Determinants of Sexual Arousal and the Accuracy of its Self-Estimation in Sexually Functional Males

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Men with and without sexual dysfunction present with varying patterns of agreement between subjective estimates of sexual arousal and more objective psychophysiological measures of the same construct. This relative accuracy seems to be associated with sexual function, with men who have sexual dysfunction presenting less accurate estimations (mostly reporting below measured arousal levels). The purpose of this study is to clarify the processes underlying sexual arousal and the accuracy of its self-estimation. We looked at potential predictors of sexual arousal (subjective and physiological) and accuracy in estimating objective sexual arousal in a sample of 60 sexually functional males. Predictors included pre-existing sexual attitudes (erotophobia), both trait and state positive and negative affect, self-focused attention, and interoceptive awareness. Results indicate that this sexually functional sample generally reported below their own erection level. Interestingly, trait negative affect was associated with somewhat lower levels of subjective arousal and higher levels of physiological arousal. On the other hand, state positive affect facilitated both subjective and objective arousal and increased somewhat the accuracy of estimates of erectile responding. Pre-existing sexual attitudes as well as variations in self-focused attention and interoceptive awareness evidenced little effect on sexual arousal or the accuracy of its estimation.

Discordance between objective and subjective reports of arousal seems to distinguish men with sexual dysfunction from sexually functional males. Beck, Barlow, and Sakheim (1982) reported that compared with sexually functional males, men with erectile disorders presented diminished correlations between tumescence and subjective arousal and perceived themselves as less able to control tumescence, despite the lack of absolute differences on objective arousal (tumescence) compared to the nonclinical group. Rowland and Heiman (1991) also found a substantial disparity between ratings of subjective and physiological arousal in males with erectile disorders. The authors demonstrated that contrary to men without sexual problems, men with erectile difficulties tended to rely more on mental than on physical cues to estimate their levels of subjective arousal.

Additionally, studies with women have found high levels of discrepancy between subjective and genital arousal in samples with and without sexual dysfunction (Geer, Morokoff, & Greenwood, 1974; Heiman, 1977, 1980; Morokoff & Heiman, 1980; Palace & Gorzalka, 1990; Wincze, Hoon, & Hoon, 1977). Laan and Everaerd (1995) as well as Korff and Geer (1983) suggested that compared to men, women in general may rely less on physiological cues to estimate their sexual arousal, and that this fact might explain why the discordance between subjective and physiological arousal is greater among women. Moreover, similar to men, women with sexual dysfunction tend to present lower levels of concordance between subjective and objective measures of sexual arousal compared to women without sexual problems (Morokoff & Heiman, 1980; Palace & Gorzalka, 1992). Morokoff and Heiman (1980) showed that despite the lack of significant differences in physiological sexual arousal responses to erotic materials in women with and without sexual dysfunction, those with sexual dysfunction rated their subjective sexual arousal as significantly lower.

A related but distinct issue is the question of whether individuals with sexual problems tend to be inaccurate in reporting their levels of physiological arousal. Whereas *subjective arousal* refers to an individual's feelings of arousal, self-reports of physiology may be obtained by asking participants to estimate the degree of their genital response (e.g., degree of erection in males). Though numerous studies have confirmed that discordance often exists between physiological and subjective arousal, less research has been conducted examining individuals' ability to estimate their physiological arousal level. Sakheim, Barlow, Abrahamson, and Beck (1987) found that at the same levels of erectile responding, men with erectile disorders due to psychogenic factors consistently underreported their levels of erection compared to patients with dysfunction due to organic causes and sexually functional males. On the other hand, males with erectile disorders due to organic causes showed a reverse trend, overreporting their levels of erection. Correlational data further confirmed this trend, showing that sexually functional males presented higher concordance between subjective ratings of erection and physiological measures of erectile response compared to the other two groups (Sakheim et al., 1987).

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There are several potential factors underlying the discrepancies found in the studies mentioned above. First, research on the influence of sexual attitudes on sexual behavior and performance consistently reveals a tendency for participants with sexual dysfunction to present with more conservative values regarding sexuality (Fisher, Byrne, White, & Kelley, 1988) and erroneous beliefs about male and female sexual response (Baker & De Silva, 1988; Nobre & Pinto-Gouveia, 2000; Nobre, Pinto-Gouveia, & Gomes, 2003). Specifically, the concept of *erotophilia-erotophobia*—"the disposition to respond to sexual cues along a negative-positive dimension of affect and evaluation" (Fisher et al., 1988, p. 123)—has been found to be associated with sexual dysfunction (Jones, Carpenter, Bruce, & Barlow, 1987) and a vulnerability to develop later sexual difficulties (Byrne & Schulte, 1990). Also, erotophobic individuals tend to present with higher negative affective reactions to erotic stimuli (Fisher & Byrne, 1978a) and less sexual activity (Fisher & Byrne, 1978b). Interestingly, a study conducted with a female sample found that erotophobic women reported less subjective sexual arousal but presented with greater physiological sexual arousal than their erotophilic counterparts during erotica exposure (Soleymani, 1999). Similarly, Morokoff (1985) found that women with high sexual guilt reported lower subjective arousal but showed significantly higher genital arousal compared to women with low sex guilt during exposure to erotic material. It is possible that in these erotophobic women, negative expectancies regarding erotica and their responses to it prompt them to experience less subjective arousal despite their increased physiological response.

