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Journal of Sex & Marital Therapy

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/usmt20

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To cite this article: Shari M. Blumenstock, Kelly Suschinsky, Lori A. Brotto & Meredith L. Chivers (26 Oct 2023): Sexual Desire Emerges from Subjective Sexual Arousal, but the Connection Depends on Desire Type and Relationship Satisfaction, Journal of Sex & Marital Therapy, DOI: 10.1080/0092623X.2023.2272719

To link to this article: https://doi.org/10.1080/0092623X.2023.2272719

JOURNAL OF SEX & MARITAL THERAPY
https://doi.org/10.1080/0092623X.2023.2272719

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RESEARCH ARTICLE

Sexual Desire Emerges from Subjective Sexual Arousal, but the Connection Depends on Desire Type and Relationship Satisfaction

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ABSTRACT

According to models of responsive sexual desire, desire emerges from sexual arousal. This study examined how sexual desire type (dyadic-partner, dyadic-other, solitary) and relationship satisfaction affect the connection between subjective sexual arousal (SSA) and desire. Women ($N = 100$; 27% with sexual interest/arousal disorder symptoms) reported SSA while viewing a sexual film. Solitary and dyadic responsive sexual desire were assessed immediately before and following the film (immediate desire) and three days later (delayed desire). SSA predicted higher immediate solitary desire. SSA also predicted higher immediate dyadic desire, and this link was stronger for those with higher relationship satisfaction; for those with low relationship satisfaction, SSA was unrelated. For delayed desire, SSA predicted higher dyadic-partner desire, regardless of relationship satisfaction. SSA also predicted higher dyadic-other desire, yet this association was stronger for those with low relationship satisfaction; for those with high relationship satisfaction, SSA was unrelated to dyadic-other desire. Findings support the theoretical premise that desire emerges from arousal, but that this connection is dependent upon additional factors, specifically the target and timing of desire and participants' current relationship quality. Relationship satisfaction may affect the motivational value of sex with (and without) a current partner.

Subjective arousal triggers desire: theory and evidence

The Incentive Motivation Model (IMM; Toates, 2009) of sexual response posits that sexual desire emerges from sexual arousal (i.e., is responsive to sexual cues) and also depends on other relevant internal and external factors. The triggering of sexual motivation and resulting sexual approach behavior requires a multi-step process that involves: 1) exposure to a sexually relevant stimulus, 2) cognitive processes that evaluate the stimulus as sexual and instigate physiological and psychological arousal, 3) a resulting motivational state that encourages the person to seek a sexual target, and 4) cognitive processes that evaluate sexual targets and sexual approach behaviors as appropriate and likely to produce wanted outcomes (Ågmo & Laan, 2022; Toates, 2009). Similarly, Basson's circular model of sexual response (Basson, 2001) highlights the responsive nature of sexual desire, suggesting that the connection between arousal and desire is

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/0092623X.2023.2272719.

reciprocally reinforcing, a sequence that is preceded by the favorable processing of sexual stimuli. While other factors influence the connection between sexual arousal, desire and later sexual expression, these reciprocal links form a critical component of the model.

The notion of desire as responsive to sexual cues is increasingly being considered a relevant and useful theory, particularly in clinical contexts involving arousal and desire challenges (Brotto, 2010), yet the direct connection between arousal and desire—a key premise of the concept of responsive sexual desire—has not been firmly established. The literature includes very few direct empirical tests, which have produced mixed findings regarding the connection between states of sexual arousal and responsive sexual desire. In an online study of 226 participants randomly assigned to an arousal condition (sexual or neutral), sexual arousal levels positively predicted men's and women's post-stimulus desire for solitary and dyadic sexual activity (Goldey & van Anders, 2012). In a laboratory study of 47 psychology students who were shown a neutral or sexual film, those in the sexual film condition (~50%) reported higher sexual arousal as well as higher mean sexual activity in the following 24 h compared to the neutral film (mean frequency .95 vs .40), however no group differences in post-stimulus sexual desire were reported (Both, Spiering, Everaerd, & Laan, 2004). Additionally, sexual arousal was not tested as a predictor of sexual desire in this study, which limits the ability to draw conclusions about any direct connections. Additionally, indirect evidence that desire is responsive can be found in women's descriptions of their experiences. In in-depth interviews, women with and without arousal difficulties identified several stimuli that "triggered" their sexual desire (Brotto, Heiman, & Tolman, 2009), and desire has been described as preceding arousal among women in focus groups (Graham, Sanders, Milhausen, & Mcbride, 2004). However, despite the increasing theoretical and clinical importance of the arousal-desire link, data directly linking arousal and desire are limited.

Desire type

Another key aspect of the IMM is that the connection between a sexual cue, such as a sexual film, and the motivation to engage in sexual activity is determined by the central representation of the stimulus, or the rewards and meanings the individual has learned about the incentive (i.e., sex; Ågmo & Laan, 2022). Recent work on sexual desire has highlighted important conceptual and empirical differences regarding types of sexual desire (Blumenstock, 2023; Chadwick, Burke, Goldey, & van Anders, 2017; Mark, Toland, Rosenkrantz, Brown, & Hong, 2018; Moyano, Vallejo-Medina, & Sierra, 2017). The desire for sex could be the desire to behave sexually alone or by oneself (e.g., masturbation; solitary desire) or to engage in sexual activity with another person (i.e., dyadic desire). Women's most frequently cited reasons for engaging in solo masturbation involve experiencing sexual pleasure or release and orgasm is a common experience when masturbating alone (Carvalheira & Leal, 2013; Driemeyer, Janssen, Wiltfang, & Elmerstig, 2017). Thus, the target of solitary desire likely involves experiencing high amounts of sexual pleasure while alone.

When sex involves another person (i.e., during dyadic sex), sexual pleasure is a frequently-cited reason for engaging in dyadic sexual activity (Meston & Buss, 2007), though women are less likely to experience orgasm, particularly if that partner is a man (Frederick, John, St, Garcia, & Lloyd, 2018). Notably, when it comes to dyadic desire, there are several possible types of sexual partners, depending on the interpersonal relationship. Each interpersonal context has the potential for dramatic differences in the meanings and outcomes from sex with that person. For instance, the meanings and expected consequences evoked from sex with a current romantic partner are likely quite distinct from those evoked from sex with someone outside one's current romantic relationship. Women hold high expectations that sex with a romantic partner will be emotionally intimate (Blumenstock, 2022) and their most frequent motivations for engaging in sexual activity with a romantic partner involve emotional intimacy (Brotto et al., 2009; Mark,

Herbenick, Fortenberry, Sanders, & Reece, 2014). In one study comparing women's motivations for sex with casual versus committed partners (Armstrong & Reissing, 2015), emotional intimacy motivated very few casual sexual encounters, whereas pleasure and physical attraction comprised most of the frequently-cited motivations. For sex with a committed partner, both intimacy and pleasure/attraction were top motivators. However, orgasms are more likely for women with committed romantic partners versus casual partners (Armstrong, England, & Fogarty, 2012). Women may also hold varying attitudes toward the acceptability of sex with casual versus committed partners (Wells & Twenge, 2005), which can affect the meaning associated with each desire target. Thus, the target of dyadic sexual desire (i.e., desire for sex with another person in general) likely involves sexual pleasure and emotional intimacy, yet the specific targets of partner-focused desire versus other-focused desire may represent distinct meanings.

