

Facial EMG Patterning as a
Measure of Affective Processes During the
Presentation of Erotic Stimuli

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ABSTRACT

Forty female volunteers participated in a study designed to investigate whether facial EMGs could be used as reliable measures of affect during sexual arousal. Audiotaped narratives were used to induce the following affect states; non-sexual-pleasant, non-sexual-unpleasant, sexual-pleasant, sexual-unpleasant. EMG activity was recorded bilaterally from the corrugator and zygomatic muscle regions. Heart rate was recorded throughout the stimulus period. Consistent with previous research, our data show significantly greater left corrugator muscle activity in response to unpleasant than to pleasant stimuli. This relationship held for both the non-sexual and sexual stimulus conditions, suggesting that corrugator muscle activity may be a reliable index of negative affect during sexual arousal. Zygomatic muscle activity was significantly greater during sexual than non-sexual stimuli, but did not increase as a function of positive affect. Laterality findings were consistent with previous research showing significantly greater left than right muscle activity, regardless of the emotion expressed. Findings were also consistent with research suggesting that sexual arousal is mediated predominantly by the right hemisphere. Heart rate activity was significantly greater in response to the pleasant narratives than to the unpleasant narratives. Conceptual and methodological issues relevant to the study of emotion are discussed

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Introduction

In recent years, research on human sexuality has come to rely on the measurement of genital responses as an objective index of sexual arousal. Since the development of the penile plethysmograph (Freund, 1957) and strain gauge (Barlow, Becker, Leitenberg, & Agras, 1970), and the vaginal photo-plethysmograph (Geer, Morokoff & Greenwood, 1974), numerous studies have shown that significant changes in the genitals occur following the presentation of erotic stimuli. The presentation of non-erotic stimuli failed to evoke these responses in both males (Schaeffer, Tregertan, & Colgan, 1976; Laws, 1977) and females (Geer et al., 1974; Hoon et al., 1976; Heiman, 1977). Evidence of genital changes specifically to psychosexual stimulation has argued well for the use of these instruments as precise measures of human sexual arousal.

When the relationship between subjective and genital measures of sexual arousal has been examined, the literature suggests that for males, there exists a relatively strong correspondence (McConaghy, 1967; Mavissakalian, Blanchard, Abel, & Barlow, 1975). With respect to females, early findings reported this relationship to be somewhat variable. For example, Geer et al. (1974) and Quincey, Steinman, Bergerson, & Holmes, (1975) found little correlation between subjective and physiological measures of sexual arousal. More recently however (Heiman, 1977; Wincze, Hoon & Hoon, 1977; Cerny, 1978; Henson, Rubin & Henson, 1979; Harris, 1980) research has shown that these measures covary significantly. Harris (1980) has argued that, based on the evidence presently available, there are no acceptable a priori reasons for selecting physiological responses in preference to subjective report as a valid measure of sexual arousal.

Self-Report Measures of Sexual Arousal

At present, self-reports constitute our major source of information concerning a subject's feelings and perceptions during psychosexual stimulation. It is becoming increasingly clear however, that caution should be exercised in the interpretation of these data.

Factors which have been shown to influence self-report measures include the demand characteristics of the experimental situation (Amoroso, Brown, Pruesse, Ware, & Pilky, 1972), personality variables (Schmidt & Sigush, 1969), social desirability (Steinman, Wincze, Sakhein, Barlow, & Mavissakalian, 1981), attitudinal factors (Fehr & Schulman, 1978) and sex guilt (Mosher & Abramsom, 1977). Similarly, the type of self-report instrument, the time at which it is administered, and the instructional set given to the subject are likely to influence the nature of the response. Amoroso and Brown (1973) make the point that, given the sensitive nature of the subject of sex, we would be foolish to overlook the possibility of a variety of response biases.

Recently, a few studies have attempted to circumvent some of the problems associated with traditional self-report instruments by using a procedure which provides continuous subjective information (Wincze, et al., 1977; Farkas, Sine & Evans, 1979; Courey, 1981). The instrument consists of a variable resistance potentiometer which can be rotated between two endpoints to indicate moment-to-moment changes in degree of subjective sexual arousal. The major advantage of the "cognitive lever" is that changes in subjective reactions can be recorded throughout the duration of the stimulus presentation, rather than retrospectively in the form of a single global or average

reaction. Studies examining the relationship between subjective reports measured by the cognitive lever, and vaginal measures have reported correlations of as high as .78 (Wincze et al., 1977; Harris, 1980). This instrument however, may be most useful in the measurement of female subjective sexual arousal. Wincze (1980) demonstrated that the cognitive lever significantly attenuates penile tumescence in males, but has no effect on vaginal responses in females. Wincze attributed this attenuation to the distracting properties of the lever. Distraction has been shown to be a potent inhibitor of penile tumescence (Geer & Fuhr, 1976; Farkas et al., 1979).

It should be noted, that despite the methodological advantages of the cognitive lever, at least in the study of female sexuality, the device remains subject to many of the previously mentioned shortcomings of subjective self-reports.

Erotic Stimuli

To date, there seems to be no standardized criteria on which to base the selection of erotic stimuli. This has resulted in the use of a wide range of erotic stimuli often chosen on the basis of experimenter intuition. For example, descriptions of erotic film stimuli include "explicit sexual behaviors" (Henson et al., 1977), "a woman's seductive behavior" (Roviaro & Holmes, 1980) or "a couple engaged in foreplay" (Farkas et al., 1979). Still others give descriptions of a variety of erotic slides and narratives. The degree to which these stimuli vary in arousal capacity may account, at least in part, for discrepancies among the findings of different investigators. The pre-testing of stimulus materials has obvious advantages over experimenter intuition, yet relatively few studies

have made this effort.

An equally important issue concerns the extent to which these erotic stimuli also produce affect states other than sexual arousal. Although investigators have generally assumed their materials were pleasantly sexually stimulating, such materials can also induce affect states of disgust, guilt or anxiety. Fehr and Schulman (1978) reported that subjects who perceived an erotic passage as unpleasant, rated it as less sexually arousing and more anxiety provoking. Furthermore, while reading pleasant erotic passages led to decreases in heart rate, unpleasant erotic passages resulted in significant increases in heart rate. Since the researchers failed to monitor other physiological responses, it remains unclear to what extent other changes may have taken place. The study did nevertheless demonstrate that different affect states may have facilitative or inhibitory effects on sexual arousal. Fehr and Schulman argue that failure to identify affect states induced during the presentation of erotic stimuli may seriously confound the interpretation of results.

Clinical findings that dysphoric mood states such as depression and anxiety interfere with sexual functioning have prompted laboratory research on the effects of these and other affect states on sexual arousal. Two commonly used paradigms include a) the effects of prior mood states on subsequent response to erotica and b) the effects of compound stimuli (i.e. affect inducing stimuli presented concurrently with erotic stimuli) on sexual arousal.

Prior Mood States and Response to Erotica

Consistent with clinical evidence, it has been demonstrated that depression attenuates physiological and subjective responses to

erotica. Wolchik et al. (1980) found that male subjects previously exposed to a film depicting a fatal car accident, experienced significantly lower sexual arousal during the presentation of a sexually explicit film. Also consistent with clinical evidence are the findings of Roviario and Holmes (1980) that prior induction of anxiety results in reduced sexual arousal during the presentation of erotic stimuli. In contrast to these findings, Hoon et al. (1977) reported that prior induction of anxiety has a facilitative effect on subsequent sexual arousal. Wolchik, Beggs, Wincze, Sakheim, Barlow, and Mavissakalian (1980) attempted to reconcile these contradictory findings by suggesting that a curvi-linear relationship may best describe the relationship between anxiety and sexual arousal. However, because of the dearth of available evidence, it may be premature to draw firm conclusions about the nature of the relationship between these arousal states.