Second, emotional state during exposure to sexual situations may affect physiological and subjective sexual arousal as well as self-estimates of physiological response. Research consistently suggests that depressive affect is negatively related to sexual arousal. Heiman and Rowland (1983) and Beck and Barlow (1986) found that individuals with sexual dysfunction reported significantly less positive affect during erotic exposure. Similarly, several studies (Koukounas & McCabe, 2001; Rowland, Cooper, & Heiman, 1995; Rowland, Cooper, & Slob, 1996) showed that positive affect and subjective sexual arousal were strongly correlated (in a positive way) in men both with and without sexual dysfunction during exposure to erotic films. In a study conducted with sexually functional females, Heiman (1980) reported similar results. Experimental studies have further supported these findings, showing that manipulated increases in depressed affect in sexually functional men produced a delay in subjective sexual arousal (Meisler & Carey, 1991) and a decrease in penile tumescence (Mitchell, DiBartolo, Brown, & Barlow, 1998). It is interesting to note that in this last study, a discrepancy between objective and subjective measures of erection was also noted. In fact, sexually functional participants, although showing a significant decrease in tumescence following the negative mood induction, did not report a concomitant decrease in their levels of subjective arousal. This finding seems to support the hypothesis that men without sexual problems may experience discordance between physiological and subjective sexual arousal, but it also gives some credence to the idea that they present an immunity of sorts to cognitive sets related to dysfunctional processes after experience with erectile insufficiency or failure (Weisberg, Brown, Wincze, & Barlow, 2001; Weisberg, Sbrocco, & Barlow, 1994).

A third variable associated with levels of sexual arousal is self-focused attention. Self-focus is usually conceptualized as a focus on information and cues coming from within the self (internal thought processes or somatic cues; Ingram, 1990). In sex research self-focus is associated with the tendency to focus on one's own responding rather than on external erotic cues. Recent studies show that during sexual activity, participants without sexual difficulties focus on erotic cues whereas individuals with sexual dysfunction focus more on concerns about their erection, anticipating personal failure and its consequences (Nobre & Pinto-Gouveia, 2000, 2003). These studies support Barlow's model (1986) that one main distinction between men with and without sexual dysfunction is the tendency shown by the former to focus their attention on off-task (negative) cues, preventing them from adequately processing erotic stimuli.

It is expected, then, that higher self-focused attention during exposure to erotica will be associated with lower tumescence and subjective arousal. Moreover, it is possible that during self-focus (on internal processes, mainly negative) participants may evidence decreased awareness of their genital sexual response and tend to underreport levels of physiological arousal.

A fourth variable affecting levels of sexual arousal is interoceptive awareness. This concept is distinct from self-focused attention, since interoceptive awareness is the ability to perceive accurately one's own physiological changes rather than the tendency to focus on internal (negative) cognitive or somatic responding. Cranston-Cuebas, Barlow, Mitchell, and Athanasiou (1993) studied the effect of three placebo pills on sexual arousal in men with and without sexual dysfunction. Participants were told that one pill would enhance their erection, a second would decrease their erection, and a third would have no effect. Manipulation checks confirmed that instructions were credible. Results indicated that sexually functional males presented with a reverse placebo effect, increasing their erection under detraction instructions, and men with erectile disorders evidenced a direct placebo effect, decreasing their erection response under the detraction relative to the enhancement and placebo conditions. The authors hypothesized that sexually functional participants possibly present greater interoceptive awareness compared to men with erectile dysfunction, which allowed them to detect their increased erectile response despite the detraction condition. This awareness of increased sexual arousal may in turn facilitate further physiological arousal through a positive feedback process. Males with erectile disorder, on the

other hand, were more responsive to the instructions since they were less (interoceptively) aware of actual erectile responding. Thus, we hypothesized that individuals with high levels of interoceptive awareness would present higher physiological sexual arousal and higher levels of accuracy of estimates of sexual arousal.

The purpose of the present study was to investigate factors that may predict sexual arousal (subjective and physiological) as well as the accuracy of self-estimates of erectile response. We hypothesized that sexual attitudes (specifically higher erotophobic levels), lack of positive affect during exposure to erotica, and higher self-focused attention during an erotic stimulus would be associated with lower tumescence, lower subjective sexual arousal, and less accuracy in estimates of physiological sexual arousal (mainly underreporting). Conversely, we expected that higher levels of interoceptive awareness would be associated with higher accuracy in estimates of erection level.