There is a growing body of empirical work supporting the notion that type of desire matters when trying to understand what influences desire, particularly when it comes to desire for sex with another person (i.e., dyadic desire). The Sexual Desire Inventory (SDI, Spector et al., 1996) is one of the most widely used measures of trait sexual desire, and its original psychometric evaluation resulted in two factors, dyadic and solitary desire. More recently, however, Moyano et al. (2017) used exploratory and confirmatory factor analyses in two samples of over 4,000 participants to show the importance of distinguishing desire for a partner from desire for attractive potential partners. Mark et al. (2018) used confirmatory factor analyses among a LGBTQ sample and reiterated that the three-factor scale significantly outperformed the original two-factor scale. Chadwick et al. (2017) also documented the importance of distinguishing between targets of desire, particularly with desire toward a stranger compared to a romantic partner, and the distinction depended upon current relationship factors—desire for a partner was characterized more by intimacy factors than desire for a stranger, but only for those currently in a relationship. Blumenstock (2023) further demonstrated the applied importance of desire target among young adults by documenting contrasting associations between desire and attachment avoidance when desire for an attractive stranger (positive association) was separated from desire for a partner (negative association). Thus, there are several targets of sexual desire that are theoretically and empirically distinct from one another, and these distinctions have important implications when investigating determinants of desire.

Relationship satisfaction

Romantic relationship factors such as dyadic adjustment and emotional intimacy have consistently been linked to women's sexual functioning and desire (Brotto, Bitzer, Laan, Leiblum, & Luria, 2010). Among 344 men and women with either other-sex or same-sex attractions (Peixoto & Nobre, 2016), adaptive relationship functioning was negatively associated with distressing sexual issues across gender and sexual identities. Using an experimental paradigm among young adult men and women, expectations of emotional closeness and pleasure both influenced sexual desire, but emotional closeness expectations had stronger effects on desire than pleasure expectations (Blumenstock, 2022). Expecting a lack of emotional intimacy (i.e., emotional distance) was the strongest deterrent to sexual desire—even stronger than expecting very little sexual pleasure or no orgasm. In a study designed to investigate the aspects of sex that men and women desire most (Mark et al., 2014), women's sexual desire most strongly stemmed from their desire for intimacy, emotional closeness, and love during sex, and these were closely followed by pleasing a partner. Furthermore, the romantic relationship is a common clinical target for women experiencing sexual arousal and desire difficulties (Aubin & Heiman, 2004; Goldstein, Meston, Davis, & Traish, 2005; Mestre-Bach, Blycker, & Potenza, 2022), and ruling out relationship discord is a critical component of diagnosing arousal and desire disorders (American Psychiatric Association, 2013; Brotto et al., 2010; Mestre-Bach et al., 2022).

The IMM (Toates, 2009) and the circular model of responsive desire (Basson, 2001) both emphasize that for sexual stimuli to trigger arousal, and in turn, motivation for specific sexual targets, the cue and the motivated sexual behavior must be evaluated as positive and rewarding. For women in monogamous romantic relationships, the process of arousal and desire is inherently situated within the context of their relationships. Basson (2001) explicitly highlights the importance of relationship factors, and states that the motivations behind women's sexual interest often span far beyond the experience of sexual release, and frequently include the desire to experience emotional intimacy and bonding with a partner through sexual connection. In a clinical sample of women with low desire, many cited partner-focused reasons that contributed to their low desire, with half specifically citing insufficient emotional intimacy (Basson, 2001). If the relationship is strained, sex with that partner may be less rewarding, and therefore the motivation for sex with that partner would be lower. Conversely, relational discord may make the idea of sex outside the relationship more appealing. Thus, relationship factors could moderate the relationship between activation of sexual motivation and its expression with a partner. Yet the role that romantic relationship satisfaction plays in the pathway between sexual arousal and responsive desire remains unknown.

Current study

The current study explored connections between laboratory-induced subjective sexual arousal and desire among women and whether those connections were shaped by relationship satisfaction and desire type (e.g., dyadic, other, solitary). Given some preliminary evidence that lab-produced desire extended beyond the lab to influence sexual behavior 24 h after (Both et al., 2004), we also assessed two different timelines of desire, specifically desire immediately following the sexual stimulus (immediate desire: solitary and dyadic) and over the next three days (delayed desire: dyadic-partner desire, dyadic-other desire, solitary desire). We focus on the subjective experience of sexual arousal, which is defined as encompassing the overall psychological evaluation of mental, emotional, and physical experiences in response to a sexual stimulus (Both & Laan 2008; Janssen & Prause, 2016) and represents a core component of Basson's circular model (2001).

We predicted that subjective sexual arousal would be positively associated with immediate and delayed sexual desire. We expected sexual desire type and relationship satisfaction to also play a role in these associations, with higher relationship satisfaction facilitating stronger connections between arousal and desire for a partner. Because being unsatisfied with a current romantic partner may increase interest in sexual partners outside the relationship (McAnulty & Brineman, 2007), we predicted that lower relationship satisfaction would be associated with stronger connections between arousal and desire for someone outside the relationship. Lastly, because solitary sexual activity does not involve a partner, we expected relationship satisfaction to be unrelated to the association between arousal and solitary desire.

Given the strong connection between relationship satisfaction and sexual satisfaction (e.g., Blumenstock, Quinn-Nilas, Milhausen, & McKay, 2020), it is possible any links between relationship satisfaction and sexual desire could be explained by satisfaction with the sexual aspect of the relationship, and not to the overall quality of the relationship. We therefore conducted the same analyses using sexual satisfaction instead of relationship satisfaction to assess the degree to which sexual satisfaction may be contributing to the results.

Thus, the current study contributes to theory by directly testing central assumptions of increasingly accepted theories regarding the responsive nature of desire, as outlined in the incentive motivation model (Toates, 2009) and the circular model of responsive desire (Basson, 2001). It also indirectly examines the speculation that different desire types represent different meanings and expectations depending on context, and therefore may be differently influenced by exposure to arousing sexual stimuli (Ågmo & Laan, 2022).

Methods

The data presented in the current study were pooled from two separate but related studies designed to examine the role of Sexual Interest/Arousal Disorder (SIAD) symptoms on sexual response. In both studies, women attended laboratory sessions and viewed sexual and nonsexual films while their genital and subjective sexual responses were assessed. Responsive sexual desire was assessed immediately following the films and three days later. The first study included vaginal photoplethysmography (VPP study) and the second study involved thermal imaging (TIL study) to assess genital arousal. All participants provided written informed consent when first visiting the lab and all procedures were approved by the first affiliated university's research ethics board.

Participants

Both studies recruited women currently in sexual or romantic relationships with men: 77 in the VPP study ($n = 16$ with SIAD symptoms) and 47 in the TIL study ($n = 14$ with SIAD symptoms). Participants were between 18 and 50 years of age (to reduce likelihood of participants being menopausal) and fluent in English. Exclusion criteria included current pregnancy or breastfeeding, endocrine or hormone disorder, tobacco use, major depressive episode or other debilitating psychiatric disorder, use of medications known to interfere with sexual response, trying to conceive, and pelvic/vulvar pain in the past 6 months. For the VPP study, participants were also required to have experienced vaginal penetration before (e.g., *via* sexual activity, tampon, pelvic examination).

Data from 1 TIL and 9 VPP participants were excluded due to poor data quality. Of the remaining participants, 10 TIL and 4 VPP participants were not in romantic relationships with men (e.g., single, casually dating multiple people, non-romantic sexual relationship). The final sample for the current analyses included 100 women ($n = 63$ VPP and 37 TIL; $n = 27$ with SIAD symptoms) in romantic relationships with men. The VPP participants were aged $M = 24.5$ years old ($SD = 7.2$, range 18-48) with average relationship length of $M = 35.0$ months ($SD = 47.2$; range 1-215) and the TIL participants were aged $M = 21.2$ years old ($SD = 4.2$, range 18-35) with average relationship length of $M = 31.3$ months ($SD = 43.0$; range 2-240). Additional participant characteristics are presented in Table 1.