Compound Stimuli and Response to Erotica

Studies in this area have primarily evaluated the role of aggression on responses to erotica. In a number of studies (Malamuth, Feshback & Jaffe, 1977; Malamuth & Spinner, 1980; Malamuth, Heim & Feshback, 1980), it has been shown that the inclusion of aggressive elements in erotic stimuli results in higher subjective ratings of sexual arousal. However, when elements of "disgust" are included in violent erotic stimuli, subjective ratings of sexual arousal have been attenuated. In one study (Malamuth et al., 1980), subjects read erotic stories which varied according to whether or not they included descriptions of a woman's experience of pain and disgust during sexual intercourse. Results showed that, for both males and females, erotic

narratives describing a woman's experience and disgust led to significantly reduced levels of reported sexual arousal. Recently, Malamuth and Check (1981) found that reports by males of lowered sexual arousal in response to erotic themes which included disgust were accompanied by a comparable reduction in penile tumescence.

Problems in Studying the Influence of Affect States on Sexual Arousal

A major unresolved problem in the studies previously described concerns the lack of an objective measure to determine whether, and to what extent a particular emotional state has been successfully induced. As mentioned, most studies have used retrospective self-reports as their primary source of data. Implicit in this methodology is the assumption that subjects possess the ability to accurately recall, isolate and quantify their affective experiences during the presentation of erotic stimuli. The 'averaging process' characteristic of subjective recall (Bentler & Abramson, 1981), and the transient nature of many affective states (Cacioppo & Petty, 1981) cast doubt on the validity of this assumption and on over-reliance upon self-report measures.

The Measurement of Affect States

As early as 1872, Darwin reported data on the cross-cultural and cross-species stability of facial emotional expression. Drawing on the anatomical and physiological data then available, notably from Bell (1844) and Duchenne (1862), Darwin hypothesized that not only could emotions be differentiated by the facial expressions exhibited, but that these patterns of facial muscle responding were in a large part innate and therefore universal. This same notion was later echoed by the works of Ekman and Izard (cf. Izard, 1977) on the cross-

cultural stability of emotional facial expression. When a few key studies failed to replicate cross-cultural stability of facial emotional expression, research was essentially halted. However, using a more sophisticated stimulus and facial rating procedure, Ekman (1973) and Izard (1977) have reported that at least six overt facial expressions are cross-culturally observed and labelled as distinct emotions. These include fear, anger, happiness, sadness, disgust and surprise.

Direct recording of facial muscle activity constitutes the most recent advance in the study of facial emotional expression. For example, Schwartz and his colleagues have demonstrated the usefulness of monitoring facial EMG activity at the corrugator, zygomatic and depressor muscle sites in studies of emotional imagery (Schwartz, Fair, Salt, Mandel, & Klerman, 1976; Schwartz, Fair, Mandel, Salt, Mieske, & Klerman, 1978; Schwartz, Ahern & Brown, 1979; Schwartz, Brown & Ahern, 1980). In one study (Schwartz et al., 1976), subjects were asked to imagine positive and negative events in their lives. The experiment demonstrated that increased EMG activity in the depressor and zygomatic muscles was associated with imagining positive events. Increases in corrugator activity were associated with imagining negative events. More recently (Sirota & Schwartz, 1982), it has been shown that recording from the zygomatic and corrugator muscle regions was sufficient to discriminate positive and negative affect. Dimberg (1982) examined subjects facial muscle reactions to viewing photographs of happy and sad faces. Consistent with the findings of Sirota and Schwartz (1982), he found increases in corrugator activity in response to sad faces and increases in

zygomatic activity in response to happy faces. Similar findings were reported by Cohen and Thayer (1982) examining facial muscle responses to happy and sad music. It is interesting to note that facial EMG responses could successfully discriminate different emotions being experienced by subjects even when these were not discernable by judges observing the subjects' faces. Schwartz et al. (1980), in an investigation of sex differences in facial EMG responding to emotional imagery, demonstrated that females, as compared to males, a) generate facial EMG responses of greater magnitude, b) report a stronger experience of emotion and, c) show greater within-subject correlations between emotional imagery content and facial EMG responses.

Hemispheric Specialization of Emotional Expression

Recent research on cerebral specialization has suggested that the right cerebral hemisphere may be more involved in the mediation of affective tone than the left cerebral hemisphere. Using lateral eye movements as an indication of asymmetric hemispheric engagement Schwartz, Davidson and Maer (1975) reported that in intact right-handed subjects, emotional questions elicited greater right hemispheric activation than comparable non-emotional questions.

Similar findings were reported by Schwartz et al. (1979) in a study examining bilateral facial EMG responses to emotional stimuli. The procedure in this study was essentially identical to that employed by Schwartz et al. (1976). In order to induce positive and negative affect states, subjects were required to engage in affective imagery. On the basis of a report by Kinsbourne (1978) suggesting that approach and avoidance behaviors may be mediated respectively by the left and right hemispheres, the authors predicted that positive emotions would

elicit relatively greater right facial muscle activity while negative emotions would elicit relatively greater left activity. The results of the study showed that, regardless of the affective state, left muscle activity exceeded right muscle activity. Sex differences indicating greater lateralization in females were also found.

Sirota and Schwartz (1982) reexamined the laterality question using a more stringent subject selection criterion. Following the mood induction procedure, subjects were requested to rate the intensity of their subjective emotional experience. Subjects whose levels of self-reported affect did not show at least a 50% change from baseline in the expected direction were excluded from the analyses. In addition, right handed subjects who had left handed parents or siblings were also excluded. The results showed a significant three-way interaction (handedness X emotion X left-right muscle activity), on the basis of which the authors concluded that right zygomatic activity is especially sensitive to positive emotions and that left corrugator activity is especially sensitive to negative emotions.

Another procedure which has proven useful in demonstrating lateralization of facial emotional response involves splitting photographs of full faces along the vertical midline and constructing composite photographs; one made up of the left side of the face and one made up of the right. Sackiem, Gur and Saucy (1978) have shown that the left side composites were consistently judged to express negative emotions more intensely than the right side composites. No significant differences were found in ratings of intensity of emotion between left side and right side composites for positive emotions. Bruyer (1981) used the same procedure to demonstrate lateralization of

emotion in brain damaged subjects. Consistent with the findings of Sackeim et al. (1978), Bruyer's results indicated that the left face composite photographs were judged as more expressive than right face composite photographs a) if the patient was left injured and b) when the expression was not a smile. Based on these findings, Bruyer concluded that while negative emotions appear to be mediated by the right hemisphere, positive emotions may be under bilateral central control.

Attempts to determine the central anatomical regions responsible for the integration and expression of emotional responses have primarily involved the study of brain damaged patients. Ross and Mesulam (1979) described two patients who lost the ability to express emotions through speech or through facial expression following infarctions of the right hemisphere. Computerized tomographic scans revealed that both lesions were localized in the temporo-parietal regions of the right hemisphere. The authors suggested that this area may be responsible for the integration and production of affective expression.

It is interesting to note that the right temporo-parietal regions have also been implicated in the experience of sexual arousal and orgasm. Cohen, Rosen and Goldstein (1976) found significant changes in right hemisphere parietal EEG activity when subjects engaged in genital self-stimulation. Based on these findings, and on the evidence suggesting a localization of emotional production processes in the right parietal regions, it is not unreasonable to assume that, like other emotional states, sexual arousal may be associated with a distinct facial EMG pattern.

