

How do men and women feel? Determinants of subjective experience of sexual arousal

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Abstract

A common finding in psychophysiological research is that correlations between sexual feelings and genital responses are lower in women than in men. Measurement issues, anatomical differences, factors influencing self-report, and the role of attention have all been considered but do not seem sufficient to explain this gender difference. Providing women with feedback about their genital response, or asking them to focus on genital sensations, does not seem to increase response concordance, suggesting that women are less accurate in detecting genital responses. It is proposed that in both men and women, automatic cognitive processing of sexual meaning activates the genital response. Men and women are believed to differ in the degree to which genital feedback contributes to their subjective experience, and in the likelihood that they process other than sexual meanings. For women, more than men, sexual stimuli convey multiple meanings, and their subjective experience seems more strongly influenced by social and situational cues relevant to, for example, physical and emotional safety, intimacy, and commitment.

According to one of the founding fathers of psychology, William James, bodily responses and emotional experience are two sides of the same emotional coin (James, 1884). In James' theory, bodily (visceral) changes follow directly the perception of the emotional stimulus, and "our feeling of the same changes as they occur IS the emotion" (1884, p. 190). James' position implies that, in order for bodily changes to take this central role, they need to be consciously perceived and processed. What is more, without these bodily changes, "a cold and neutral state of intellectual perception is all that remains" (1884, p. 193). Recent cognitive neuroscience perspectives acknowledge that bodily changes are an apparent aspect of emotional response. According to Damasio (2003), feelings consist, among other things, of "the perception of a certain state of the body" (2003, p. 86).

The question is, however, to what extent bodily changes contribute to emotional experience, and whether this contribution is similar in men and women. James' theory appears less appropriate for women than for men with respect to the experience of sexual emotions. A review of the literature on female sexual arousal reveals that there is little agreement between reported genital sensations and changes in genital vasocongestion (Laan & Everaerd, 1995a). Across studies, correlations between changes in genital vasocongestion and subjective sexual arousal range from significantly negative, to nonsignificant, to significantly positive. In contrast, correlations between genital and subjective sexual arousal in men are usually significantly positive, despite differences in methodology and procedures. Studies designed to compare female and male sexual arousal patterns in one experimental design, thus precluding methodological variation, consistently report higher correlations in men than in women (cf. Dekker & Everaerd, 1988; Heiman, 1977; Wincze, Venditti, Barlow, & Mavissakalian, 1980; Steinman,

Wincze, Sakheim, Barlow, & Mavissakalian, 1981). A very recent study found that the association between genital and subjective sexual arousal was lower for women than for men and postoperative male-to-female transsexuals (Chivers, Rieger, Latty, & Bailey, in press).

Anecdotal evidence suggests that discrepancies between genital response and sexual feelings are not limited to laboratory situations. According to reports of subjects, therapists and patients, women may notice that they have increased vaginal lubrication, but in such instances often do not experience any feelings of sexual arousal, nor any inclination to engage in sexual activity. Other anecdotal evidence suggests that during rape or other types of sexual abuse women may notice increased vaginal lubrication even though they find the situation highly aversive. There have even been reports of women having had an orgasm during such situations (personal communication R.L. Levin, May 2003 and need to add relevant reference).

This paper reviews possible explanations for the observed gender differences in agreement between genital response and sexual feelings, and offers some tentative answers to the question of what, if not genital response, determines the experience of sexual arousal in women.

Measurement artefacts

A number of explanations have been forwarded to explain the low correlations between genital response and sexual feelings in women. The most obvious one is measurement error of instruments designed to assess vaginal vasocongestion. However, low correlations between genital response and sexual feelings are not restricted to a single

measure of genital response (e.g., Slob, Bax, Hop, Rowland, & van der Werff ten Bosch, 1996). Heiman and colleagues compared the most often used instrument to assess vaginal vasocongestion, the vaginal photoplethysmograph, with pelvic MRI during erotic film (Heiman, Maravilla, Hackbert, Delinganis, Heard, Garland, Carter, Weisskoff, & Peterson, 2001). They found that correlations with MRI were even lower than with the vaginal photoplethysmograph.