Method

Participants

Sixty undergraduate males with no history of sexual dysfunction participated in the study. Participants were recruited via IRB-approved advertisements. The inclusion criteria asked for males between 18 and 45 years old with no major psychological disturbance as determined by a structured clinical interview (Anxiety Disorders Interview Schedule for DSM-IV [ADIS-IV]); Brown, Di Nardo, & Barlow, 1994) and no sexual dysfunction as assessed by the Sexual Dysfunction Interview (SDI; Sbrocco, Weisberg, & Barlow, 1992). Other criteria included consent to view sexually explicit materials, self-reported heterosexual orientation (to allow standardization of the erotic stimuli presented in laboratory) and ability to reach a full erection during the exposure to the erotic materials (in order to calibrate the percentage of full erection). A total of 16 participants out of an initial pool of 81 who were recruited and signed consent forms (19.75%) were excluded due to not reaching a full erection. Each person who was excluded was replaced by another participant until we reached a total of 60 males who completed the study. All participants were paid $50 U.S. after concluding their participation or after being excluded for not meeting inclusion criteria.

Procedures

All participants underwent a phone screen during which the goal and procedures used in the study were explained and the presence of psychological disorders or sexual dysfunction was preliminarily assessed. Participants were then scheduled for a first session at the Center for Anxiety and Related Disorders, where they were informed about the specific procedures of the study, visited the sex laboratory, and obtained familiarity with the experimental apparatus.

Participants were given an opportunity to ask questions and then completed a list of self-report measures: Sexual Opinion Survey (SOS; Fisher et al., 1988); Positive Affect and Negative Affect Scales (PANAS-G; Watson, Clark, & Tellegen, 1988); Self-Consciousness Scale (SCS; Fenigstein, Scheier, & Buss, 1975); and Body Consciousness Questionnaire (BCQ; Miller, Murphy, & Buss, 1981). Subsequently, participants were interviewed with the ADIS-IV (to screen for major psychological disorders) and the SDI (to assess for the presence of sexual dysfunction). Participants who presented with either a major psychological diagnosis (DSM-IV clinical disorder) or any sexual dysfunction were informed about their ineligibility to participate in the study based on scientific criteria, were paid for their contribution, and were given referrals for treatment.

In the second session of the study, participants watched six different erotic films (one calibration and five experimental stimuli presented in a counterbalanced order) of differing explicitness while their erectile response was measured via penile plethysmography. The calibration film incorporated into this session was aimed at calibrating the percentage of full erection obtained during exposure to the erotic materials. Participants who failed to obtain a full erection were excluded (since there was no possibility of determining an absolute value for the full erection as a baseline from which to calculate the relative level of erection as a percentage of full erection).

After the completion of the calibration procedure, a small table was placed over the participants' lap, preventing them from observing their genital response during the remaining exposure to erotic films. During the baseline and immediately before exposure to the erotic films, participants were asked to complete the PANAS-Present (PANAS-P) to measure positive and negative affect at that point in time. After watching each film, participants were asked to complete the PANAS-P along with a set of Likert-type items assessing such dimensions as affective reactions to erotica (ARE), subjective arousal, anxiety, attention to erotic stimuli, involvement in the task, control over erection, and an estimate of the maximum percentage of a full erection attained (using a 0–100% scale). Following each film segment, participants had a minimum of a 3-minute recovery phase to achieve complete detumescence. If no complete detumescence was achieved after that period, the participants were asked to perform mental arithmetic tasks until penile erection returned to baseline.

Materials

Sexual Opinion Survey. The Sexual Opinion Survey (SOS; Fisher et al., 1988) is a questionnaire developed to assess the "disposition to respond to sexual cues along a negative-positive dimension of affect and evaluation" (p. 123). We used this measure to assess the concepts of erotophobia-erotophilia. The scale consists of 21 items scored on a Likert scale (from 0 = *strongly agree* to 6 = *strongly disagree*). Data indicate that the scale is internally consistent and shows acceptable degrees of convergent and discrimi-

nant validity. Factor analysis has identified three dimensions: open sexual display, sexual variety, and homoeroticism (Fisher et al., 1988).

Positive Affect and Negative Affect Scales. The Positive Affect and Negative Affect Scales (PANAS; Watson et al., 1988) are measures specifically developed to assess the dimensions of positive and negative affect. The questionnaire consists of a 20–item scale composed of 10 positive affect items (e.g., excited, interested, enthusiastic) and 10 negative affect items (e.g., distressed, guilty, scared, irritable, nervous). The scales are shown to be highly internally consistent, largely uncorrelated, and stable at appropriate levels over a 2-month time period. In the present study we used a general (PANAS-G) and a present (PANAS-P) version of the measure to assess both trait and state affect.