The Present Study

The purpose of the present study is to examine whether facial EMG responses can be used as a continuous objective measure of affect states during psychosexual stimulation. Such a measure would lessen the present dependence on self-report measures and would permit, for the first time, precise evaluation of affect states co-occurring with sexual arousal in response to laboratory erotic stimuli. It would also provide a methodology for the more rigorous investigation of the relationship between affect states and sexual arousal. Successful differentiation of affective tones experienced during the presentation of erotic stimuli, through the use of facial EMGs would provide a powerful supplement to traditional self-report measures.

Female subjects listened to audiotaped narratives in which affective and erotic content varied. The narratives were adaptations of the stimuli used by Heiman (1977) and Malamuth and Check (1983). The first narrative was designed to generate positive affect and sexual arousal. A second generated negative affect and sexual arousal. The utility of monitoring facial EMG patterning as a continuous, objective measure of affect states during psychosexual stimulation was determined by the extent to which patterns of facial muscle activity can successfully discriminate the two affect states.

As noted earlier, it is possible that sexual arousal may be associated with a distinct pattern of facial muscle activity. Should this be the case, differential facial EMG patterning may be reflective of changes in sexual arousal rather than changes in affective tone. To control for this possible confound, two additional narratives were added containing the following stimulus elements: a) positive affect,

non-sexual and b) negative affect, non-sexual. The addition of these two groups permitted replication of the Schwartz findings that facial EMG patterning can differentiate positive and negative affect and, enabled us to compare quantitative and/or qualitative changes in facial muscle activity when affective tone was held constant and sexual arousal is varied. Any qualitative differences in facial EMG patterning occurring as a function of sexual arousal would indicate that sexual arousal is associated with a distinct pattern of facial muscle activity.

As a second physiological measure of positive and negative affect, heart rate was recorded continuously throughout the stimulus presentation. Fehr and Schulman (1978) have shown that heart rate covaries with affective tone of the erotic stimuli.

In this study, all subjects were asked to complete the Sexual Opinion Survey (SOS), the Sexual Arousability Inventory (SAI), the Bentler Heterosexual Experience Scale, and a stimulus-affect rating form. The SOS is a measure of erotophobic-erotophilic disposition and has been shown to mediate approach-avoidance responses to sexual stimuli (Fisher, Byrne & White, 1981). The SAI is a measure of the degree of sexual arousal individuals say they feel to a wide variety of erotic situations. The SAI has been shown to be related to satisfaction of sexual responsivity, frequency of intercourse, and awareness of physiological changes during sexual arousal. As sexual experience has been shown to influence arousability ratings of erotic stimuli (Griffith, 1975), the Bentler Scale and a question relating to the number of sexual partners were included. The stimulus-affect ratings form was used to assess subjective affective reactions to the

stimulus tapes. These measures were included to control for individual differences in response to erotic stimuli. Subjective sexual arousal was assessed using the cognitive lever.

An issue closely related to individual differences concerns the degree to which women who participate in sexuality research are comparable to women in the general population. For example, Courey (1981) noted that women who participated in a study involving the use of genital measures, were more liberal with respect to sexual issues and more sexually experienced than women who withdrew from the study. For purposes of generalizability, obtained scores on selected variables were compared to a number of studies employing similar measures.

Method

Subjects

As noted in the introduction, Schwartz and his colleagues have shown that females are particularly well suited for research using facial EMGs. For this reason, only female subjects were used in the present study. They were recruited through classroom soliciting and advertisements posted throughout the Concordia and McGill University campuses.

A total of 60 female volunteers participated in the research. Twenty subjects were used to pre-test the stimuli, and the remaining 40 were used in the actual experiment. All subjects were randomly assigned to one of the four stimulus conditions. There were no cases of subject withdrawal. A full description of subsequent aspects of subject participation appears in the Procedure section.

Apparatus

Facial EMG activity was recorded from miniature Beckman silver-silver chloride electrodes (diameter = 4mm) placed bilaterally over the zygomatic and corrugator muscle regions. All electrodes were referenced to a single ground electrode placed on the center of the forehead. Heart rate was monitored by a Grass Model PTT16 Photoelectric plethysmograph placed on the left index finger.

All physiological recordings were amplified by 6 channels of a Grass Model 7B polygraph. EMG electrodes were coupled to four Wide Band AC preamplifiers (Model 7P511) capable of monitoring electromyographic activity. Raw EMG was written out on the polygraph with a full scale pen deflection of 40 mm (1 mm = 45 uV). Heart rate was recorded and integrated through a Grass Model 7P4 EKG-Tachograph. The cognitive lever was driven through a Grass Model 7DAE DC amplifier. A Sony Model TC-270 was used to present the stimuli. An Apple II microprocessor and Graphics Tablet were used to digitize EMG output.

Procedure

Women interested in participating in the study were requested to contact the investigator (male) by telephone. A brief description of the study was given to the subject at that time and an appointment was arranged. All subjects were tested by one of three investigators; one female and two males.

When the subject arrived at the lab, a detailed description of the procedure was given (Appendix A). All subjects were required to sign a consent form before entering the study (Appendix B). When written consent was given, the subject was led into a sound attenuated and temperature controlled room and seated in a reclining chair. Eight small surface electrodes were placed on the subject's corrugator and zygomatic muscle regions, and a ground electrode was placed on the center of the forehead. The zygomatic electrode placement was approximately 2 cm. below the outer corners of eyes near the cheekbone. The corrugator electrode placement was 1 cm. above the eyebrows and approximately 2 cm. to the left and right of the nasal midline. These placements correspond to those described by Sirota and Schwartz (1982). Prior to the attachment of the electrodes, the skin was cleaned and lightly abraded. Beckman electrode paste was used as the conducting medium. All inter-electrode resistances were reduced to less than 10,000 ohms.

Subjects first listened to a 7 minute relaxation tape selected from Goldfried and Davidson (1976), following which they completed the stimulus-affect rating form (Appendix C). When the rating form had been completed, subjects were informed as to which stimulus condition they had been assigned. At this point, subjects had the opportunity

to withdraw from the study by pressing a signal button. If the subjects wished to continue, they were instructed that the narrative tape would begin in one minute.

The rationale for this manipulation was two-fold. It was felt that by making the subjects aware of the content of the stimulus narrative, their expectancies would correspond more closely with the stimulus material and hence reduce the possibility of a confound. Furthermore, given the sensitive nature of some of the stimulus material, subjects were provided this additional opportunity to withdraw.

If the subject did not signal the experimenter during the one minute 'decision period', she then listened to one of four audiotaped narratives corresponding to the condition to which she had been assigned (Appendix D). Although the actual texts varied in length, the running time of each narrative was equated by pacing the rate of speech. All stimulus narratives were approximately 5 minutes in length. At the conclusion of the narrative audiotape, the electrodes were removed and the subjects completed a second stimulus-affect rating form, the SOS, the SAI and the Bentler Scale (Appendix E).

Data Reduction

EMG Measures

Polygraph chart speed was reduced to 5mm/sec. such that the output resembled a solid bar of ink which increased in height as a function of increased pen deflection (amplitude). The Apple II Graphics Tablet was then used to digitize the output. Data were sampled in 15 sec. blocks at 10 sec. intervals. Using the Graphics Stylus to trace the boundaries of each block, the area of these was calculated in square millimeters.

As a certain degree of subjectivity was involved in the identification and exclusion of artifact, EMG measures were scored independently by two experimenters who were blind with respect to stimulus condition. The average of these scores was computed and used in all subsequent analyses. The sixth minute of relaxation was used as the baseline for all physiological measures.

Results

Since there has been some concern over whether women who participate in sexuality research are typical of the general population, a number of sample characteristics are presented in order to provide information relevant to the limits of generalizability.