The discrepancy between genital arousal and sexual feelings in women is not affected by the way in which sexual feelings are assessed (by Likert scales to be filled out directly after exposure to an erotic stimulus or by continuous measures with which the intensity of feelings can be measured concurrent with erotic stimulus exposure) or which sexual feelings are measured (from a single item about sexual or genital sensations to extensive emotion questionnaires with a wide range of possible sexual feelings).

Anatomy and sensitivity

Anatomy or sensitivity?

Many men seem to infer their sexual feelings from changes that take place in their genitals (Sakheim, Barlow, Beck, & Abrahamson, 1984), which is what William James suggested we all do. When it comes to sexual arousal, men are likely to have more cues they can use to detect genital response than women do. Think, for instance, of visual feedback, or tactile feedback when an erect penis is pressing against clothing. It is therefore possible that women can detect their genital responses less easily than men can, for reasons related to the anatomy of the genitals. Even though such cues can aid in making inferences about feelings, the data from Chivers and colleagues (in press) suggest

that they are not strictly necessary. Postoperative male-to-female transsexuals, who lack visual and tactile genital feedback from a penis, showed associations between genital arousal and sexual feelings that were as high as in men. While processes relevant to memory and learning may need to be considered, these findings indicate that direct feedback from the genitalia may not be sufficient in explaining gender differences. According to Damasio's 'somatic marker' hypothesis of consciousness, feelings require the participation of brain regions that are involved in the mapping and/ or regulation of our continuously changing internal states (Damasio, Grabowski, Bechara, Damasio, Ponto, Parvizi, & Hichwa, 2000). Perhaps the gender differences in associations between genital arousal and sexual feelings can be explained by gender differences in the somatosensing regions of the brain, i.e. the insula and the anterior cingulate, reflecting stronger proprioceptive genital feedback to the brain in men than in women. One of the most robust findings from imaging studies of sexual arousal is bilateral activation of the insula (Sumich, Kumari, & Sharma, 2003). One of the few studies comparing brain activity between genders during erotic stimulus exposure using functional magnetic resonance imaging found significant increases in the insula and anterior cingulate, indicating that the mapping of body states had been significantly modified during the process of feeling (Damasio, 2003), but no gender differences in activity in these regions were found (Karama, Lecours, Leroux, Bourgouin, Bedoin, Joubert, & Beaugregard, 2002).

The same study showed that in male subjects only, processing of the erotic cues was also associated with significant activation in the hypothalamus and thalamus. The authors assert that the greater hypothalamic activation found in male subjects implies that

they were more physiologically aroused than the female subjects, and that the greater thalamic activation, mirroring the higher reports of sexual arousal in men, suggests that this region is implicated in the cognitive dimension of sexual arousal. There was a positive correlation between the intensity of sexual feelings and the magnitude of hypothalamic activation in men, but not in women. These findings may suggest that women are less sensitive to sexual stimuli than men are, and that women would need stronger stimuli to reach a comparable level of genital arousal. There is evidence that still pictures evoke genital response in most men (O'Donohue & Geer, 1985) but hardly any in women (Laan & Everaerd, 1995b). It is not clear, however, which visual stimuli would be most arousing for most men, and which visual stimuli would be most arousing to most women. The erotic stimuli used in the study of Karama et al. (2002) were preselected so as to evoke lowest disgust ratings in women, but they were not selected based on their sexually arousing qualities for women. It can therefore not be ruled out that the erotic film excerpts used in this study were less effective in generating sexual arousal in the female subjects, which may have explained the differences in thalamic and hypothalamic activity. Because we cannot directly compare genital responses in men and women it is as yet impossible to say which of the two explanations, the anatomy explanation or the sensitivity (of brain or genitals) explanation, is more likely.