Table 1. Demographic characteristics of the sample.

	VPP		TIL		Total	
Characteristic	N	%	N	%	N	%
Total N	63	100	37	100	100	100
SIAD status						
Non-SIAD	48	76.2	25	67.6	73	73.0
SIAD	15	23.8	12	32.4	27	27.0
Race/Ethnicity						
Asian	6	9.5	5	13.5	11	11.0
European	44	69.8	27	73.0	71	71.0
Other[a]	13	20.7	5	13.5	18	18.0
Relationship status						
Dating	52	82.0	34	91.9	87	87.0
Engaged	4	6.6	0	0.0	4	4.0
Married/Common-Law	7	11.4	3	8.1	10	10.0
Gender attraction						
Men only	38	60.3	23	62.2	61	61.0
Men mostly, but women occasionally too	21	33.3	12	32.4	33	33.0
Men mostly, but women frequently (but not more than toward men)	4	6.3	2	5.4	6	6.0

Note. TIL = Thermal imaging of the labia study group. SIAD = Sexual Interest/Arousal Disorder. VPP = vaginal photoplethysmograph study group.

[a]Other includes Hispanic, African, Middle-Eastern, or multiple identities.

Procedure

Participants from both sample groups completed eligibility screening over the phone.

VPP

Participants scheduled 4 total laboratory visits. The first included informed consent and a clinical interview, and the following three were testing sessions with identical procedures that varied only in the type of video viewed (heterosexual sexual activity, sexual activity among two men, and a neutral video). The current study includes only data from the heterosexual sexual activity sessions. Participants completed baseline questionnaires online the day prior to their laboratory visit. During the laboratory visits, participants completed additional questionnaires and were then shown to a private, dimly lit viewing room that locked from the inside. After the VPP was demonstrated by a trained lab technician, participants were left to undress and insert the VPP themselves. An intercom allowed the experimenter and participant to communicate throughout the session. During the session, participants were seated in a recliner and watched a ten-minute baseline video, followed by one of the three twelve-minute experimental videos. Participants completed self-report questions before and after each stimulus using a keypad. Self-reported arousal was assessed *via* keypad during the videos.

72 h following their testing session, participants completed a follow-up questionnaire online, which assessed their experiences of sexual desire, functioning, and behavior over the past three days (i.e., since their lab visit). Data collection occurred from 2015 to 2017.

TIL

Procedures for the TIL participants were the same as the VPP heterosexual sex testing sessions, with the following exceptions. First, participation included a single lab visit, during which all baseline questionnaires were completed (same questionnaires as the VPP participants). Second, while viewing the baseline and sexual stimuli videos, sexual arousal was assessed *via* a thermal imaging camera, which required participants to remain uncovered from their waist down. The sexual stimuli video was identical to that shown during the VPP session. Participants also completed the same follow-up questionnaires 72-h after their visit. Data collection occurred from 2017 to 2018.

Measures

Subjective sexual arousal

During the films, participants indicated their perceived sexual arousal using a virtual gauge manipulated with up or down buttons on a keypad. The possible range was 0 (Not at all sexually aroused) to 100 (Extremely sexually aroused, feelings experienced right before an orgasm). The participants' arousal score was averaged across the length of the video to obtain a single overall score for the stimulus (Chivers et al., 2014), creating a measure of the overall level or amount of sexual arousal experienced by the participant when exposed to the sexual cue.

Responsive sexual desire

In both studies, sexual desire was assessed at two time points: immediately following the films (immediate responsive desire) and three days later (delayed responsive desire). For immediate desire, participants completed items assessing dyadic desire ("How strong is your desire for sex with a partner?") and solitary desire ("How strong is your desire to masturbate?") with response scales from 0 to 9.

To assess delayed responsive desire, we used the Report of Behaviors and Feelings—Desire where participants were asked to indicate how frequently they had engaged in certain behaviors,

thoughts, or feelings in the past three days (i.e., since their laboratory visit) (Velten et al., 2020), with a response scale from 0 (Not at all) to 5 (5 times or more). Desire for and attraction to a current romantic partner (delayed dyadic-partner desire) included 3 items, e.g., fantasized about sex with a current partner. Desire for and attraction to non-partner others (delayed dyadic-other desire) included 6 items, such as fantasized about sex with a stranger or acquaintance. Desire to masturbate or behave sexually alone (delayed solitary desire) included 3 items assessing masturbation or use of erotica. Items were summed to where higher values indicated higher desire. (Cronbach's alpha = .908 for Partner Desire, .856 for Other Desire, and .606 for Solitary Desire).

Relationship satisfaction

Relationship satisfaction was assessed using the Relationship Assessment Scale (Hendrick, 1988), which includes 7 items about general aspects of the relationship with a response scale from 1 (e.g., Low satisfaction) to 5 (e.g., High satisfaction). Example items include "In general, how satisfied are you with your relationship?" and "How many problems are there in your relationship?". Items were summed, with two items reverse-scored, so that higher values indicated higher relationship satisfaction. Internal reliability in the current sample was good (Cronbach's alpha = .849).

Sexual Interest/Arousal Disorder (SIAD) status

Women were screened for SIAD symptoms *via* a 6-item tool developed by Lori Brotto (Brotto et al., 2021). Women were considered to have SIAD symptoms if they endorsed three of six criteria, each lasting at least six months, and sexual distress. The criteria include lack of interest in sexual activity and/or responsive desire, reduced initiating sex or being receptive to sexual advances, and reduced or absent erotic thoughts, sexual pleasure, or sexual sensations.

Gender attraction

A modified Kinsey Sexual Attraction scale was used to assess participants' sexual attractions based on the gender of those they are attracted to, using a scale of 0 (sexually attracted to men only) to 6 (sexually attracted to women only). Responses were coded as 1 = sexually attracted to men only and 0 = other responses.

Sexual satisfaction and baseline trait sexual desire

The Female Sexual Function Index (FSFI; Rosen et al., 2000) is a 19-item scale designed to assess several aspects of women's sexual functioning. Sexual satisfaction was assessed using the satisfaction subscale, which includes two items regarding how satisfied participants were with their sex lives in the past four weeks. Response scale ranged from 1 (Very dissatisfied) to 5 (Very satisfied). Items were summed so greater values indicated greater satisfaction. Internal reliability was high in the current sample (Cronbach's alpha = .926). The control variable for baseline trait desire was also assessed *via* the FSFI, using the desire subscale, which used two items to measure the frequency and degree of sexual desire or interest in the past 4 wk. Response scale ranged from 1 (Almost never or never; very low or none at all) to 5 (Almost always or always; very high). Internal reliability in the current sample was high (Cronbach's alpha = .906).

Data analysis

Though all relevant procedures for the current analyses were identical across study group, the samples were recruited for different procedures (VPP vs TIL), which introduces the possibility

of unexpected group differences. Preliminary analyses therefore tested for differences between study groups in the key variables.

For the primary analyses, linear regression models were used to predict the five different types of sexual desire (immediate dyadic, immediate solitary, delayed dyadic-partner, delayed dyadic-other, delayed solitary). All models accounted for age, relationship length, sexual attraction (exclusively men versus predominately men), study group (VPP vs TIL), and SIAD status. Relationship satisfaction was mean-centered.