Sample Characteristics

The mean age of the sample was 23.7 years with a range of 18 to 39 years. Mean number of years of education was 15.1 with a range of 11 to 20 years. Of the 40 participants, 28 were students, 10 were employed and 2 were housewives. Thirty subjects were single, 5 were married or living with a partner and 5 were divorced or separated. The mean number of sexual partners was 6.6 with a range of 0 to 15.

Sexual Arousal Inventory (SAI)

The SAI requires subjects to rate, on a 7 point scale, the degree to which they find each of 28 activities to be sexually arousing. The ratings range from -1 indicating 'adversely affects arousal, repulsive, distracting' to 5 indicating 'almost always causes sexual arousal, extremely arousing'. Scores can range from a minimum of -28 to a maximum of 140, with the total score being the algebraic sum of positive and negative ratings.

Hoon et al. (1976) reported a mean score of 88 (SD = 19.9) for their normative sample. In the present study, a comparable mean score of 90.8 (SD = 17.0) was obtained.

Sexual Opinion Survey (SOS)

The SOS requires subjects to rate, on a 7 point scale, their degree of agreement or disagreement with 21 statements about a variety

of sexual topics. Possible scores range from 21 to 147, where high scores are indicative of positive attitudes about sex and the low scores reflect negative attitudes.

The present sample yielded a mean score of 97.9 (SD = 17.2). These scores are substantially higher than those reported by Kalogeropoulos (1982) in a sample of 25 heterosexual women (M = 71.8, SD = 15.8).

Bentler Heterosexual Experience Scale

This scale consists of 21 items describing a hierarchy of sexual activities ranging from one minute of continuous lip kissing to mutual oral stimulation of genitals to mutual orgasm. The items are tallied to yield a single score of sexual experience which can range from 0 to 21.

Although no normative data are available for this scale, Harris (1981) reported a mean of 17.9 (SD = 2.7) in a sample of 53 heterosexual women who participated in a study examining the relationship among various physiological and subjective measures or sexual arousal. The present study yielded a mean of 18.8 (SD = 2.8).

Relationship Among Descriptive Variables

Pearson product-moment correlations revealed that the SAI, SOS and Bentler scales were all significantly positively correlated. Although there are no previous reports examining the relationship between the SOS and the two other scales, Hoon et al. (1976) reported a correlation of .42 between the SAI and the Bentler Scale. As shown in Table 1, a comparable correlation of .41 was obtained in this study.

All three scales were positively correlated with number of sexual

TABLE 1

Correlations Among Descriptive Variables

	SOS	SAI	BENTLER
SOS			
SAI	.55**		
BENTLER	.32*	.41**	
SEX PARTNERS	.45**	.50**	.27*

* p < .05

** p < .01

partners. These results appear in Table 1. A significant positive correlation ($r = .43$, $p < .01$) was found between age and number of sexual partners. Age did not correlate significantly with any other descriptive variable.

Statistical Design and Analysis

The present experiment evaluated the combined effect of two independent variables simultaneously; namely, a sexual variable and an affect variable. The data were therefore analyzed as a fixed model, two-way factorial design with two factors and two levels of each factor. Baseline measures were used as covariates.

On the sexual dimension, the first level included the stimulus conditions which contained sexual elements: sexual-pleasant and sexual-unpleasant. The second level included those which did not contain sexual elements: non-sexual-pleasant and non-sexual-unpleasant. This factor will be referred to as the sex factor.

With respect to the affective dimension, the first level included the stimulus conditions aimed at producing a positive affect state: sexual-pleasant and non-sexual-pleasant. The second level included those aimed at producing a negative affect state; sexual-unpleasant and non-sexual-unpleasant. This factor will be referred to as the affect factor.

Individual Difference Measures

Two-way (sex x affect) analyses of variance (ANOVA) did not reveal any significant differences among the four stimulus conditions on the SAI, SOS and Bentler scales. These results are presented in Table 2.

TABLE 2

Cell Means and Ratios for SAI,
SOS and Bentler Scales

SAI

SOS

	pleasant	unpleasant
sexual	95.5	93.3
non-sexual	85.1	92.0

SEX $F(1,36) = 1.08$ ns
 AFFECT $F(1,36) = .19$ ns
 S x A $F(1,36) = .68$ ns

	pleasant	unpleasant
sexual	60.7	58.9
non-sexual	58.1	60.5

SEX $F(1,36) = 1.34$ ns
 AFFECT $F(1,36) = .62$ ns
 S x A $F(1,36) = .41$ ns

Bentler

	pleasant	unpleasant
sexual	19.8	19.0
non-sexual	17.8	18.8

SEX $F(1,36) = 1.53$ ns
 AFFECT $F(1,36) = .08$ ns
 S x A $F(1,36) = 1.10$ ns

Stimulus-Affect Ratings

Pre-test. In order to assess the effectiveness of the stimuli in producing the intended affect states, 20 subjects (5 per condition) listened to and rated one of the narratives. Two-way ANOVAs were performed to determine whether the groups differed significantly on relevant dimensions. The narratives with sexual content were rated as significantly more sexually arousing than those with no sexual content, $F(1,16) = 91.3, p < .01$. With respect to affective tone, the unpleasant narratives were rated as significantly more negative, $F(1,16) = 8.4, p < .01$, and unpleasant, $F(1,16) = 18.3, p < .01$, than the pleasant narratives.

End of Relaxation (Baseline). To ensure that the various conditions were comparable with respect to baseline affect ratings, subjects completed a stimulus-affect rating form following the relaxation tape. Two-way ANOVAs were performed on the following affective dimensions: pleasant-unpleasant, good-bad, happy-sad, sexual-non sexual. There were no significant differences among the stimulus conditions on any of the above ratings. Cell means and F ratios for these variables appear in Table 3.

End of Stimulus. Subjective ratings of affect following the stimulus tapes were analyzed using two-way (sex x affect) analyses of covariance (ANCOVA) where post-relaxation ratings were used as covariates. Examination of the covariate by condition interactions revealed that the assumption of homogeneity of regression had not been violated.

A significant sex main effect was obtained, $F(1,35) = 22.3, p < .01$, for subjective ratings of sexual arousal. A Neuman-Keuls

TABLE 3

Cell Means for Selected Post - Relaxation
Affect Ratings

1 = pleasant
7 = unpleasant

pleasant unpleasant

sexual	6.20	6.10
non - sexual	6.20	6.10

SEX $F(1,36) = .01$ ns
AFFECT $F(1,36) = .08$ ns
S X A $F(1,36) = .01$ ns

1 = good
7 = bad

pleasant unpleasant

sexual	2.50	2.30
non - sexual	1.90	2.10

SEX $F(1,36) = .05$ ns
AFFECT $F(1,36) = .01$ ns
S X A $F(1,36) = .26$ ns

1 = happy
7 = sad

pleasant unpleasant

sexual	3.20	2.90
non - sexual	2.90	3.20

SEX $F(1,36) = .01$ ns
AFFECT $F(1,36) = .01$ ns
S X A $F(1,36) = .08$ ns

1 = non-sexual
7 = sexual

pleasant unpleasant

sexual	1.70	1.90
non - sexual	2.00	1.90

SEX $F(1,36) = .09$ ns
AFFECT $F(1,36) = .01$ ns
S X A $F(1,36) = .07$ ns

post hoc multiple comparison revealed that both sexual conditions were rated as significantly more sexually arousing than the non-sexual conditions. The sexual-pleasant and sexual-unpleasant conditions did not differ significantly with respect to levels of self-reported sexual arousal.