Self-Consciousness Scale. The Self-Consciousness Scale (SCS; Fenigstein et al., 1975) is a measure developed to assess individual differences on self-consciousness. The questionnaire consists of 23 items scored on a Likert scale and has high test-retest reliability. A factor analysis by Finigstein et al (1975). identified three factors: Private Self-Consciousness, Public Self-Consciousness, and Social Anxiety. Public Self-Consciousness correlated moderately with both Private Self-Consciousness and Social Anxiety, while the correlation of Private Self-Consciousness with Social Anxiety fluctuated around zero (Fenigstein et al., 1975). In the present study, we used the Private Self-Consciousness subscale to measure self-focused attention.

Body Consciousness Questionnaire. The Body Consciousness Questionnaire (BCQ; Miller et al., 1981) is a self-report measure developed to assess the propensity to be aware of the internal and external aspects and modifications of one's body. Miller et al's (1981) factor analysis identified two factors: Private Body Consciousness (awareness of internal sensations) and Public Body Consciousness (awareness of observable aspects of the body). Acceptable test-retest reliability and correlations with other personality measures (Self-Consciousness Inventory, Hypochondriasis scale of the MMPI, and the Emotionality scale of the EASI) were also achieved. In our study, we used the five items of the Private Body Consciousness subscale as a measure of interoceptive awareness.

Subjective measures. We also used a set of subjective measures of sexual arousal consisting of Likert-type scales to assess different dimensions of subjective experience during the exposure to the erotic materials. These measures specifically assess subjective sexual arousal ("What was your maximum feeling of sexual arousal?"; 0–10 scale), anxiety ("How anxious or nervous were you during the film?"; 0–10 scale), distraction ("How distracted were you during the film?"; 0–10 scale), involvement ("How involved were you in the film?"; 0–10 scale), perceived control over erection ("How much control did you have over your erection level?"; 0–10), and estimated maximum percentage of a full erection attained ("What is the maximum percentage of a full erection that you attained during the film?"; 0-100% scale). We compared this last measure with the real percentage of full erection obtained during the exposure to the erotic films to calculate the accuracy of the self-estimate for each participant.

Physiological measures. We used penile circumference changes measured with a mercury-in-rubber strain gauge to assess erectile response. Because the degree of accuracy of the self-estimate of sexual arousal was a central variable in the study, we used the following method to increase its assessment reliability: After calibration and once a strain gauge was on a participant's penis, he was asked to self-stimulate until obtaining a full erection while watching the first film. The experimenter then recorded the degree of penile circumference change displayed by a CAT600 monitoring system at the precise point of full erection, as representing 100% tumescence. The lowest stable value obtained during this procedure became baseline (0% tumescence). We then systematically compared the relative position (to the 0-100% scale obtained) of the penile circumference changes during the subsequent exposure to erotic films (after removing all potential artifacts detected) to subjective self-estimate of the percentage of full erection reported by the participants after watching each film. The formula used to calculate the degree of accuracy was as follows: accuracy = [self-estimated percentage of full erection] – [percentage of full erection obtained]; negative numbers reflected reporting below measured arousal levels and positive numbers reflected reporting above measured arousal levels.

Erotic stimuli. Five 3-minute erotic films with different degrees of erotic explicitness were used: One film (A) consisted of images of female models in bathing suits, which were not sexually explicit (low arousal). A second film (B) contained images of a woman masturbating herself and was more explicit (medium arousal). The remaining three films (C, D, & E) presented images of sexual intercourse between heterosexual couples and were much more explicit (high arousal). The films were presented in a counterbalanced order.

Results

On average, all films except one produced high levels of physiological arousal. As expected, Film A (presenting images of female models in bathing suits) produced significantly lower percentages of full erection when compared with the other four films, $F(4, 240) = 79.5$, $p < .001$ (see Table 1). Post-hoc comparisons (Bonferroni) were significant for all comparisons between Film A and the other films ($p < .001$). Also, Film C produced significantly higher erectile responses than Films D and E ($p < .001$). Interestingly, Film B, specifically prepared to elicit moderate levels of erection response, produced levels of physiological arousal similar to the high arousal films.

Subjective arousal experienced by the participants during exposure to the erotic materials (measured on a 0–10 scale) followed a similar pattern. Film A produced signifi-

Table 1. Arousal Measures and Accuracy of Erection Self-Estimation During High Versus Low Arousal Films

	% Full erection *M (SD)*	Subjective arousal *M (SD)*	Accuracy of estimation *M (SD)*
High arousal films			
Film C	87.8% (21.4)	6.8 (2.09)	-16.3 (16.9)
Film B	81.3% (27.5)	6.4 (2.26)	-16.6 (20.8)
Film D	76.8% (28.1)	6.0 (2.73)	-13.5 (22.2)
Film E	75.1% (26.9)	5.8 (2.47)	-16.2 (20.7)
Low arousal film			
Film A	31.9% (28.7)	3.0 (2.33)	-9.3 (20.6)

cantly less subjective arousal in comparison with the other films, F (4, 232) = 41.76, $p < .001$ (see Table 1). Post-hoc comparisons (Bonferroni) were significant for all contrasts between Film A and the other films ($p < .001$).