Learning and attention

Perhaps women have learned less well than men to become aware of their sexual responses. Women and men undergo quite different learning experiences in understanding their bodies' signals. Girls are generally discouraged to attend to their

lower body parts. Steiner-Adair (1990) for instance, has argued that society's insistence on the shamefulness of menstrual events is a powerful socialization that encourages young women to turn away from and even mistrust their bodies' physiological cues. With regard to sexual arousal, women are more socialized to restrict knowledge of their genitalia (Gartrell & Mosbacher, 1984). They may not have had the learning experiences that men had to become accurate perceivers of bodily signs of sexual arousal. For instance, in western cultures, more men than women masturbate and the women that masturbate do so less frequently than men (Oliver & Hyde, 1993). Perhaps, masturbatory behavior is the learning experience par excellence in making an individual an accurate perceiver of bodily signs of sexual arousal. Laan, Everaerd, van Aanhoud and Rebel (1993) indeed found that women who masturbate often had higher correlations between both measures of sexual arousal than women who do not or only rarely masturbate. If learning experiences are a key component in the discrepancy between genital and subjective sexual arousal in women, one would predict that instructing women to attend to bodily cues would improve response concordance. A recent study found that correlations between genital arousal and sexual feelings remained low even when women were asked to estimate their genital response during erotic stimulation (Merrit, Graham, & Janssen, 2001). Cerny (1978) found that even when women received feedback concerning their level of vaginal engorgement, correlations were low and statistically non-significant. Conscious efforts of women to monitor their genital response does not seem to enhance response concordance. A recent study however suggests that some type of learning may be involved. Laan and van Lunsen (2002) found that women who were sexually stimulated to orgasm by watching an erotic video combined with clitoral

vibration, evidenced low correlations between genital and subjective sexual arousal, even though vibrotactile stimulation of the clitoris combined with visual sexual stimulation is significantly more genitally and subjectively sexually arousing than visual stimulation alone (Laan, Sonderman, & Janssen, 1995). That study required women to return to the lab two more times, with a few days between sessions, in which they underwent the exact same procedure, including the use of the same visual stimuli. In the second and third session, correlations between genital and subjective sexual arousal were substantially higher. A different focus of attention in the second and third session could account for these findings as well. With the visual stimulus and the laboratory environment being familiar, women may have shifted their attention towards feelings in their genitals, aided by the clitoral stimulation. Their subjective report may thus have been less influenced by their evaluation of the visual stimulus (cf. Laan & Everaerd, 1995, Laan, Everaerd, van Bellen, & Hanewald, 1994).

Social desirability

Now we consider the possibility that women are generally aware of their genital arousal response, but that they, as a result of socialization pressures, women tend to downplay their subjective reports of sexual arousal. Studies into the characteristics of people who are, and people who are not willing to participate in sexuality research convincingly show that participants hold more liberal attitudes towards sexuality, experience less sex guilt, are less sexually inhibited, evaluate explicit sexual stimulus materials more positively, and are more sexually active than non-participants (e.g., Catania, Gibson, Chitwood, & Coates, 1990; Morokoff, 1986). Given that for participants the expression of sexuality is

less restricted than for non-participants, it seems unlikely that underreporting of sexual feelings is a significant factor. But there are other indications that consciously underreporting of sexual feelings, or plain lying, can not be an important explanation for disagreement between genital and subjective response.

Firstly, the phenomenon of response disagreement occurs quite systematically. Unless one wants to assume that all these women are lying, other mechanisms should be at work. Secondly, in a study in which we showed women erotic film clips, but also a clip in which the beginning of rape was shown, most women reported having experienced feelings of anger and resentment during the rape scene, but also feelings of sexual arousal (Laan, Everaerd, & Evers, 1995). The fact that women report sexual feelings during a scene depicting nonconsensual sex makes it unlikely that women would not report sexual feelings during consensual sex scenes. In addition, in a study in which we compared sexual responses of lesbian and heterosexual women we found that women with less liberal sexual attitudes regarding sexuality did not report lower levels of sexual arousal to heterosexual and lesbian film clips (Laan, Sonderman, & Janssen, 1995). And finally, women who scored high on a questionnaire measuring social desirability did not show lower correlations between genital arousal and sexual feelings than women who had low scores on that same questionnaire (Brody, Laan, & van Lunsen, 2003).

To summarize, women seem to be less able to detect genital responses, for reasons related to genital anatomy, sensitivity, or attentional focus. A more important reason for disagreement between sexual response components may be that genital responses may be activated without conscious cognitive control.