Significant main effects due to affect were obtained for ratings on the following affective dimensions: 'pleasant-unpleasant', $F(1,35) = 17.4$, $p < .01$; 'felt good-felt bad', $F(1,35) = 24.5$, $p < .01$; 'felt happy-felt sad', $F(1,35) = 14.3$, $p < .01$. Post hoc analyses revealed that, the sexual pleasant condition was rated as significantly more pleasant than both unpleasant conditions. The non-sexual-pleasant condition was rated as significantly more pleasant than the non-sexual-unpleasant condition while it did not differ significantly from the sexual-unpleasant condition. This same pattern of differences was obtained for ratings of 'felt good-felt bad' and 'felt happy-felt sad'. Cell means (adjusted for covariates) corresponding to these F ratios are presented in Table 4.

Analysis of Physiological Measures.

Inter-rater Reliability. As noted earlier, two experimentors independently scored the EMG data. Pearson product-moment correlations were computed between the scores obtained by the two experimentors for 30 to the 40 subjects. Correlations ranged from .74 to .98 with a mean of .90.

In order to obtain a single score for each muscle group, the EMG data for the second, third and fourth minutes of the stimulus period were averaged. This time period was judged by the experimentors to contain the most salient affective components.

TABLE 4

Cell Means for Selected Post-Stimulus
Affect Ratings

1 = pleasant
7 = unpleasant

1 = good
7 = bad

	pleasant	unpleasant
sexual	5.09	3.10
non-sexual	4.59	2.10

	pleasant	unpleasant
sexual	2.41	4.74
non-sexual	3.48	5.95

1 = happy
7 = sad

1 = non-sexual
7 = sexual

	pleasant	unpleasant
sexual	3.27	4.92
non-sexual	3.62	5.47

	pleasant	unpleasant
sexual	4.92	3.98
non-sexual	2.22	1.55

Two-way (sex x affect) ANCOVAs were conducted, using baseline scores as covariates, to determine whether there were significant differences on the physiological measures in response to the various stimulus conditions. In the analyses to follow, only significant F ratios will be reported. Summary tables appear in Appendix F.

Covariate by condition interactions were examined in order to test for violations of homogeneity of regression. According to Winer (1971), given equal n, there is evidence to indicate that ANCOVA is robust with respect to assumptions of homogeneity of regression. In view of this, Tabachnick and Fidell (1983) have suggested that the .01 level of significance is appropriate for testing this assumption. Table 5 shows that, on this basis, the physiological measures did not violate homogeneity of regression.

Corrugator Muscle Activity. A significant main effect due to affect was obtained for left corrugator muscle activity, $F(1,35) = 5.8$, $p < .05$. Muscle activity was significantly greater in response to unpleasant stimulus materials than to pleasant.

There were no significant differences among the stimulus conditions with respect to right corrugator activity. Presented in Table 6 are the cell means (adjusted for covariates) for the corrugator muscle groups.

Zygomatic Muscle Activity. A significant sex main effect was obtained for left zygomatic activity, $F(1,35) = 4.5$, $p < .05$. Muscle activity was significantly greater in response to the sexual narratives than to the non-sexual.

A significant main effect due to sex was also obtained for right zygomatic muscle activity, $F(1,35) = 4.9$, $p < .05$. Muscle

TABLE 5

Tests for Homogeneity of Regression
Covariate by Condition Interactions

RC	$F(1,38) = .39$	$p > .01$
RZ	$F(1,38) = 3.02$	$p > .01$
LZ	$F(1,38) = 6.02$	$p > .01$
LC	$F(1,38) = 1.84$	$p > .01$
HR	$F(1,38) = .03$	$p > .01$

TABLE 6 Mean Amplitude For Muscle Activity
 In The Corrugator Muscles
 (Adjusted For Covariates)

LEFT

	pleasant	unpleasant	
sexual	162.9	193.8	178.3
non-sexual	140.4	172.0	156.2
	151.6	183.9	

RIGHT

	pleasant	unpleasant	
sexual	100.1	94.7	97.4
non-sexual	95.7	110.5	103.1
	97.4	102.6	

activity under the sexual stimulus conditions exceeded that in the non-sexual stimulus conditions. Cell means (adjusted for covariates) for the zygomatic muscle groups are presented in Table 7.

Heart Rate. A significant main effect due to affect was obtained for heart rate, $F(1,35) = 14.7$, $p < .01$. Heart rate activity was significantly greater in response to the pleasant stimulus conditions than to the unpleasant conditions. Presented in Table 8 are the cell means (adjusted for covariates) for heart rate. Also included are the corresponding percentage change scores (from baseline) in order to provide information concerning the relative direction of heart rate change in the various stimulus conditions.

Heart rate was negatively correlated with 'felt bad' ($r = -.46$, $p < .01$), 'felt sad' ($r = -.27$, $p < .05$) and positively correlated with 'felt angry' ($r = .37$, $p < .01$).

Lateralization of Facial EMG Activity. Within subjects analyses of covariance were conducted to examine whether there were significant differences in muscle activity between left and right sides of the same muscle groups. These analyses were conducted separately for each stimulus condition.

In the non-sexual-pleasant condition, left zygomatic activity significantly exceeded right zygomatic activity, $F(1,8) = 6.9$, $p < .05$. In the non-sexual-unpleasant condition, left corrugator activity was significantly greater than right corrugator activity, $F(1,8) = 7.8$, $p < .05$. In the sexual-unpleasant condition, left zygomatic activity exceeded right zygomatic activity, $F(1,8) = 8.4$, $p < .05$, and left corrugator activity exceeded right corrugator activity, $F(1,8) = 10.8$, $p < .01$. No significant left-right

TABLE 7:

Mean Amplitude For Muscle Activity
In The Zygomatic Muscles

(Adjusted For Covariates)

LEFT

	pleasant	unpleasant	
sexual	159.0	177.5	168.2
nonsexual	145.6	134.1	139.8
	152.3	155.8	

RIGHT

	pleasant	unpleasant	
sexual	126.4	112.8	119.6
nonsexual	103.4	104.5	103.9
	114.9	108.6	

TABLE 8 Adjusted Cell Means for Heart Rate
and Percentage Change Scores
from Baseline

Beats per Minute

	pleasant	unpleasant	
sexual	78.0	73.2	75.6
nonsexual	77.6	73.0	75.3
	77.8	73.1	

Percentage Change

	pleasant	unpleasant
sexual	+5.9%	-2.0%
nonsexual	+3.0%	-1.9%

differences in muscle activity were observed in response to the sexual-pleasant condition. These results appear in Table 9.

Cognitive Lever. Due to a number of technical and methodological difficulties, the data obtained from the 'cognitive lever' were excluded from the analyses. The data for 6 subjects were lost due to equipment failure, 4 from the sexual-pleasant condition and 2 from the sexual-unpleasant condition. Furthermore, a number of subjects reported that they found it to be distraction. Still others reported that they had forgotten about it until the end of the stimulus period.

Discussion

A major aim of the present study was to examine the extent to which facial EMGs could be used to differentiate positive and negative affect states during sexual arousal. For purposes of discussion, it is convenient to consider, separately, the results pertaining to corrugator and zygomatic muscle activity.

CORRUGATOR MUSCLE ACTIVITY

Significant differences in left, but not right, corrugator activity were obtained between the pleasant and unpleasant stimulus conditions. In other words, in the presence or absence of sexual arousal, negative affect was associated with increased left corrugator activity, particularly on the left side, is sensitive to the experience of negative affect. Our findings extend those of previous investigations in demonstrating that these differences can be obtained with narrative stimuli, and that the relation between corrugator muscle activity and negative affect holds under compound affect states, that is, when sexual arousal is present in addition to negative affect. It appears therefore, that monitoring facial muscle activity from the left corrugator site has potential utility as a measure of affect during sexual arousal.

