.-Asex. | .617 | 0.44 |
| | | | | M | $F(2,62) = 5.87$ | .005 | .16 | Het.-Gay | .003 | 0.84 | Gay-Asex. | .007 | 1.00 | |
| MANCOVA 2 | | | | | | | | | | | | | | |
| MANCOVA 2 | SIS-1 | $F(5,58) = 0.52$ | .758 | .04 | FF | $F(2,62) = 10.18^a$ | < .001 | .25 | Het.-Gay ^c | < .001 | 1.25 | Het.-Asex. | .030 | 0.86 |
| | | PT = 0.04 | | | MM | $F(2,62) = 5.44$ | .007 | .15 | Het.-Gay | .005 | 0.83 | Gay-Asex. | .009 | 0.90 |
| | Grp. | $F(10,118) = 3.91$ | < .001 | .25 | MF | $F(2,62) = 4.11$ | .021 | .12 | Het.-Gay | .010 | 0.75 | Het.-Asex. | .047 | 0.66 |
| | | PT = 0.50 | | | F | $F(2,62) = 7.34^a$ | .001 | .19 | Het.-Gay | .002 | 1.05 | Het.-Asex. | .058 | 0.77 |
| | | | | M | $F(2,62) = 6.24$ | .003 | .17 | Het.-Gay | .004 | 0.86 | Gay-Asex. | .004 | 1.00 | |
| MANCOVA 3 | | | | | | | | | | | | | | |
| MANCOVA 3 | SIS-2 | $F(5,58) = 0.20$ | .960 | .02 | FF | $F(2,62) = 9.46^a$ | < .001 | .23 | Het.-Gay ^d | < .001 | 1.22 | Het.-Asex. | .011 | 0.94 |
| | | PT = 0.02 | | | MM | $F(2,62) = 5.63$ | .006 | .15 | Het.-Gay | .005 | 0.85 | Gay-Asex. | .006 | 0.90 |
| | Grp. | $F(10,118) = 4.22$ | < .001 | .26 | MF | $F(2,62) = 3.71$ | .030 | .11 | Het.-Gay | .013 | 0.75 | Het.-Asex. | .049 | 0.63 |
| | | PT = 0.53 | | | F | $F(2,62) = 6.83^a$ | .002 | .18 | Het.-Gay | .003 | 1.03 | Het.-Asex. | .030 | 0.83 |
| | | | | M | $F(2,62) = 7.08$ | .002 | .19 | Het.-Gay | .005 | 0.86 | Gay-Asex. | .001 | 1.09 | |

Note. *n* = 19 asexual men, *n* = 26 heterosexual men, *n* = 21 gay men.

Stim. = stimulus, Grp. = group, PT = Pillai's trace, SES = sexual excitation, SIS-1 = sexual inhibition due to the threat of performance failure, SIS-2 = sexual inhibition due to the threat of performance consequences, FF = female-female film clip, MM = male-male film clip, FM = female-male film clip, F = female masturbation film clip, M = male masturbation film clip, Het. = heterosexual, Asex. = asexual.

^aSignificant Levene's test.

^bAll other comparisons were not significant, *ps* > .181.

^cAll other comparisons were not significant, *ps* > .571.

^dAll other comparisons were not significant, *ps* > .456.

subjective ($\eta^2 = 0.07$) arousal when they could choose their own fantasy content (supportive of Hypothesis 2). Contrary to our prediction, asexual men scored higher than heterosexual men and marginally higher than gay men on a measure of SI due to the threat of performance consequences and significantly higher than both gay and heterosexual men on SI due to the threat of performance failure. Supportive of Hypothesis 3, asexual men scored lower on a measure of SE than both heterosexual and gay men. SE was found to influence differences in genital arousal between asexual and sexual men to their preferred erotic film stimuli (further supportive of Hypothesis 3). Last, we found that asexual men were less likely to masturbate than gay men (but not heterosexual men) and had lower scores on orgasmic functioning than heterosexual men (but not gay men). Compared to sexual men, asexual men were less likely to engage in sexual activity, had less sexual desire, and had more sexual aversion. They did not differ in overall sexual satisfaction (generally supportive of Hypothesis 4).

Overall, asexual men displayed lower genital and subjective sexual arousal compared to sexual men viewing preferred erotic film clips, with lower SE in asexual men influencing the difference in genital arousal. This indicates that it is lower SE (and not higher SI) that influences asexual men's reduced sexual arousal to erotic films of people engaging in sexual activity. However, when engaging in sexual fantasy, genital and subjective sexual arousal of asexual men did not differ from sexual men, in that all men experienced similar levels of sexual arousal to sexual fantasy. Neither SE nor SI impacted the genital arousal to fantasy. These findings support the notion that the capacity for sexual arousal in asexual men is no different than sexual men.