Regarding the accuracy of self-estimates of full erection, and somewhat unexpectedly, our results showed an overall tendency for individuals to report below measured physiological arousal levels. Average results across all five films were negative (meaning that the estimation was lower than the observed maximum percentage of erection obtained; see Table 1). A repeated analysis of variance (ANOVA) was significant [F (4, 232) = 2.66, $p < .05$, $\eta^2 = .04$], showing that the level of accuracy was different across the films (but note the low effect size). Specifically, the difference between self-reported percentange of full erection and objectively measured percentage of full erection was less during the low arousal film (Film A) compared to the high arousal films ($p < .05$), meaning that these men without sexual dysfunction demonstrated somewhat greater levels of accuracy in estimating their level of erection at lower levels of arousal. This tendency is evidenced in Table 2, where estimation accuracy was categorized as follows: report below measured arousal levels (defined by differences between the estimation and the observed erection below −10), report above measured arousal levels (differences higher than +10), or accurate (differences between −10 and +10).

To determine if the tendency to under-, over-, or accurately report levels of erection was consistent across the participants, we examined the percentage of individuals classified in the same estimation category across at least three of the four high arousal films. A total of 60.7% of the participants consistently reported their levels of physiological arousal using this procedure. Among these individuals, 56.8% reported below, 40.5% were accurate, and 2.7% reported above their physiological arousal levels. These results confirmed the tendency of our sample to report below measured levels of erection.

Table 2. Percentage Reporting Below, Accurately, or Above Maximum Erectile Response

	Report below	Accurate	Report above
High arousal films			
Film C	53%	47%	0%
Film B	50%	43%	7%
Film D	47%	39%	14%
Film E	53%	42%	5%
Low arousal film			
Film A	42%	42%	16%

We analyzed the differences between these groups, excluding the reporting above group since it was composed of only one participant. We observed that despite similar results on physiological arousal levels (M = 71.06% of full erection obtained for the underreporting groups and M = 75.31% of full erection obtained for the accurate group, $t = -.66$, $p = .52$), participants who consistently reported below their erection levels presented statistically significantly lower subjective arousal as measured by Likert scale ratings ($M = 4.68$) in comparison with the accurate group ($M = 6.72$), $t = -3.94$, $p < .001$.

In a preliminary analysis of the differences between these two groups on the proposed predictors, the only statistically significant result was for positive affect during the films. Participants who consistently reported below their levels of physiological sexual arousal presented lower positive affect during the films ($M = 26.7$) compared with the accurate group ($M = 34.0$), t (31) = -2.47, $p < .05$. Moreover, we observed a trend for the reporting below group to show lower general positive affect (trait affect), $M = 36.5$ versus $M = 40.2$, t (33) = -1.95, $p = .06$.

To clarify the relationship between the proposed predictors and the extent of sexual arousal (subjective and physiological) and estimates of erection, we conducted correlational and multiple regression analyses.[1] When we studied the influence of sexual attitudes on sexual arousal and its estimates, we found no statistically significant correlations. However, and contrary to predictions, multiple regression analysis showed that erotophilia was a statistically significant predictor of subjective arousal in the high arousal films ($\beta = -.33$, $p < .05$; see Table 3). That is, the higher the erotophilia scores, the lower the subjective arousal presented by participants during the high arousal films. We observed a similar although not statistically significant trend for the physiological arousal presented during the high arousal films ($\beta = -.22$, $p = .12$; see Table 4).

Regarding the relationship between emotional response during the erotic films and level of sexual arousal and estimates of erection, results partially supported our hypothesis. Positive affect correlated significantly with subjective arousal in both the high ($r = .37$, $p < .01$) and

[1] To simplify statistical analysis, we decided to use composite measures for the high and the low arousal films. Since Films B and C presented significant differences from Film A in both objective and subjective sexual arousal, we used two groups: high arousal films (Films B and C) and low arousal film (Film A). For the high arousal films, we used averages of physiological arousal, subjective arousal, and accuracy of estimates across films in subsequent analysis. The multiple regression analysis used the following as criterion variables: subjective arousal, maximum percentage of physiological arousal, and accuracy of self-estimates of erection. The predictor variables were erotophilia, general (trait) positive affect, general (trait) negative affect, self-focus, body awareness, situational (state) positive affect, and situational (state) negative affect.