As noted earlier, research examining the role of mood states on sexual arousal has relied exclusively on self-reports as indices of affective experience. It was further been argued that the susceptibility of self-report measures to a wide variety of biases may account, at least in part, for the discrepancies in reported findings. The use of facial muscle recording may circumvent some of the problems associated with traditional self-report measures and provide an

additional and more precise means of assessing the interaction between affect and sexual arousal.

ZYGOMATIC MUSCLE ACTIVITY

For both right and left zygomatic muscle groups, regardless of the emotional context in which it occurred, sexual arousal was associated with increases in muscle activity. These results imply that the zygomatic muscles are sensitive to the experience of sexual arousal. Successful replication of these results would support the use of zygomatic muscle recording as an alternative measure of erotic response to the more intrusive vaginal photoplethysmograph. It could also be of considerable value for direct cross-sex comparisons of sexual response should it prove to be an accurate measure of sexual arousal in males. To date, there have been no other reports of facial muscle response specifically to sexual arousal. Consequently, interpretation of our findings remains tentative.

The results of the present study are not consistent with previous findings showing increased zygomatic activity to positive emotional stimuli (eg. Sirota & Schwartz, 1982). Differences in stimuli may account for this discrepancy. The stimuli used in the present study may have induced positive affect states of insufficient intensity to produce significant changes in this muscle group. In previous studies, positive affect was induced by requesting the subjects to recall and imagine the most pleasant situation they had ever experienced. Elation imagery of this kind may be a more potent inducer of positive affect than listening to a narrative depicting a couple sailing on a sunny day.

LATERALIZATION OF EMG ACTIVITY

Several findings in the present study bear on the issue of lateralization of facial muscle response. In the non-sexual conditions, left muscle activity either significantly exceeded right muscle activity, or approached significance in that direction. These findings are consistent with those reported by Schwartz et al. (1979) indicating that regardless of the emotion expressed, muscle activity on the left side of the face was significantly greater than that on the right. The data do not support the contention by Sirota and Schwartz (1982) that positive emotions are mediated predominantly by the left hemisphere and hence, expressed more strongly on the right side of the face. However, as pointed out earlier, the two studies may differ with respect to the strength of the positive stimuli employed.

It should be noted that Sirota and Schwartz (1982) obtained their findings using subjects selected more stringently than in the present study. In their original sample of mixed handed subjects, no laterality differences were found. Greater right than left zygomatic activity in response to positive stimuli was found only in their subsample of pure right handed subjects who showed at least a 50% change in self-reported affect. Given the small sample size of the present study, it was not possible to examine a similar subset of subjects.

The same pattern of greater left muscle activity was found in response to the sexual unpleasant condition. Similar differences were observed in the sexual pleasant condition although they did not reach statistical significance. These findings are again consistent with

research showing that emotions are expressed more strongly on the left side of the face. In addition, the data support the findings of Cohen et al. (1976) suggesting that sexual arousal is mediated by the right hemisphere.

FACIAL EMGs AS OBJECTIVE MEASURES OF EMOTION

The rise in popularity in the use of facial EMGs as measures of emotion appears to have been born out of a general dissatisfaction with self-report ratings of emotion. There has also been a tendency to view facial EMGs, and physiological measures in general, as being more objective than self-report ratings. Recently, questions have been raised concerning the extent to which facial EMGs can be considered objective indices of affect states. Notarius et al. (1982) have argued that facial expressions are subject to strong personal monitoring and voluntary control, and thus may be responsive to demand characteristics in much the same way as self-reports. Fridlund (1982) has expressed similar concern over the effects of experimental demand in facial EMG studies.

Sirota and Schwartz (1982) have pointed out that although demand characteristics cannot be ruled out as an alternative explanation to account for both self-report and facial EMG data, their results do not support such an interpretation. According to these authors, the growth functions in muscle activity observed during imagery induced emotions were different from those observed during voluntary voluntary facial expression. Furthermore, laterality differences were observed during affective imagery but not during voluntary facial expression. The laterality findings of the present study are comparable to those observed during affective imagery, suggesting that they are not the

product of experimental demand characteristics.

HEART RATE

In the present study significantly greater heart rate activity was observed under the pleasant stimulus conditions than in the unpleasant. Heart rate did not differ significantly between the sexual and non-sexual conditions. Our data show that positive and negative affect are associated, respectively, with increases and decreases in heart rate. The inclusion of sexual arousal does not significantly alter this pattern of cardiac response. These data clearly emphasize the need to consider the emotional context within which sexual arousal occurs. Failure to do so may result in misleading conclusions concerning heart rate response to sexual arousal. The bulk of research examining cardiac response to sexual arousal has neglected to consider emotional factors as significant determinants of heart rate activity, and it is therefore not surprising that there is no consensus as to the expected direction of heart rate change in response to erotic stimuli.

Katkin et al. (1982) have recently reported changes heart rate comparable to those obtained in this study. These investigators examined heart rate changes in response to viewing pleasant erotic slides, and slides of fatal car accident victims. They noted heart rate increases in response to erotic slides and heart rate decreases to the slides depicting car accident victims.

Our findings are not consistent with those reported by Fehr and Schulman (1978). They reported heart rate decreases to the reading of pleasant erotic passages, and heart rate increases in response to unpleasant passages. A number of methodological differences between

the two studies may account for this discrepancy. For example, the mood induction procedure differed with respect to mode of presentation, and in the latter study, the stimuli were not pre-tested. Furthermore, all subjects viewed an erotic film prior to reading the stimulus passages. Since change scores from baseline were used as data, baseline levels of heart rate may have confounded their results.

The correlation between heart rate and self-report ratings of affects highlight the importance of clearly specifying the affective states under study, and moreover, question the generalizability of findings relevant to specific mood states. For example, 'felt bad', 'felt sad', and 'felt angry' can all be subsumed under the rubric of negative affect states. However, the results of the present study indicate that these mood states are associated with different heart rate activity. While 'felt bad' and 'felt sad' were negatively correlated with heart rate, a positive relationship was found between heart rate and 'felt angry'.

Recently, Lang (1984) has introduced a model of cardiovascular changes to emotional imagery which may account for our correlational data. This model differentiates emotions according to whether or not they are action oriented. Lang argues that action oriented emotions are more likely to be associated with increases in cardiac activity than more passive emotions. Although Lang has yet to categorize the various emotions along this dimension, it is not unreasonable to assume that anger would constitute an action oriented emotion, in contrast to the more passive nature of 'felt bad' or 'felt sad'.

MOOD INDUCTION PROCEDURES

Mood induction procedures tend to vary considerably across studies. Some of these include the reading of self-referent statements (Velten, 1968), autobiographical recollection imagery (Schwartz et al., 1979), the reading of passages (Fehr & Schulman, 1978; Malamuth & Check, 1980), the viewing of slides (Katkin et al., 1982), and listening to audiotaped passages (Heiman, 1975; Harris, 1981). There is some evidence to suggest that these various methods of mood induction differ with respect to their efficacy in producing intended affect states.

Brewer (1982) has reported that the autobiographical recollection method is significantly superior to Velten's self-referent statements method in producing depressed affect. Similarly, Sirota and Schwartz (1982) have found that self-generated relation imagery produced stronger zygomatic muscle responses than relation induced by the Velten method. Furthermore, Polivy and Doyle (1980) have presented evidence suggesting that mood changes using the Velten method are predominantly a function of demand characteristics.

Another issue which is closely related to mood induction procedures concerns the choice of stimuli. As noted in the introduction, a wide variety of stimuli have been used to induce emotions, making comparisons between studies hazardous. The issue is further complicated by recent evidence (Zevon & Teldengen, 1982) showing extreme variability across subjects in their reactions to the same emotional stimulus. These authors have argued that reactions to the same emotional stimulus vary as a function of an individual's learning history. That is, certain stimuli become associated with

different meanings and we cannot assume that these are constant across subjects. The data from the present study, in addition to previous findings, suggest that facial muscle recording may provide a valuable methodology with which to verify the nature of affective change following a mood induction procedure.