We first ran the models assessing the main effects of subjective sexual arousal in predicting sexual desire. Next, we included an interaction term between subjective sexual arousal and relationship satisfaction. Lastly, we added an interaction term that included study group (TIL vs VPP) to assess if there were any differences between the two study groups.

We then added a baseline desire variable to all models to see if this altered results. For the two immediate desire outcome measures, this baseline desire measure was the pre-stimulus desire level. For the delayed desire outcome measures, the baseline desire measure was the desire subscale from the FSFI.

The analyses were also run with sexual satisfaction instead of relationship satisfaction to examine whether the associations were driven by the sexual aspect of the relationship or more general satisfaction with the relationship overall. Because the 3-way interaction with study group revealed unexpected significant differences, further analyses were conducted to further understand these findings, described in the Results section below.

Results

Descriptive statistics for key variables are presented in Table 2. The VPP women reported significantly lower immediate solitary desire than the TIL women. No other group differences were observed.

Does subjective sexual arousal predict sexual desire?

Initial linear regression results are presented in supplemental materials (Table S1). Across all desire types, subjective sexual arousal was a significant positive predictor of desire.

When controlling for pre-stimulus desire levels (Table 3), subjective sexual arousal remained a positive predictor of immediate solitary and immediate dyadic desire. When controlling for trait sexual desire, the significant association between subjective sexual arousal and delayed dyadic-partner desire remained, yet the associations with delayed dyadic-other desire and delayed solitary desire were no longer statistically significant.

The role of relationship quality

Initial linear regression results that assessed the moderating role of relationship satisfaction are presented in supplemental materials (Table S2). The interaction between subjective arousal and relationship satisfaction was not significant for any types of desire; subjective arousal continued to have a positive main effect on all types of desire. When including the desire control variables, the significant associations with subjective sexual arousal remained for immediate dyadic and solitary desire, but were no longer significant for delayed dyadic-other and delayed solitary desire (Table 4).

However, surprisingly, when the three-way interaction term that included study group was added, significant differences with relationship satisfaction emerged, dependent upon desire type and study group (Table S3); when controlling for baseline trait desire levels, the overall findings

Table 2. Descriptive statistics of key variables by sample.

Variable	VPP		TIL		Sample differences		
	M(SD)	Range	M(SD)	Range	*t*	*p*	*d*
Relationship satisfaction	29.0(5.1)	19-35	29.6(4.1)	20-35	−0.58	0.562	−0.123
Subjective sexual arousal	36.7(21.3)	0-91.8	36.3(19.7)	0-73.3	0.09	0.926	0.019
Immediate dyadic desire	4.4(1.8)	1-7	4.8(1.7)	1-7	−1.03	0.304	−0.214
Immediate solitary desire	3.0(1.9)	1-7	4.0(1.9)	0-7	−2.59	0.011	−0.537
Delayed partner desire	5.3(4.0)	0-15	6.0(4.8)	0-15	−0.79	0.434	−0.164
Delayed other desire	1.5(2.4)	0-9	2.2(4.3)	0-20	−1.03	0.308	−0.214
Delayed solitary desire	1.1(1.5)	0-6	1.4(2.4)	0-10	−0.74	0.460	−0.155
Trait desire	3.4(1.1)	1-5	3.2(1.4)	1-5	0.82	0.416	0.169
Sexual satisfaction	3.9(1.2)	1-5	3.8(1.3)	1-5	0.77	0.443	−0.002

d: Cohen's *d*; TIL: Thermal imaging of the labia; VPP: Vaginal photoplethysmography.
N = 63 VPP women and 37 TIL women.

remained the same (Table 5). Figure 1 presents the interactions. Specifically, for immediate dyadic desire, higher relationship satisfaction was associated with higher desire, but this was true only for the TIL group. Post-hoc simple slope analyses indicated that, for the TIL women, subjective arousal was associated with higher immediate dyadic desire for those with average relationship satisfaction (B = .04, p < .001) or high (+1 SD) relationship satisfaction (B = .08, p < .001). For those with lower (-1SD) relationship satisfaction, subjective arousal was unrelated to immediate dyadic desire (B = .00, p = .855). For the VPP women, subjective arousal was positively associated with immediate dyadic desire across all relationship satisfaction levels (ps < .001).

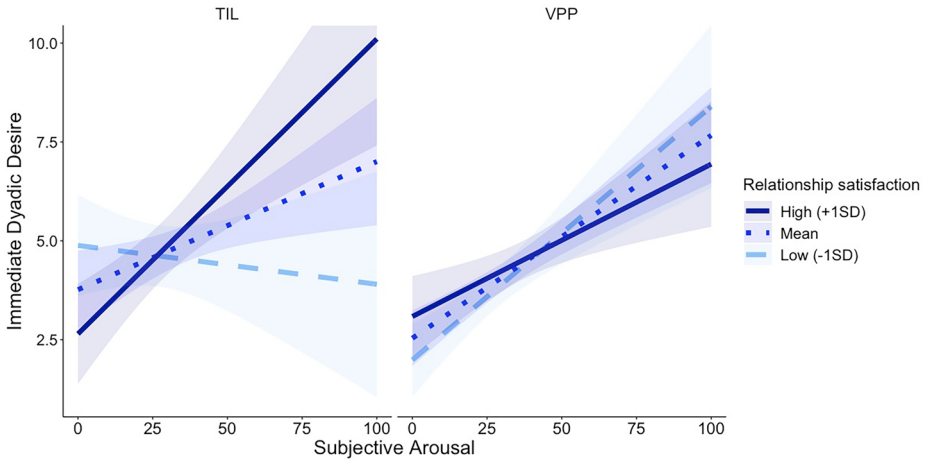

Figure 1. Three-way interaction between subjective sexual arousal, relationship satisfaction, and study group predicting immediate dyadic desire. Predicted values from linear regression models. Shaded areas represent 95% confidence intervals. TIL = Thermal imaging of the labia group (n = 37). VPP = Vaginal photoplethysmography group (n = 63).

For delayed dyadic-other desire, the three-way interaction itself was not statistically significant, but revealed significant two-way interactions (presented in Figure 2A). Specifically, relationship satisfaction was a negative moderator in that the association between subjective arousal and delayed dyadic-other desire was stronger for those in less satisfying relationships. Post-hoc simple slope analyses indicated that higher subjective arousal predicted higher delayed dyadic-other

Table 3. Linear regression results: main effects for subjective arousal predicting responsive sexual desire (with desire controls).

	Immediate Desire				Delayed Desire					
	Dyadic		Solitary		Partner		Other		Solitary	
Variable	B (SE)	*p*	B (SE)	*p*	B (SE)	*p*	B (SE)	*p*	B (SE)	*p*
Intercept	2.25(0.8)	.006	1.37(0.9)	.115	−0.62(2.6)	.809	−1.67(2.2)	.454	0.02(1.3)	.988
Age	0.01(0.0)	.875	0.04(0.0)	.300	−0.07(0.1)	.383	0.16(0.1)	.023	0.01(0.0)	.847
Relationship length	0.00(0.0)	.896	−0.01(0.0)	.152	0.01(0.0)	.255	−0.02(0.0)	.035	−0.01(0.0)	.183
Kinsey attraction	0.68(0.3)	.031	−0.07(0.3)	.845	0.33(0.8)	.671	−1.14(0.7)	.097	−1.09(0.4)	.009
SIAD status	−0.29(0.4)	.413	−0.25(0.4)	.515	−0.01(1.1)	.990	−0.60(0.9)	.526	0.45(0.6)	.428
Study group	−0.63(0.3)	.046	−1.25(0.3)	<.001	−1.01(0.8)	.188	−1.30(0.7)	.052	−0.37(0.4)	.355
Pre-stimulus dyadic desire	0.36(0.2)	.026	–	–	–	–	–	–	–	–
Pre-stimulus solitary desire	–	–	0.47(0.2)	.043	–	–	–	–	–	–
Baseline trait desire	–	–	–	–	1.57(0.3)	<.001	0.25(0.3)	.407	0.40(0.2)	.025
Subjective sexual arousal (SSA)	**0.05(0.0)**	**<.001**	**0.05(0.0)**	**<.001**	**0.04(0.0)**	**.028**	0.03(0.0)	.064	0.01(0.0)	.237
Relationship satisfaction (RelSat)	0.02(0.0)	.627	−0.04(0.0)	.242	0.06(0.1)	.432	**−0.19(0.1)**	**.008**	−0.05(0.0)	.214

Study group was coded as 1 = Vaginal photoplethysmography (VPP), 0 = Thermal imaging (TIL).
Bold font indicates significant focal associations at $p < .05$. $N = 63$ VPP women and 37 TIL women.