Automatic activation of genital response

A surprising finding from our studies was the ease with which healthy women become genitally aroused in response to erotic film stimuli (Laan & Everaerd, 1995). When watching an erotic film depicting explicit sexual activity, most women respond with increased vaginal vasocongestion. This increase occurs within seconds after the onset of the stimulus, which suggests a relatively automatized response mechanism for which conscious cognitive processes are not necessary. Even when these explicit sexual stimuli are negatively evaluated, or induce little or no feelings of sexual arousal, genital responses are elicited. Genital arousal intensity was found to covary consistently with stimulus explicitness, defined as the extent to which sexual organs and sexual behaviors are exposed (Laan, Everaerd, van der Velde, & Geer, 1995). This automatized response occurs in young women without sexual problems, but also in women with a testosterone deficiency (Tuiten, Laan, Everaerd, Panhuysen, de Haan, Koppeschaar, & Vroon, 1994), in postmenopausal women (Laan & van Lunsen, 1997; Laan, van Lunsen, & Everaerd, 2001), and also in women with sexual arousal disorder (Laan, van Driel, & van Lunsen, submitted).

Such a highly automatized mechanism is adaptive from a strictly evolutionary perspective. If genital responding to sexual stimuli did not occur, our species would not survive. For women, an increase in vasocongestion produces vaginal lubrication, which obviously facilitates sexual interaction. One might be tempted to assume that, for adaptive reasons, the explicit sexual stimuli used in our studies represent a class of unlearned stimuli, to which we are innately prepared to respond. These stimuli seem to override the effects of various attempts at voluntary control (Laan et al., 1993).

Emotional stimuli can evoke emotional responses without the involvement of conscious cognitive processes (Spiering & Everaerd, submitted). For instance, subliminal presentation of slides with phobic objects result in fear responses in phobic subjects (Öhman and Soares, 1994). Before stimuli are recognized and processed, they are evaluated, for instance as being good or bad, attractive or dangerous. According to Öhman (1993) the evolutionary relevance of stimuli is the most important prerequisite for such a quick, preattentive analysis. As was argued earlier, perhaps sexual stimuli fall within this category and can they be unconsciously evaluated and processed. A number of experiments in which sexual stimuli were presented subliminally to male subjects showed that this is indeed possible (see Spiering & Everaerd, submitted, for a review).

Preattentive processing of sexual stimuli occurs in women as well, but appears to be dependent upon the type of prime. Explicit sexual primes do not lead to priming-effects, but romantic sexual primes do (Spiering, Everaerd, Both, Karsdorp en Brauer, in preparation). That seems to contradict Öhman's (1993) notion that evolutionary relevant primes can be unconsciously processed. Possibly preattentive processing is not entirely governed by evolution, but partly the result of overlearning or conditioning.

Automatic activation and regulation

A prerequisite of automatic processing seems to be that sexual meaning resulting from visual sexual stimuli is easily accessible in memory. Based on a series of priming experiments Janssen, Everaerd, Spiering, and Janssen (2000) presented an information processing model of sexual response. Two information processing pathways are distinguished (cf. LeDoux, 1996). The first pathway is about appraisal of sexual stimuli

and response generation. This pathway is thought to depend largely on automatic or unconscious processes. The second pathway concerns attention and regulation. In this model sexual arousal is assumed to begin with the activation of sexual meanings in memory. This in turn activates physiological responses. It directs attention to the stimulus and ensures that attention remains focused on the sexual meaning of the stimulus. This harmonic cooperation between the automatic pathway and attentional processes eventually result in genital responses and sexual feelings. Disagreement between sexual response components would occur, according to this model, when the sexual stimulus elicits sexual meanings but also non-sexual, and more specifically, negative emotional meanings. The sexual meanings activate genital response, but the balancing of sexual and nonsexual meanings determine to what extent sexual feelings are experienced.

The fact that disagreement between genital and subjective sexual arousal occurs more often in women might suggest that for women sexual stimuli have, more often than for men, sexual but also nonsexual or even negative meanings. There is some evidence that sexual stimuli generate negative sexual meanings in women more often than in men (Dekker, 1988; Everaerd, 1993). Sexual stimuli evoke mostly sexual emotions in men, but a host of other nonsexual meanings, both positive and negative, in women.