Table 3. Multiple Regression Analysis for Proposed Predictors of Maximum Subjective Sexual Arousal During High Arousal Films

	B	*SE*	β	*t*	*p*	Tolerance
Erotophilia	-0.4	.02	-.33	-2.20	.034	.876
Positive affect (G)	-0.7	.04	-.24	-1.53	.133	.794
Negative affect (G)	-0.5	.05	-.18	-1.12	.269	.764
Self-focus	0.3	.05	.09	0.59	.556	.809
Body-awareness	0.1	.08	.03	0.17	.863	.896
Positive affect (P)	0.8	.03	.43	2.39	.022	.600
Negative affect (P)	0.2	.06	.05	0.29	.774	.710

Note. G = general positive or negative affect (trait affect); P = positive or negative affect presented during exposure to films (state affect).

the low ($r = .33$, $p < .05$) arousal films. Correlations with physiological arousal were not as strong and only reached statistical significance during the low arousal film ($r = .30$, $p = .05$). For the relationship between state positive affect and accuracy of self-estimates of arousal, correlations were positive but not statistically significant. Multiple regression analysis more strongly supported this pattern, showing that positive affect during exposure to the erotic films is a statistically significant predictor of subjective arousal in both the high ($\beta = .43$, $p < .05$; see Table 3) and low ($\beta = .34$, $p < .05$) arousal films (see Table 5). Moreover, despite not reaching statistical significance, positive affect was the best predictor of physiological arousal during the low arousal film ($\beta = .28$, $p = .08$; see Table 6). On the other hand, negative affect during exposure to erotica was unrelated to subjective and physiological arousal and estimates of erection.

Interestingly, when we analyzed the relationship between general affect (trait) and sexual arousal and estimates of erection, results showed a different pattern from the one we observed for situational affect (mood during exposure to erotic materials). General negative affect was weakly associated with subjective arousal (negative correlations), but showed strong positive correlations with physiological arousal. That is, the greater the negative trait affect, the higher the percentage of full erection obtained during exposure to erotica. This tendency reached statistical significance in the high arousal film ($r = .27$, $p < .05$). Regarding the accuracy of self-estimates of arousal, results indicated a relationship pattern similar to the subjective arousal. The higher the general negative affect values, the lower the accuracy of estimates of arousal (tendency to report below measured erection levels). This tendency was evident during the low arousal film ($r = -.26$, $p = .05$). Multiple regression analysis confirmed the correlational studies, indicating that trait negative affect was the best predictor of both physiological arousal ($\beta = .46$, $p < .01$, high arousal film; see Table 4) and the accuracy of its estimation ($\beta = -.27$, $p = .08$, low arousal film; see Table 7). On the other hand, general positive affect was associated weakly or not at all with all dependent variables.

Self-focused attention (measured by private self-consciousness subscale of the SCS) presented differential correlations with low and high arousal films. Specifically, high trait private self-consciousness correlated significantly with subjective arousal in the low arousal film ($r = .37$, $p < .01$) but not in the high arousal films ($r = -.004$, $p = .98$). This finding was supported by multiple regression analysis ($\beta = .36$, $p < .05$, in the low arousal film; see Table 5) and seems to suggest that, when exposed to low arousal

Table 4. Multiple Regression Analysis for Proposed Predictors of Percentage of Maximum Physiological Sexual Arousal During High Arousal Films

	B	*SE*	β	*t*	*p*	Tolerance
Erotophilia	-.27	.17	-.22	-1.58	.121	.879
Positive affect (G)	-.58	.47	-.18	-1.23	.227	.788
Negative affect (G)	1.40	.46	.46	3.03	.004	.748
Self-focus	-.61	.48	-.19	-1.26	.215	.778
Body-awareness	.97	.86	.16	1.13	.266	.909
Positive affect (P)	.11	.36	.05	0.30	.768	.603
Negative affect (P)	.21	.60	.06	0.35	.726	.698

Note. G = general positive or negative affect (trait affect); P = positive or negative affect presented during exposure to films (state affect).

Table 5. Multiple Regression Analysis for Proposed Predictors of Maximum Subjective Sexual Arousal During Low Arousal Film

	B	*SE*	β	*t*	*p*	Tolerance
Erotophilia	-.00	.02	-.00	-.01	.989	.894
Positive affect (G)	.02	.05	.05	0.37	.712	.874
Negative affect (G)	.00	.06	.01	0.04	.967	.731
Self-focus	.15	.06	.36	2.51	.015	.717
Body-awareness	-.06	.09	-.08	-0.61	.543	.864
Positive affect (P)	.09	.04	.34	2.25	.029	.636
Negative affect (P)	-.06	.07	-.13	-0.85	.401	.639

Note. G = general positive or negative affect (trait affect); P = positive or negative affect presented during exposure to films (state affect).