Table 4. Linear regression results: interactions with relationship satisfaction (with desire controls).

	Immediate Desire				Delayed Desire					
	Dyadic		Solitary		Partner		Other		Solitary	
Variable	B (SE)	*p*	B (SE)	*p*	B (SE)	*p*	B (SE)	*p*	B (SE)	*p*
Intercept	2.09(0.8)	.012	1.37(0.9)	.130	−0.21(2.6)	.937	−1.27(2.3)	.577	0.33(1.3)	.809
Age	0.01(0.0)	.704	0.04(0.0)	.314	−0.09(0.1)	.290	0.14(0.1)	.051	−0.01(0.0)	.900
Relationship length	0.00(0.0)	.963	−0.01(0.0)	.159	0.02(0.0)	.194	−0.02(0.0)	.067	−0.01(0.0)	.309
Kinsey Attraction	0.73(0.3)	.023	−0.06(0.4)	.854	0.23(0.8)	.774	−1.24(0.7)	.074	−1.17(0.4)	.006
SIAD status	−0.26(0.4)	.475	−0.25(0.4)	.522	−0.13(1.1)	.908	−0.72(1.0)	.457	0.37(0.6)	.521
Study group	−0.67(0.3)	.037	−1.25(0.3)	<.001	−0.91(0.8)	.240	−1.20(0.7)	.074	−0.29(0.4)	.462
Pre-stimulus dyadic desire	0.35(0.2)	.028	–	–	–	–	–	–	–	–
Pre-stimulus solitary desire	–	–	0.47(0.2)	.045	–	–	–	–	–	–
Baseline trait desire	–	–	–	–	1.56(0.3)	<.001	0.23(0.3)	.433	0.39(0.2)	.029
Subjective sexual arousal (SSA)	**0.05(0.0)**	**<.001**	**0.05(0.0)**	**<.001**	**0.04(0.0)**	**.022**	0.03(0.0)	.050	0.01(0.0)	.179
Relationship satisfaction (RelSat)	−0.03(0.1)	.624	−0.04(0.1)	.482	0.16(0.1)	.257	−0.10(0.1)	.418	0.02(0.1)	.810
SSA X RelSat	0.00(0.0)	.351	0.00(0.0)	.972	0.00(0.0)	.405	0.00(0.0)	.348	0.00(0.0)	.231

Study group was coded as 1 = Vaginal photoplethysmography (VPP), 0 = Thermal imaging (TIL). Bold font indicates significant focal associations (or main effects of significant interactions) at $p < .05$. $N = 63$ VPP women and 37 TIL women.

desire for those with average relationship satisfaction ($B = .04$, $p = .0192$) or low (-1SD) relationship satisfaction ($B = .06$, $p = .034$). For those with high relationship satisfaction, subjective arousal was unrelated to delayed dyadic-other desire ($B = .02$, $p = .388$).

For delayed solitary desire, including the 3-way interaction also revealed significant two-way interactions (presented in Figure 2B). The associations followed the same patterns as described for delayed other desire, such that the relationship between subjective arousal and delayed solitary desire was stronger for those in less satisfying relationships. The post-hoc simple slope analyses indicated that higher subjective arousal predicted higher delayed solitary desire for those with average or low relationship satisfaction ($B = .02$, $p = .045$ and $B = .04$, $p = .030$, respectively). For those with higher relationship satisfaction, subjective arousal was unrelated to delayed solitary desire ($B = .01$, $p = .788$).

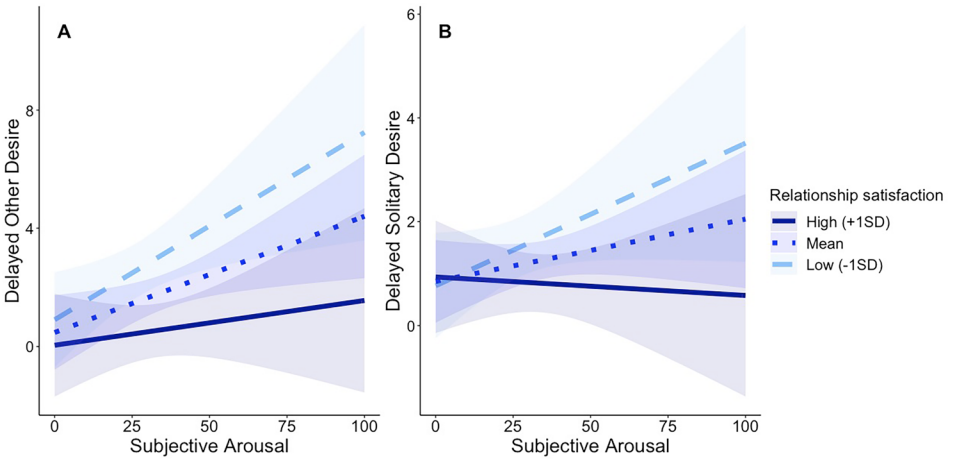

Figure 2. Two-way interaction between subjective sexual arousal and relationship satisfaction predicting A) delayed dyadic-other desire and B) delayed solitary desire. Predicted values from linear regression models. Shaded areas represent 95% confidence intervals. TIL = Thermal imaging of the labia group ($n = 37$). VPP = Vaginal photoplethysmography group ($n = 63$).

Table 5. Linear regression results: including the three-way interaction with group (with desire controls).