What is needed to experience sexual feelings? We hypothesize that the experience of sexual arousal is the result of an amalgam of stimulus characteristics (content and intensity), unconditioned and conditioned autonomic nervous system (ANS) responses, and conscious assessment of the response as 'sexual'. Experience of sexual arousal, which by definition involves awareness, is hypothesized to depend on what is retrieved from explicit (declarative) memory. The conscious balancing of sexual and nonsexual

meanings evoked by the sexual stimulus, eventually determines the intensity of our sexual feelings. We have recently started a series of studies aimed at establishing that genital sexual arousal is possible without awareness of the sexual stimulus, but that sustained sexual response (both genital arousal and sexual feelings) requires awareness of the stimulus and hence the involvement of explicit memory.

‘Male’ and ‘female’ regulation?

We presume that this information processing model of sexual response applies to both men and women. Sexual meanings of the stimulus will automatically generate a genital response, granted that the genital response system is intact. The difference between men and women in experienced sexual feelings have to do with the relative contribution of two sources. The first source is the awareness of this automatic genital response (peripheral feedback), which, as was argued above, will be a more important source for men’s sexual feelings as for women’s sexual feelings. For women a stronger contribution to sexual feelings will come from a second source, the meanings generated by the sexual stimulus. In other words, women’s sexual feelings will be determined to a greater extent by all kinds of (positive and negative) meanings of the sexual stimulus, meanings that are stored in explicit memory.

Canli, Desmond, Zhao, and Gabrieli (2002) found support for the idea that emotional stimuli activate memory more readily in women than in men. They asked 12 women and 12 men during functional MRI to rate the intensity of their emotional arousal to 96 neutral to negative pictures. After three weeks they were given an unexpected memory task. It was found that women rated more pictures as highly negatively arousing than did men. The memory task revealed that women had better memory for the most

intensely negative pictures. Exposure to the emotional stimuli resulted in left amygdala activation in both sexes, the central brain structure for implicit memory (LeDoux, 1996). In women only, the left amygdala and right hippocampus were activated during the most emotionally arousing stimuli that were also recognized three weeks later. Explicit memory is situated in the neocortex and is mediated by the hippocampus (Squire, 1992). These findings may suggest that in processing emotional stimuli, explicit memory is more readily accessible in women. If these findings would hold for sexual stimuli, we may have a neural basis for our suggestion that sexual stimuli activate explicit memory in women, and that the different meanings sexual stimuli may have, influence sexual feelings.

Our hypothesis is that in women other (stimulus or situational) information beyond stimulus explicitness determines sexual feelings, whereas for men peripheral feedback from genital arousal (and thus stimulus explicitness) is the most important determinant of experience of sexual arousal. This hypothesis fits well with the observed gender difference in response concordance. It coincides with Baumeister's (2000) assertion that women evidence greater erotic plasticity than men. After reviewing the available evidence on sexual behavior and attitudinal data of men and women he concluded that women's sexual responses and sexual behaviors are shaped by cultural, social, and situational factors to a greater extent than men's.

Both women's and men's sexuality are likely to be driven by an interaction of biological and sociocultural factors. Evolutionary arguments often invoke differential reproductive goals for men and women (e.g., Buss & Schmidt, 1993). The minimal reproductive investment for females is higher than for males. Given these reproductive

differences, it would have been particularly adaptive for the female, who has a substantial reproductive investment and a clearer relationship to her offspring, to manifest strong attachments to her infants but also to be selective in choosing mates who can provide needed resources. This selectivity mandates a complex, careful decision process that attends to subtle cues and contextual factors. Consistent with men's and women's reproductive differences, Bjorklund and Kipp (1996) proposed that cognitive inhibition mechanisms evolved from a necessity to control social and emotional responses.

Social and situational cues and sexual feelings

Concurrent with our hypothesis we predict that variations in gender-relevant social and situational factors accompanying explicit sexual stimuli will affect experience of sexual arousal in women, but not in men. Genital arousal in women as well as in men will be a function of stimulus explicitness and will not vary with social and situational manipulations. In a first experiment to test this hypothesis we showed 33 men and 36 women a female-initiated and female-centered erotic film, and a male-initiated and male-centered erotic film (Laan, in preparation). Both film types were matched for explicitness and sexual activity. As predicted, genital responses of men and women were similar to both types of film. In women, subjective sexual arousal to the female-initiated film was higher than to the male-initiated film, despite the absence of differences in genital arousal. Sexual feelings of men did not differ between films.

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