Table 6. Multiple Regression Analysis for Proposed Predictors of Percentage of Maximum Physiological Sexual Arousal During Low Arousal Film

	B	*SE*	β	*t*	*p*	Tolerance
Erotophilia	0.09	0.27	.05	0.34	.735	.894
Positive affect (G)	-0.05	0.62	-.01	-0.08	.934	.874
Negative affect (G)	0.85	0.72	.17	1.18	.243	.731
Self-focus	0.47	0.75	.09	0.62	.539	.717
Body- awareness	1.29	1.20	.15 1	.08	.286	.864
Positive affect (P)	0.91	0.51	.28	1.81	.077	.636
Negative affect (P)	0.08	0.87	.01	0.09	.931	.639

Note. G = general positive or negative affect (trait affect); P = positive or negative affect presented during exposure to films (state affect).

Table 7. Multiple Regression Analysis for Proposed Predictors of Accuracy of Self-Estimates of Physiological Sexual Arousal During Low Arousal Film

	B	*SE*	β	*t*	*p*	Tolerance
Erotophilia	0.01	.15	.01	-0.07	.943	.894
Positive affect (G)	0.05	.34	.02	0.13	.894	.874
Negative affect (G)	0.70	.39	.27	1.80	.078	.731
Self-focus	0.26	.41	.10	0.63	.534	.717
Body-awareness	-0.45	.65	-.10	-0.69	.493	.864
Positive affect (P)	0.38	.27	.22	1.38	.175	.636
Negative affect (P)	-0.22	.47	-.08	-0.46	.645	.639

Note. G = general positive or negative affect (trait affect); P = positive or negative affect presented during exposure to films (state affect).

erotic material, sexually functional males with high private self-focus patterns are more greatly subjectively aroused.

Results for physiological arousal (although not significant) showed a similar pattern to those for subjective arousal. We found a moderate correlation between private self-consciousness and physiological arousal during the low arousal film ($r = .22$, $p = .09$), in contrast to the results presented on the high arousal films ($r = .04$, $p = .75$). No significant correlation was found between private self-consciousness and the accuracy of sexual arousal in both high and low arousal films. Thus, trait private self-consciousness does not seem to be consistently related with sexual arousal or estimates of erection. With the exception of the low arousal film, all correlations were close to zero.

For body consciousness, and contrary to predictions, we found weak to moderate correlations with all criterion variables. Thus, these data failed to support the expected positive effect of body awareness on the accuracy of self-estimates of physiological arousal.

Discussion

Sexually functional males participating in this study presented a general tendency to report below their levels of physiological sexual arousal. Though somewhat unexpected, this finding does not necessarily contradict reports about the greater tendency shown by men with psychogenic sexual dysfunction to report below their sexual arousal levels (Sakheim et al., 1997). Further, other recent work from our laboratory also found that sexually functional men tended to underreport their erection levels (Weisberg, 2000). There are multiple potential explanations for this finding.

First, it should be mentioned that some discrepancy between physiological and subjective sexual arousal measures as well as inaccuracy of self-estimation of erectile response was expected, taking into consideration the different nature of the variables involved. It is worth mention that most studies point to correlations between physiological and subjective measures of arousal that range from .66 to .90 in sexually functional males (Rosen & Beck, 1988). Although statistically significant, these correlations show some degree of discrepancy.

Second, unlike most former studies, which have typically used correlational analysis to examine the relationship between subjective and physiological measures of sexual arousal, we also examined the relationship between self-reported genital response and actual genital response. This method allowed a consistent comparison between a participant's self-estimate of erection and its physiological counterpart (calculating percentages of full erection obtained compared to self-estimation) and possibly led to somewhat different conclusions. It should be noted that such a procedure presents some limitations, namely the assumption that the relationship between penile circumference and erection is linear. In fact, some authors (Earls & Marshall, 1982; Metz & Wagner, 1981; Rowland, 1999) have questioned that assumption, demonstrating that penile circumference is not linearly correlated with erection, mainly in both extremes of the continuous erectile response. In their view, penile circumference change may underestimate erection levels in the earlier stages (erection starts before circumference changes are noted) and overestimate them in the final stages (maximum circumference attained before maximum erection). Thus, while the average maximum percentage of tumescence attained in the high arousal films was higher than 80%, it may be possible that penile erection as well as subjective arousal still had a greater margin in which to increase. In this case, the results might not necessarily mean that participants underreported their levels of erection, but that the percentage scores obtained overreported true erection. Moreover, the finding that participants in the low arousal film (with average percentages of full erection around 32%) tended to present less inaccurate estimates of erection (lower underreporting) might also be understood in this manner. In addition, the fact that the calibration procedure used to determine the point of full erection was not counterbalanced might also have introduced some bias, leading to potential habituation effects and underreporting of arousal levels.