	Immediate Desire				Delayed Desire					
	Dyadic		Solitary		Partner		Other		Solitary	
Variable	B (SE)	*p*	B (SE)	*p*	B (SE)	*p*	B (SE)	*p*	B (SE)	*p*
Intercept	2.65(0.9)	.004	0.79(1.1)	.458	0.36(2.8)	.898	−2.39(2.3)	.310	0.13(1.4)	.927
Age	0.00(0.0)	.955	0.05(0.0)	.212	−0.10(0.1)	.252	0.18(0.1)	.015	0.00(0.0)	.937
Relationship length	0.00(0.0)	.628	−0.01(0.0)	.121	0.02(0.0)	.186	−0.02(0.0)	.027	−0.01(0.0)	.246
Kinsey Attraction	0.55(0.3)	.075	−0.04(0.4)	.914	0.23(0.8)	.777	−1.13(0.7)	.100	−1.12(0.4)	.009
SIAD status	−0.26(0.3)	.451	−0.25(0.4)	.521	−0.06(1.1)	.955	−0.79(0.9)	.401	0.36(0.6)	.527
Study group	**−1.26(0.6)**	**.038**	−0.62(0.7)	.373	−1.73(1.6)	.275	−0.15(1.3)	.908	−0.22(0.8)	.785
Pre-stimulus dyadic desire	0.45(0.2)	.005	–	–	–	–	–	–	–	–
Pre-stimulus solitary desire	–	–	0.45(0.2)	.063	–	–	–	–	–	–
Baseline trait desire	–	–	–	–	1.59(0.4)	<.001	0.19(0.3)	.513	0.39(0.2)	.033
Subjective sexual arousal (SSA)	**0.03(0.0)**	**.011**	**0.06(0.0)**	**<.001**	0.03(0.0)	.354	**0.05(0.0)**	**.045**	**0.02(0.0)**	**.340**
Relationship satisfaction (RelSat)	**−0.24(0.1)**	**.007**	−0.12(0.1)	.232	0.32(0.2)	.150	**−0.06(0.2)**	**.749**	**0.10(0.1)**	**.397**
SSA X RelSat	**0.01(0.0)**	**.004**	0.00(0.0)	.704	−0.01(0.0)	.328	**−0.01(0.0)**	**.033**	**−0.01(0.0)**	**.045**
SSA X Group	0.02(0.0)	.183	−0.02(0.0)	.298	0.02(0.0)	.573	−0.04(0.0)	.237	−0.01(0.0)	.774
RelSat X Group	**0.35(0.1)**	**.002**	0.13(0.1)	.331	−0.27(0.3)	.347	−0.04(0.2)	.870	−0.12(0.1)	.407
SSA X RelSat X Group	**−0.01(0.0)**	**.002**	0.00(0.0)	.621	0.01(0.0)	.502	0.01(0.0)	.079	0.01(0.0)	.119

Study group was coded as 1 = Vaginal photoplethysmography (VPP), 0 = Thermal imaging (TIL). Bold font indicates significant focal associations (or main effects of significant interactions) at $p < .05$. $N = 63$ VPP women and 37 TIL women.

For immediate solitary desire and delayed dyadic-partner desire, none of the included interactions were significant. Subjective sexual arousal remained a significant predictor of immediate solitary desire, but was no longer significant for delayed dyadic-partner desire.

The role of desire type

To assess whether the link between arousal and desire depended on desire type, we compared the findings across the five desire types. Summary of the main findings are presented in Table 6. There were clear differences in how arousal was related to the different types of desire.

Table 6. Summary of key associations by desire type.

	Immediate Desire		Delayed Desire		
Association	Dyadic	Solitary	Partner	Other	Solitary
Main effects models					
Subjective sexual arousal (SSA)	+	+	+	(+)	(+)
Standardized Beta	0.53***	0.49***	0.23	0.20	0.13
Relationship satisfaction (RelSat)	n.s.	n.s.	n.s.	–	n.s.
Standardized Beta	n.s.	n.s.	n.s.	−.27**	n.s.
Interaction models					
VPP					
SSA: Low RelStat	+	n.a.	n.a.	+	+
Simple slope	0.07***	n.a.	n.a.	0.06*	0.04*
SSA: High RelStat	+	n.a.	n.a.	n.s.	n.s.
Simple slope	0.05***	n.a.	n.a.	n.s.	n.s.
TIL					
SSA: Low RelStat	n.s.	n.a.	n.a.	+	+
Simple slope	n.s.	n.a.	n.a.	0.06*	0.04*
SSA: High RelStat	+	n.a.	n.a.	n.s.	n.s.
Simple slope	0.08***	n.a.	n.a.	n.s.	n.s.

Note. n.a. = not applicable because the interactions were not significant. n.s. = Not significant at $p<.05$. TIL = Thermal imaging of the labia group ($n=63$). VPP = Vaginal photoplethysmography group ($n=63$). Parentheses indicate main effect did not hold when accounting for baseline/trait desire.

*$p < .05$,
**$p < .10$,
***$p < .001$

Immediate solitary desire increased as subjective arousal increased, and this association was found regardless of relationship satisfaction. For immediate dyadic desire, the association depended upon relationship satisfaction and group. The VPP women indicated a positive association between subjective arousal and immediate delayed desire regardless of relationship satisfaction. Relationship satisfaction played a role in the connection between arousal and immediate dyadic desire, but not immediate solitary desire. Thus, the desire type that involved another person depended on how the women felt about her current relationship with her partner.

The only desire type to have a main effect with relationship satisfaction was delayed dyadic-other desire—lower relationship satisfaction predicted higher desire for someone other than a current partner.

For TIL women in unsatisfying relationships, subjective sexual arousal predicted higher delayed dyadic-other desire (i.e., for non-partner others), but did not predict delayed dyadic-partner desire (i.e., specifically for a current romantic partner).

Over the three days following exposure to the sexual stimuli, experiencing desire for sexual activity that does not involve a current partner (i.e., by oneself or with a non-partner) was positively predicted by subjective arousal, but only for those in low quality relationships. Desire for a current partner across those three days was unrelated to the women's experience of arousal during the study.

Ruling out sexual satisfaction

Analyses replacing relationship satisfaction with sexual satisfaction indicated no significant associations with sexual satisfaction. Results presented in supplemental materials.

Interrogating the Study Group Difference for Immediate Dyadic Desire

We examined whether the greater proportion of SIAD-affected women in the TIL group explained the differences, and this was not the case either. The SIAD women reported lower subjective arousal than non-affected women on average in both studies, but the associations did not differ by SIAD status. Interactions with SIAD were not significant either, as mentioned above.

For the VPP women, there was a small difference in immediate dyadic desire based on whether the heterosexual stimulus was their first testing session ($M = 5.02$, $SD = 1.6$) or their last testing session ($M = 3.84$, $SD = 1.8$); $t(65) = 2.84$, $p = .006$). To test whether this explained the group-based results, we tested whether stimulus order was a significant predictor or moderator of the associations, and it was not associated in any way (Main effect $p = .45$, 2-way interaction $ps \geq .18$, 3-way interaction $p = .32$). Thus, stimulus order does not explain the group differences.

Discussion

The aim of the current study was to assess whether subjective sexual arousal is significantly associated with different types of responsive sexual desire, and whether this association is moderated by relationship satisfaction. In general, our results overall showed a robust positive connection between women's experiences of sexual arousal reported while viewing sexual stimuli and the desire for sexual activity following the stimulus, with higher arousal predicting higher desire overall. However, these associations varied across relationship satisfaction level and desire type. Notably, the results were similar across both study groups for all desire types except one (immediate dyadic desire). Subjective arousal predicted higher immediate solitary desire regardless of relationship satisfaction, yet the association with delayed solitary desire depended on relationship satisfaction; specifically, the association was stronger among those with lower satisfaction. The same moderation pattern was found for the association between arousal and delayed dyadic-other desire (i.e., desire for sex with someone specifically other than a current romantic partner), with the strongest associations found among those with the lowest relationship satisfaction. The link between subjective arousal and immediate dyadic desire (i.e., desire for sex with another person, generally) was moderated by relationship satisfaction for the TIL women, with the positive association being strongest among women most satisfied with their relationships. For the VPP women, however, the association was straightforward, with higher arousal predicting higher immediate dyadic desire. Higher subjective arousal also predicted higher delayed dyadic-partner desire (i.e., desire for current romantic partner), regardless of relationship satisfaction. These results demonstrate the influence of relationship satisfaction on the links between sexual arousal and responsive sexual desire.

Does sexual arousal trigger sexual desire?