Genital and Subjective Arousal to Erotic Films

Penile plethysmography has been used as a reliable tool to discriminate between sexual orientations (Chivers et al., 2010; Freund, 1963), and sexual arousal in response to preferred targets is dependably shown to be a strong indicator of sexual attraction and orientation. Within our sample, sexual participants showed higher average sexual arousal, both genital and subjective, to their preferred film stimulus compared to asexual men. Asexual men in this study, who we characterized by lack of sexual attraction to others, experienced lower than average genital and subjective arousal across film categories, corresponding to their lack of interest in the content of these films. In other words, asexual men did not significantly differ from gay and heterosexual men when these sexual men viewed clips showing their non-preferred sex (e.g., gay men viewing female masturbation clips). Some have speculated that asexual individuals are sexually attracted to others but may be masking or denying those attractions (for various reasons; see Brotto & Yule, 2017). Instead, our findings suggest that the films did not elicit a sexual response in asexual men *because* of the lack of sexual attraction to the actors in the videos.

Genital and Subjective Arousal to Sexual Fantasy

Some asexual individuals engage in sexual fantasy, which may indicate some sexual interest among asexual individuals (Yule et al., 2014b, 2017b). It has been suggested that this sexual interest is not directed toward anyone or anything, aside from themselves; alternatively, it may involve a disconnection between asexual people's sense of sexual "self" and others even if other people are included in their fantasies (Bogaert, 2012a, 2012b).

When given the opportunity to engage in sexual fantasy, men in the current study were able to focus on whatever they found to be most sexually arousing. A small proportion of asexual participants ($n = 2$; 4.3%), and none of the sexual participants, stated that they fantasized about “nothing,” and one asexual, one gay, and one heterosexual participant (6.5%) described being distracted while engaging in fantasy. Despite this, all three groups displayed some level of sexual arousal, both genital and continuous subjective arousal, in response to engaging in sexual fantasy, and there was no significant difference in magnitude of sexual arousal between groups. This provides further evidence of category specificity in the patterns of asexual men’s sexual arousal. Asexual men in our study were capable of genital and subjective arousal when given the opportunity to engage with content that was preferred to them, likely because it had the greatest effect on eliciting a high level of arousal (and probability of orgasm).

Furthermore, all men, including asexual men, showed a significant increase on discrete measures of subjective sexual arousal, including self-reported physical sexual arousal, autonomic arousal, and sensuality/sexual attraction with sexual fantasy. Additionally, positive affect increased for all groups, whereas negative affect and anxiety were not affected by sexual fantasy for all groups of men. This suggests that asexual men can experience subjective sexual arousal in a controlled context to a sexual stimulus of their choosing, as has been shown with asexual women (Brotto & Yule, 2011). The information processing model of sexual arousal suggests that a stimulus must be appraised as being sexually relevant and attended to appropriately for sexual arousal (genital or subjective) to occur (Rosen & Beck, 1988). Our findings suggest that the cognitive and attentional pathways that are crucial for sexual responding are intact in asexual men. It follows that any stated apathy toward traditional sexual stimuli or activity is not due to faulty cognitive or attentive processes, but perhaps due to genuine disinterest in that stimuli.

Impact of Sexual Excitation and Sexual Inhibition on Genital Arousal

The Dual Control Model (Bancroft & Janssen, 2000) posits that sexual response involves an interaction between sexual excitatory and sexual inhibitory processes. Individuals are predisposed to have varying levels of both SE and SI and propensities for low SE and/or high SI are associated with sexual response difficulties, including erectile difficulty (Bancroft et al., 2009; Janssen et al., 2002). Our findings of lower SE and higher SI in asexual participants compared to other groups differs from Prause and Graham’s findings (Prause & Graham, 2007) that asexual individuals experienced lower SE but similar levels of SI, and the reason for this discrepancy in findings is not clear.

We found that asexual participants’ relatively lower SE (but not their higher SI) may be driving their lower levels of genital arousal to clips of sexual men’s preferred stimuli compared to these groups. However, despite their lower SE they were able to become genitally aroused to a fantasy of their choosing, although this arousal was expectedly somewhat (but not significantly) lower than gay and heterosexual men. Based on the Dual Control Model, we interpret this to mean that asexual individuals’ propensity toward lower SE could be an important

factor in their general disinterest in engaging in viewing certain stimuli that tend to be preferred by men of other sexual orientations and in sexual activity with others. Thus, the lack of sexual interest experienced in asexuality is not the result of dysfunction of the genital arousal system, but likely the result of a lower level in SE, which is a natural variation of human sexuality.