COGNITIVE LEVER

Korff and Geer (1983) have recently reported findings on the use of a continuous subjective self-report measure of sexual arousal which apparently circumvents some of the problems associated with the cognitive lever. The procedure is called psychophysical scaling and consists of setting the intensity of a tone to rate an erotic stimulus. These authors have argued that psychophysical scaling is less distracting than the cognitive lever as it does not have a numbered scale and has a much larger range of settings. Reported correlations between psychophysical scaling and genital measures of sexual arousal range from .73 to .98.

SUMMARY

At present, reports of facial EMG activity in response to positive and negative affect have been consistent across studies. Schwartz et al. (1979) have demonstrated that corrugator muscle activity increases to negative affect and that zygomatic muscle activity increases to positive affect. Similar findings have been reported by Sirota and Schwartz (1982) using the Velten mood induction procedure, by Dimberg (1982) using photographs of facial emotional expressions as stimuli, and by Cohen and Thayer (1982) using music. The results of the present study, with respect to the corrugator muscle, indicate that a similar pattern can be obtained using

narrative stimuli. Furthermore, the present findings indicate that when a compound affect state is created by adding sexual arousal to negative affect, corrugator muscle activity continues to be sensitive to negative emotions. The results support the use of facial muscle recording as an index of negative affect states during sexual arousal.

Our data further suggest that recording zygomatic activity may provide an alternative, less intrusive measure of sexual arousal. While increased zygomatic activity was noted in response to sexual arousal, we did not replicate previous findings showing zygomatic increases to positive affect.

The laterality findings are consistent with previous research showing that emotions are expressed more strongly on the left side of the face. The present study also lends support to Cohen et al. (1976) who proposed that sexual arousal is mediated predominantly by the right hemisphere.

The heart rate data are not consistent with previous research showing specific cardiac response to sexual arousal. Based on our findings, it appears that that cardiac response noted during sexual arousal may best be explained by the emotional context within which it occurred.

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APPENDIX A

Description of Study

The study in which you are to participate was designed to examine women's facial responses while they are experiencing various emotions. In order to create these emotions, you will listen to one of four narrative tapes. These tapes vary according to their sexual content and also according to how pleasant or unpleasant they are. You will be assigned on a random basis to listen to one of these tapes and will be told in advance which one was selected. I will also be asking you to fill in questionnaires dealing with your sexual attitudes, experience, and other reactions to the tape.

The study also involves some physiological measures. Nine small electrodes will be placed on your face. This procedure is absolutely painless and is used to record facial muscle activity. A plethysmograph will be placed on one of your fingers to record heart rate. Please understand that you are free to discontinue at any point during the study.

APPENDIX B

CONSENT FORM

1. I am informed that this study is an attempt to examine women's facial responses to a range of emotions which will be elicited during the experiment.
2. I understand that I will be listening to an audiotape which may include an explicit description of a sexual encounter between a man and a woman (who may or may not be consenting). I am aware that I will be told in advance, the contents of the audiotape that I will be hearing.
3. I am willing to answer questionnaires concerning my general sexual attitudes and reactions to the narrative tape.
4. I understand that I am free to ask any questions concerning the procedure used in this study at any time. If for any reason I experience discomfort or concern during my participation in this study, I understand that I am free to discuss this with the experimenter and/or discontinue if I wish.
5. I understand that nine recording electrodes^o will be placed on my face and a plethysmograph on one of my fingers. I have been informed that this procedure is safe and painless.
6. I understand that if the results of this study are published, my part in it will be completely anonymous and my privacy will be completely protected.

On the basis of this information, I _____
willingly consent to participate as a subject in this study.

APPENDIX C

NARRATIVE RATINGS FORM

For each scale, place an "X" to indicate how you felt about the narrative you just heard.

The narrative was:

- GOOD :__ :__ :__ :__ :__ :__ :__ :__ : BAD
UNPLEASANT :__ :__ :__ :__ :__ :__ :__ :__ : PLEASANT
DULL :__ :__ :__ :__ :__ :__ :__ :__ : ENTERTAINING
POORLY WRITTEN :__ :__ :__ :__ :__ :__ :__ :__ : WELL WRITTEN
OFFENSIVE :__ :__ :__ :__ :__ :__ :__ :__ : NOT OFFENSIVE
DISTURBING :__ :__ :__ :__ :__ :__ :__ :__ : NOT DISTURBING

The narrative made me feel:

- GOOD :__ :__ :__ :__ :__ :__ :__ :__ : BAD
HAPPY :__ :__ :__ :__ :__ :__ :__ :__ : SAD
DEPRESSED :__ :__ :__ :__ :__ :__ :__ :__ : NOT DEPRESSED
ANXIOUS :__ :__ :__ :__ :__ :__ :__ :__ : NOT ANXIOUS
NERVOUS :__ :__ :__ :__ :__ :__ :__ :__ : NOT NERVOUS
STRESSED :__ :__ :__ :__ :__ :__ :__ :__ : NOT STRESSED
NOT RELAXED :__ :__ :__ :__ :__ :__ :__ :__ : RELAXED
ANGRY :__ :__ :__ :__ :__ :__ :__ :__ : NOT ANGRY
NOT SEXUALLY AROUSED :__ :__ :__ :__ :__ :__ :__ :__ : SEXUALLY AROUSED
POSITIVE :__ :__ :__ :__ :__ :__ :__ :__ : NEGATIVE

APPENDIX D

STIMULUS NARRATIVES

NON-SEXUAL-PLEASANT

A lime-green Triumph sped along into South Hampton. It was a June day, sunny, warm, and clear-fine weather for putting the top down. Todd was driving, his sun bleached hair beating on his shades and an old shirt covering his trunks. Jackie was next to him, her light brown hair whipping in the wind. A blue workshirt, knotted at her waist, loosely covered her faded bikini.

Today was sort of a celebration - their friends were getting together for the first time since they had all been away to college. The others were coming out to the beach later, but Jackie and Todd wanted to get there early.

Parking the car within sight of the water, they took their towels and walked onto the sandy beach. They spread their towels and stretched out under the sun. The sand was warm, the hot sun seemed to soak in, loosening their bodies and making them drowsy. For about half an hour, they lay under the sun until Jackie suggested that they go down to the water. Reluctantly, Todd staggered to his feet and jogged to the water. Jackie had no mercy and started throwing water on him. After a screaming splash battle, they raced back to the towels and let the sun warm and dry their bodies.

Jackie turned to Todd and said that they should go inside the beach house for refreshments. She stood up and brushed the sand off her legs. Todd did the same as they took their towels and walked inside. Jackie rushed to the refrigerator and opened two cokes. They sat. They sat in the front room, and Jackie suggested that they take the sailboat out. Todd agreed. They both went out and examined the boat. It looked seaworthy.

They attached the mast, put the sail in the cockpit, and pushed the whole thing down to the water, which they discovered was not as easy as it appeared to be. Jackie had sailed more than Todd so she was giving the orders.

The wind seemed stiffer now that they were entering the water, so Jackie decided to row the boat out a ways before putting the sail up. The water felt cold after the hot sand, but it was a welcomed cold. The waves made the first ten yards the most difficult, but with Jackie paddling and Todd kicking from behind, it was soon far enough to put up the sail. Jackie did so while Todd lowered the centerboard. There was a nice offshore breeze which filled the sail quickly. They were on their way.