The connection between arousal and desire is a key component of models of sexual motivation and sexual response (e.g., Basson, 2001; Toates, 2009), with desire theorized to emerge from and reciprocally strengthen arousal. Ours is one of the few studies to test that connection directly. Our results overall showed a robust connection between women's experiences of sexual arousal evoked by audio-visual sexual stimuli and the desire for sexual activity following the stimulus. As a further test of whether these associations were explained by the women's experiences of desire and not due to potential confounding individual characteristics (e.g., trait desire), we also controlled for desire immediately prior to the stimulus (for immediate desire types) or at baseline (for delayed desire types). When controlling for pre-stimulus desire, the immediate desire findings remained. This echoes Goldey and van Anders' (2014) finding that subjective sexual arousal was a positive predictor of sexual desire. Yet, it is somewhat in contrast to Both et al. (2004), who found no differences in immediate desire between the sexual stimulus group and the neutral group, possibly due to their tests relying on broad comparisons by group, as opposed to assessing more direct associations between the degree of arousal experienced during the stimulus and subsequent desire. Our findings support the theorized effects of sexual arousal on sexual motivation in the moments it is experienced (Toates, 2009). These main effects also reiterate several

qualitative studies in which women describe experiencing arousal and desire in tandem, and often to the point of having difficulty differentiating between the two (Brotto et al., 2009; Graham et al., 2004).

After controlling for baseline desire levels, the direct association between subjective arousal and delayed partner desire remained statistically significant, yet the associations with the other delayed desire types did not. This further reinforces the notion that desire type and target matters for understanding differences in sexual desire (Blumenstock, 2023; Chadwick et al., 2017; Meana, 2010). Notably, the stimuli depicted a highly intimate and mutually respectful dyadic sexual experience that featured high amounts of pleasure for both partners. Women are most likely to have this type of sexual experience with a committed romantic partner (Armstrong et al., 2012), thus the closer alignment with the stimuli may have strengthened the link between the arousal that the stimulus elicited and desire for a current romantic partner. This is of course speculative; replication of these results is needed, and future research could explore these explanations more directly.

Findings suggest that the overall direct connections between arousal and desire may not last beyond 24 h, as previously found (*via* the proxy of sexual activity; Both & Laan, 2004), or that perhaps trait-levels of desire may dictate how sustained this triggered desire lasts. Another explanation is that, because the 3-way interactions remained significant after controlling for baseline desire, the longer-term effects on arousal-induced state desire may be more prone to influence by other aspects of women's daily lives (e.g., stressors, conflict, opportunities for sexual activity), making the connection more tenuous for some women or relationships, depending on these other aspects in their lives (e.g., poorer quality relationships or women with sexual difficulties).

Roles of relationship satisfaction and desire type

For three desire types, the degree to which arousal triggered desire varied across levels of relationship satisfaction. This is consistent with a large and growing body of research indicating the critical role that relationship factors play in sexual functioning and response (Brotto et al., 2010; Graham, 2010). Relationship problems such as poor dyadic adjustment and maladaptive conflict resolution strategies have been consistently linked to poorer sexual outcomes such as reduced arousal and desire (Brotto, 2010; Goldstein et al., 2005; Graham, 2010). Indeed, the romantic relationship is a common target for clinical interventions involving sexual challenges such as low desire among couples (Brotto et al., 2010; Goldstein et al., 2005).

Solitary and dyadic-other desire

The link between subjective sexual arousal and immediate solitary desire was unrelated to relationship satisfaction, with higher subjective arousal predicting higher immediate solitary desire across all satisfaction levels. However, the link with delayed solitary desire differed across relationship satisfaction levels, with stronger positive connections between arousal and solitary desire for women in less satisfying relationships. Solo sexual activity may be more likely to result in pleasure and/or orgasm than sex with a partner, and this may be particularly true for women who have male sex partners (Armstrong et al., 2012; Frederick et al., 2018; Goldey, Posh, Bell, & van Anders, 2016; Rowland et al., 2019), like the participants in the current study. This could be why the connection between arousal and desire in the moment was robust to relationship satisfaction levels. Women with satisfying relationships may have reported lower desire for and engaging in solo sex because they were able to have sex with their partner, and this was a much more appealing prospect than sex alone. Notably, the immediate and delayed desire measures were not identical; the immediate solitary desire measure was based on degree of desire in the moment, and the delayed solitary desire measure was based on frequency of solitary desire and activity over three days. To further understand sexual motivation, future research should assess

whether these differences in associations across time period (immediate vs delayed) are due to differences in measure (frequency vs degree), context (laboratory vs real life), timing since stimulus (immediate vs delayed), or a combination of these factors.

Similar to the findings for delayed solitary desire, the links between subjective arousal and delayed dyadic-other desire were moderated by relationship satisfaction, with the strongest positive links found among those in the least satisfying relationships. Interestingly, delayed dyadic-other desire was the only desire type to be directly and negatively connected to relationship satisfaction. This aligns with other research indicating increased likelihood of considering and seeking physical intimacy with people outside the relationship when unhappy in a current relationship (McAnulty & Brineman, 2007).

Immediate dyadic desire

Unexpectedly, the moderation of immediate dyadic desire was only found among the TIL women, and indicated that, for those in highly satisfying relationships, subjective arousal predicted higher desire for sex with a partner. Yet for those in relatively unsatisfying relationships, subjective arousal was actually unrelated to immediate dyadic desire. These results are intuitive, yet it is unclear why this pattern was only found among the TIL women. Among the VPP women, there was a straightforward relationship, with higher subjective arousal predicting higher immediate desire for a partner regardless of satisfaction, suggesting the associations may be more complex. Both studies relied on validated methods of assessing genital arousal, and there were no differences across samples in terms of arousal, dyadic desire, or relationship satisfaction. The TIL group included a larger proportion of women with SIAD symptoms, yet our post-hoc probing indicated this did not explain the differences. Other possible explanations could be differences across methodology. For instance, the methods could be associated with different levels of participant comfort or self-consciousness, which could in turn affect the connections between arousal and desire. Thermal imaging requires a direct line of sight between the camera and the participants' genitals, which could result in participants feeling more exposed. The photoplethysmograph allows participants to be fully covered (e.g., with a blanket) once placed, yet requires insertion of the equipment in the vagina, which may be seen as more invasive, thereby increasing discomfort. Differences could also be due the participants' experiences of arousal. Specifically, the VPP method requires genital contact and vaginal penetration, which could have increased women's awareness of and sensitivity to genital sensations, potentially strengthening signals of arousal that trigger responsive desire and weakening the effects of other pathways in the IMM. VPP and TIL measure related but somewhat different processes of genital vasocongestion, and direct comparisons of these two modalities are very rare (for more information about the methods, see Huberman, Dawson, & Chivers, 2017); however, one study assessing gender specificity of sexual response indicated no differences between the two methods when measured concurrently (Huberman & Chivers, 2015). It is also important to note that the TIL group was somewhat smaller than the VPP group. While drawing from existing data offered a useful exploratory investigation into these questions, critical next steps include replication, larger sample sizes, and studies designed specifically to assess these questions.

Delayed dyadic-partner desire

Given the large amount of research indicating relationship factors are critical for desire within the relationship (Brotto et al., 2010; Graham, 2010; Impett, Muise, & Peragine, 2014), it was surprising that relationship satisfaction was not associated with delayed desire for a current romantic partner (directly or indirectly). Again, it could be that the stimuli's depiction of intimate, pleasurable sex played a role—the degree to which the sex depicted in the film reflected sexual experiences with their current may have been more important in the longer-term effects of desire for their partner, essentially overriding the effects of relationship satisfaction. Alternatively, the measure may not have fully captured the experience of desire, as it assessed frequency of

desire across three days as opposed to strength or degree of desire, as in several of the previous quantitative studies indicating a more direct link (Impett et al., 2014).