On the other hand, it may be that inaccuracy in reporting physiological arousal and a general tendency to report below measured arousal levels, although common in functional samples, is more evident in men with sexual dysfunction. It should be noted that Sakheim et al.'s (1987) findings regarding the tendency for sexually functional individuals to accurately report their erection levels were not absolute. The results were presented in comparison with the self-estimates of a group of men with erectile difficulties. At the same levels of erectile responding, men with erectile disorders due to psychogenic factors consistently underreported their levels of erection compared with sexually functional males and patients with erectile disorders due to organic factors. Because a clinical sample was not used in the present study, this hypothesis was not tested. However, the systematic study of the characteristics of the participants who consistently reported below measured arousal levels indicated that they possessed some of the characteristics that have been identified in the scientific literature as associated with sexual dysfunctional processes. Specifically, low subjective

arousal and low positive affect during exposure to erotica are factors common to our underreporting group and general samples of individuals with sexual dysfunction (Beck & Barlow, 1986; Heiman & Rowland, 1983). A replication of this study using men with erectile disorders is needed to test these tentative explanations.

When we analyzed the role of some potential predictors on sexual arousal (both subjective and physiological) and the accuracy of self-estimates of erection, we found that the results supported some but not all of the proposed hypotheses. Generally, pre-existing sexual attitudes, self-focused attention, and interoceptive awareness (at least as currently measured) showed relatively little relation to subjective or physiological measures of arousal or self-estimates of erection. However, we did find a consistent relationship between general (trait) and situational (state) affect and sexual arousal as well as accuracy of estimation of erection. Interestingly, the results showed a differential impact of these two different facets of emotion on objective and physiological arousal responses. General (trait) negative emotional patterns were associated with somewhat lower levels of subjective arousal but higher levels of physiological arousal. Perhaps as a consequence of this differential impact, individuals with high general negative affect tended to report below measured tumescence levels. General (trait) positive affect, on the other hand, did not seem to influence sexual arousal or its estimates.

When analyzing the impact of situational affect (using PANAS-P), we observed that the positive emotional state and not the negative state consistently correlated with sexual arousal and its estimates. Positive emotions during exposure to erotic material were consistently associated with higher subjective arousal and to a certain degree also physiological arousal. This finding might be related to the fact that positive situational affect slightly increased the accuracy of degrees of erection estimation (less underreporting). Negative situational affect, on the other hand, presented no impact on subjective arousal or physiological response.

The impact of general negative affect on physiological sexual arousal could be interpreted according to recent findings. Negative affect, particularly anxiety, has been reported to increase sexual arousal in both men and women (Barlow, Sakheim, & Beck, 1983; Hoon, Wincze, & Hoon, 1977; Laan, Everaerd, Van-Aanhold, & Rebel, 1993). Moreover, studies regarding the impact of sympathetic nervous system (SNS) activation (the physiological component of anxiety) have consistently indicated a facilitating effect on physiological sexual arousal, especially in women (Meston & Gorzalka, 1996; Palace, 1995; Palace & Gorzalka, 1990). Thus, the tendency toward increased tumescence levels associated with higher negative affect may reflect a transfer of arousal (Barlow, 2002).

On the other hand, lower situational positive affect (positive emotional response during exposure to erotica) impacted negatively on subjective sexual arousal and, to a certain extent, on physiological arousal and accuracy of estimation (higher underreporting). Recent studies (Heiman & Rowland, 1983; Koukounas & McCabe, 2001; Meisler & Carey, 1991; Mitchell et al., 1998; Rowland et al., 1995, 1996) support this finding, indicating that it is the lack of positive affect and not the high levels of negative affect that impact both objective and subjective sexual arousal. Rowland et al. (1995, 1996) have shown that, in contrast with negative affect (operationalized by negative emotions such as worry, anger, disgust, and embarrassment), positive affect (operationalized by emotions such as pleasure, interest, attraction, or excitement) correlates significantly with measures of subjective sexual arousal. Moreover, Koukounas and McCabe (2001) reported that positive feelings show significant positive correlations with both subjective and objective measures of sexual arousal, while boredom is negatively correlated with the same measures. On the other hand, emotions such as anxiety, disgust, and anger show lower positive correlations with sexual arousal. In fact, our results show little if any effect of situational negative emotions on subjective arousal and a slightly positive effect on erection level. We may hypothesize that it is low positive affect (usually associated with depressed mood) that primarily impairs sexual arousal (although the causality of this relationship could not be fully established using our design). The mechanisms that mediate this interference are yet to be understood, but may be associated with decreased autonomic arousal or cognitive processes such as an attentional focus on negative self-statements and evaluations, or some combination of cognitive and emotional factors. Further studies assessing both emotional responses and cognitive content during exposure to erotica in both sexually functional and dysfunctional samples may help clarify the role of cognitive-emotional factors in sexual arousal and the accuracy of its estimation.

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