Differences in Sexual Function and Behavior

Finally, asexual men displayed some differences in scores on measures of sexual function and behavior compared to sexual men. Specifically, asexual men were less likely to masturbate, engage in sexual activity, had lower scores on orgasmic function, lower scores on sexual desire, and higher scores on sexual aversion compared to sexual men, replicating findings of previous research (Brotto et al., 2010; Yule et al., 2017a). However, asexual men did not differ from sexual men in scores on overall sexual satisfaction. Given evidence for sexual arousal and satisfaction, it is possible that these other domains of reduced sexual activity and response may pertain more to a lack of sexual attraction, and not be indicative of a sexual dysfunction, per se.

Limitations

Asexual participants in this study were a heterogeneous group in terms of the variations of asexual identity and it was not possible to examine sub-groups of asexual participants based on identity due to small sample size. Further, our asexual sample may not be representative, given that our participants agreed to view erotic stimuli and engage in sexual fantasy in the lab. Because asexuality is defined as a lack of sexual attraction, there may be discomfort in any experimental procedure that involves presentation of undesired stimuli, particularly when genital response is being measured. Future studies should employ psychophysiological measures that do not rely on invasive measurements of genital responding, such as eye-tracking, which has been recently examined in asexual women (Brown et al., 2021) or neuroimaging. This would also allow for inclusion of transgender or non-binary asexual individuals in future research. Indeed, all participants in our study were cisgender and this poses a limitation to the generalizability of the study.

Trans and non-binary genders have been observed to be more prevalent in asexual people, with up to 24.6% of asexual individuals reporting a gender other than what they were assigned at birth (Brotto et al., 2010; Gazzola & Morrison, 2012; Ginoza et al., 2014). The self-reported and genital arousal responses among transgender asexual individuals may be different from cisgender individuals. Because of the equipment involved in assessing genital sexual response, we were only able to recruit cisgender men with a phallus for this study. Because of differences in genital arousal patterns from gay and heterosexual men, we did not include bisexual men in this study, and it will be important to do so in future replication studies. Similar to the challenges inherent with a small sample of asexual participants, we recruited only small samples of gay and heterosexual men, limiting representativeness.

Another limitation relates to the use of erotic stimuli featuring men and women engaging in sexual activity only. Showing a wider variety of sexual stimuli (e.g., sexual stimuli that contain romantic contexts) may elicit greater genital and subjective responses and indicate potential sexual attraction to other stimuli. Furthermore, any deviations in patterns were in instances involving the masturbation clips (e.g., the difference in subjective sexual arousal between gay men and heterosexual men for the female masturbation clip was only marginally significant). Other research has suggested that masturbation clips do not always lead to the greatest arousal (e.g., Chivers et al., 2007), which may have impacted our results. More participants declined to participate in sexual fantasy at the BU site, owing, we believe, to having to come back to participate in sexual fantasy at the BU location, whereas at UBC, sexual fantasy was always completed on the same day as watching the clips. This led to a smaller sample size of participants who participated in both parts of the study, although site was not identified as a potential covariate in our analyses. Finally, we did not include measures to fully assess sexual desire, erectile function, and distress and this would be an area to explore in more detail in future research.

Conclusion

Overall, compared with gay and heterosexual men, asexual men demonstrated lower genital arousal response to erotic films, but had similar levels of genital arousal when engaging in sexual fantasy. This suggests that asexual men's genital responses to erotic films confirm previously observed patterns, as they did not display genital arousal to imagery they were not sexually attracted to. Asexual men scored lower on SE which underpinned their lowered genital arousal to the preferred stimuli of gay men and heterosexual men. These results suggest that asexual men should be viewed as a unique group differing from men with traditionally defined sexual orientations (i.e., gay and heterosexual men) because they do not evince high arousal to sexual stimuli featuring either same-sex or other-sex actors. This is consistent with the notion that asexual men lack sexual attraction to others. Asexual men may have some sexual interest in the content of their sexual fantasies, but this interest is not necessarily directed outwardly. Thus, asexual men may be more similar to sexual men in terms of fantasy-based arousal than they are in regard to erotic-film based arousal and interest in engaging in sexual activities, further suggesting that asexuality is not due to low responsivity of sexual arousal.

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Disclosure Statement

No potential conflict of interest was reported by the authors.

Author Contributions

Drs. Yule and Brotto developed the study concept and design. Testing, data collection, and data analysis were performed by Drs. Yule and Skorska. All authors were involved in data interpretation. Dr. Yule drafted the initial manuscript and Dr. Skorska drafted the revised manuscript, under the supervision of Drs. Brotto and Bogaert. All authors approved the final version of the manuscript for submission.

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