Connections and contributions to theory

The associations between arousal and subsequent responsive desire documented in the current study provide clear support for the Incentive Motivation Model's premise that desire emerges from arousal (IMM; Toates, 2009). Furthermore, given that a key component of the incentive motivation model is that motivation toward a sexual activity depends on the expected rewards and consequences of that activity (Ågmo & Laan, 2022), our findings suggest that the quality of the women's current romantic relationship may have altered the incentive value of sex with (or without) their current romantic partner. As arousal increased, sex that did not involve the current partner (i.e., delayed solitary and dyadic-other desire) became more appealing for those with lower relationship satisfaction, suggesting that the context of a low quality relationship may increase the value of sex *without* a current romantic partner (i.e., masturbation or sex with non-partner others), at least over time. However, the connection between arousal and delayed partner desire was similar across satisfaction levels, suggesting relationship satisfaction may not influence desire for a current partner as the women go about their daily lives.

Sex with a partner may include experiences of emotional intimacy—a strong motivator of sexual desire (Blumenstock, 2022; Cooper et al., 2006; Mark et al., 2014; Meston & Buss 2007)—but if there are significant problems in the relationship, intimacy during sex may not be as much of a motivating factor, making sex with that specific partner a less appealing target for desire at the height of arousal. It is also possible the intimate and affectionate nature of the sex depicted in the film could have strengthened these effects.

The interactions and differing patterns across relationship satisfaction and desire type that were documented in the current study suggest that failing to account for relationship satisfaction could mask the associations between arousal and immediate sexual desire for a current romantic partner. Similarly, not accounting for desire type could also mask associations between arousal and desire, particularly if desire for others is combined with desire for a current partner—the opposing directional effects could cancel each other out.

Additionally, the immediate direct associations between arousal and desire were quite robust, somewhat more so than the delayed associations. This suggests a timing component to the incentive motivation model, whereby desire triggered *via* arousal dissipates or may become more dependent upon other factors such as context (which we did not assess).

That the same patterns were not found across all dependent variables is consistent with recent empirical and theoretical work indicating that the *target* of sexual desire is a critical consideration when assessing and drawing conclusions about sexual desire—*what*, exactly, is being desired matters (Blumenstock, 2023; Chadwick et al., 2017; Mark et al., 2014; Meana, 2010). Different sexual targets may represent different, possibly opposing incentive values (e.g., for those in a monogamous relationship, sex with a current partner versus sex with someone other than a current partner). This is further corroborated by evidence that the perceived likelihood of reward and pleasure of a particular sexual act dictates motivation to engage in that activity (Ågmo & Laan, 2022; Blumenstock, 2022; Meana, 2010).

Clinical implications

First, the evidence from our experimental paradigm has implications for our basic understanding of human sexual response. The data clearly point to the relationship between arousal and desire, and that desire emerges from activation of the sexual response system, indicating that desire has a responsive quality and is not inherently a spontaneous phenomenon (Toates, 2009). Yet, desire is also informed by current interpersonal contexts. Though this was not a clinical sample, our findings also have implications for clinicians treating women with desire difficulties. Because distressing desire difficulties often arise within the context of romantic relationships (Rosen

et al., 2009) and are likely to involve desire for a current romantic partner, our findings suggest that clinicians should consider the combination of being provided sufficiently arousing sexual stimuli in addition to relationship satisfaction when working to treat sexual desire difficulties. Specifically, our findings suggest that the two work in tandem—even in the context of a highly satisfying relationship, if a woman is not being exposed to sufficiently arousing stimuli, desire may remain low. This aligns with previous laboratory-based research documenting that women who report distressingly low levels of arousal do not exhibit significantly different arousal in response to sexual stimuli compared to women without such challenges, which has led some researchers to conclude that their arousal difficulties could be due to insufficiently arousing stimuli in the home (Laan, Van Driel, & Van Lunsen, 2008).

Findings also suggest the potential for motivation to engage in sexual activity without the partner when unsatisfied women do receive sufficiently arousing stimulation. This could be an adaptive response to seeking desired levels of sexual intimacy when not received from a current partner, yet could introduce additional difficulties to an already strained relationship. Awareness of this potential and how to manage it could be helpful for women who present with low desire in their relationship yet high desire outside the relationship.

Limitations and future directions

Additional limitations should be noted. The delayed desire measure could also have introduced limitations, as it assessed the overall frequencies of experiences of desire (versus degree of desire), and the vast majority of women reported low or zero frequencies regarding desire for others or for solo sexual activity across the three days. It could therefore be the case that the time frame was too short to capture such experiences. Alternative study designs, such as daily diary methods, could assess how long this triggered desire lasts and for whom. Additionally, the immediate and delayed desire measures were not identical, which therefore limits the comparability between them. The dyadic measures in particular could introduce complexity, as the immediate dyadic desire measure captured degree of desire for sex with "a partner", which could include any person, whereas the delayed desire measures included frequency of desire specifically for a current romantic partner (delayed partner desire) and for someone other than a current romantic partner (delayed other desire).

As a whole, the women in these study groups were relatively satisfied with their relationship ($M = 29.0$ and 29.6 on 19-35 scale), which is similar to numerous studies with relationship-based recruitment criteria. A small portion of the women reported low relationship satisfaction, which limits our understanding of the full range of effects that relationship satisfaction could have on the arousal-desire link. Future researchers could seek to recruit women in relationships that represent a more even distribution across satisfaction levels, such as by targeting those in unhappy relationships. The sample was also restricted to cis-gendered women who experienced sexual attraction to men. Because of the original study focus and the heterosexual sex depicted in the stimuli, these were necessary components of the sample, yet they introduce important limitations in generalizability. To thoroughly test the applicability of the IMM and its broad utility in understanding human sexual response, critical next steps include directly testing the model among populations representing the full range of gender and sexual diversity. Such steps could also uncover important expansions in the model.

The current study drew from archival data, and the original studies were not designed specifically to assess differences between two different measurement modalities of genital response. Because of the identical designs regarding the sexual film protocols, (i.e., identical stimuli, timing, and all measures except genital arousal) between the two studies, we did not expect to find such significant differences in these associations. Thus, all probing was post-hoc, in an effort to provide useful information for future studies. Relatedly, the sample sizes for both studies were determined prior to data collection, yet were based on simpler group-differences analyses (ANCOVAs). Thus, the non-significant findings for the delayed desire models could

be due to a lack of sufficient power to detect smaller but meaningful effects in these more complex models. An important next step is replicating the findings in samples selected for these particular analyses.

Conclusions

Overall, our study adds to the growing body of literature supporting the relationship between subjective experiences of arousal and responsive sexual desire, and extend the findings by including the roles of relationship satisfaction and desire type, contributing to a more comprehensive understanding of the factors that influence women's sexual desire. Relationship satisfaction may influence arousal's effect on desire by altering the incentive value of different sexual experiences. For some, such as those in monogamous relationships, sex with a current partner and sex with non-partner others may represent discrepant sexual experiences with opposing incentive values. Researchers should carefully consider the incentive value of sexual stimuli as well as sexual target when investigating and drawing conclusions about what influences sexual desire.

Acknowledgements

Funding for this study was from an Operating Grant (MOP- 130347) from the Canadian Institutes of Health Research awarded to Meredith Chivers and Lori Brotto.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Author note

Data analyzed in the current study may be requested by contacting Dr. Meredith Chivers at mchivers@queensu.ca.

Funding

The author(s) reported there is no funding associated with the work featured in this article.

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