The boat was small enough for one person to control most of the time, and so they took turns at the helm. The downwind speed was tremendous, strong enough to let them hike out, sitting and leaning well over the side to keep the boat upright. Their hair was whipping in the breeze and the burns of the sun and wind were beginning to show on their faces. But they continued talking, laughing, changing places and zig-zagging back and forth along the shore. It was a terrific day for sailing. Two or three seagulls were following them, occasionally diving for the fish that surfaced or jumped from the water.

For an hour or so, they continued to sail, then decided that they were exhausted and it was time to head back. Jackie turned the boat around and asked Todd to raise the centerboard. Todd did so and they sailed the boat back into shore. Once on shore, they dragged the boat slowly back up to the house. Todd quickly stepped into the shower to wash off the sand and the salt. Jackie followed afterwards. By the

time Jackie was clean and dressed, Todd was collapsed on the couch in a half doze, groaning something about sailor's arm.

Jackie laughed and started to make some ice tea, telling Todd that it was just a case of dehydration. She looked at the clock and realized that they had sailed for nearly four hours. Jackie sat down, now suddenly tired. They sipped at their iced tea enjoying every gulp, totally exhausted from the sun and the activity.

NON-SEXUAL UNPLEASANT

Marie stood at the entrance of the small boutique she owned. Across the street from her was a man watching her carefully. He was a short man, rather heavy set, wearing a drab wrinkled suit that was obviously tailored for a man taller than himself. The dark bags under his sunken eyes told of many drunken and sleepless nights on city park benches. He passed his fingers through his knotted beard and as Marie turned to go back into the store, he began crossing the street. He shoved one hand into his pocket to feel the sharp edge of a knife he had concealed there. He had been watching Marie all day through the storefront window. He knew her frail body would be easily overpowered and robbing the store would be no problem.

The man came to the door and said that he wanted to buy a dress he had seen earlier. Marie opened the door and the man entered. Marie quickly stepped back to avoid the strong smell of liquor on his breath. She asked him which dress he wanted to buy but he did not answer. His cold eyes stared intently at the cash register. Marie could feel her heart beating stronger and stronger; she knew something was wrong. Without breaking his glassy stare, the man locked the door and began moving towards the cash.

Marie knew she had to get help, call the police. She thought of the phone in the backroom and without thinking twice broke for the rear of the store. But before she could take a second step, the man leaped forward and pulled the knife from within his jacket pocket. His powerful arms wrapped around Marie's body pinning her arms back so that she was unable to move. Forcefully, he turned her towards the cash and threw her forwards. Marie stumbled and let out a cry as her

head cracked against the side of the counter. She could feel the warm trickle of blood running down the side of her face.

Impatiently, the man grabbed Marie by the hair and pulled her to her feet. Crying and trembling in fright, Marie fumbled with the cash register. As the drawer opened, he pushed her aside and she fell to the floor. He stood there mumbling as he counted all the money.

Fearing his next move, Marie looked towards the front door wondering whether she would have time to escape. She drew herself to her feet and ran for the door. Panic-stricken, she tried desperately to steady her hands long enough to unlock the door. She could hear his footsteps approaching behind her, there wasn't much time. The door was now unlocked, but as she reached for the handle, she felt the sharp edge of the knife dig deep into her side. Marie cried out as her body arched back in pain. She fell against the glass and slowly slid to the floor.

Twisting and squirming, Marie reached for her side to cover the wound. She could feel the deep slice in her skin and the thick blood gushing with every heartbeat. Tears blurred her vision but she could still see the man standing in front of her smiling. Pleading and crying, Marie tried to move away from him. He knelt down beside her and placed the knife to her throat. Marie closed her eyes and cried hysterically. When she opened her eyes, he was standing by the door. He looked back at her and laughed. Never had she heard such an evil sound. He swung the door open and walked out.

Marie tried hard to pull herself to her feet. She stumbled again and again as she made her way towards the phone. Her clothes were now drenched with blood. Her vision was growing dimmer and she could feel

her legs giving way. Finally she reached the phone and called for help. Her strength now exhausted, Marie's body slid to the floor. She was tired now, very tired. She closed her eyes and slowly drifted off to sleep.

SEXUAL PLEASANT

Jenny closed the book, placed it on the floor beside her and slowly turned towards Robert. He was propped back against the chair, knees drawn back, staring into the the flames of the fireplace. The firelight made Robert's body look even more attractive. The shadows really emphasized his chest and his broad shoulders. Jenny moved closer of him and placed her arm around his waist. Robert then put his arm around Jenny and began making caressing movements with his fingers. Jenny shivered with pleasure as his touches sent tingles down her back.

She rolled Robert over onto his back and sat on his stomach. He lay there, breathing slowly, head turned towards the fire, his eyes half open. Jenny looked down at his face; she found his ruffled hair and half open shirt very appealing at this moment. She leaned forward and fondled the hairs on his chest then slowly, she undid the remaining buttons on his shirt and drew it completely open.

Jenny continued caressing Robert for a while and then slowly took off her own blouse. She really enjoyed undressing in front of Robert. Jenny knew how excited he would always get and how turned on he was by her body. Robert reached up and took her breasts in his hands. Then, he wrapped his arms around her and pulled her down on top of him. She could feel the tingling of his chest hairs against her breasts. Jenny began kissing the side of his neck and rubbing her body against his.

She let her hand move gently and freely over the whole length of Robert's body. She passed her hand along the inside of his thigh until she felt his erection in her hand. Jenny fondled it teasingly,

fascinated by how thick it had become. She then moved her head down and took his penis into her mouth, squeezing and stroking it with her tongue. She felt Robert become very excited.

Jenny's own desire was growing stronger; she sat up, took Robert's hands and placed them gently on her breasts. She then took his penis in her hand and guided it slowly inside her. She trembled in ecstasy as she thrust her hips forward and felt his erection fill her completely. Robert started to follow her movements and Jenny could feel their excitement growing in force. Both were breathing heavily now and pulling at each other's bodies. Jenny's body shivered as she felt the waves of pleasure fill every part of her body. Their bodies tensed and trembled as they came together. Jenny now lay exhausted on top of Robert. The warmth of his body seemed to relax her even more and she slowly drifted off to sleep.

SEXUAL UNPLEASANT

Johanna opened the drawer and noticed the gun concealed there. For years now, her whole inner sexual life seemed to revolve around the memory of her rape. A day would not go by without her remembering it. She gazed out the window and thought back to that sunny afternoon in Mexico. Johanna was vacationing in a small house by the cove. The doorbell rang, the door swung open, and a man walked in. He wasn't a Mexican, she didn't know what he was. He was tall and well dressed; his broad shoulders made him appear very powerful. There was a certain sternness in his face, he looked like the kind of man who always got what he wanted. He pretended that he was interested in selling something but he didn't look like a salesman. Johanna sensed that something was wrong. He asked her if she was alone but in such a smooth easy manner that he really didn't frighten her. Still something about the situation was unnatural, making her feel uneasy.

He pulled a knife from his pocket and placed it on the table. He told her that he was going to rape her. He reassured her that he was not a pervert and that if she did everything he said, he would not harm her. He even told her that she would enjoy it.

All the time he was talking, Johanna could see the front of his trousers beginning to bulge. The man told her to take her clothes off. With some hesitation she began by slowly unbuttoning her blouse. She paused for a second and then removed it completely to reveal her breasts. With one hand, which seemed to be trembling, he gently stroked her nipples. With the other, he picked up the knife. Johanna began to feel weak, her body trembled in fear. The man slowly brought the knife to her waist and cut the strings off her skirt. The skirt fell

to the ground exposing the rest of her body. She was naked standing before him. He examined her for a while, her long legs, her silky blonde hair.

He continued to touch her, so sensually that she began to feel a disturbing mixture of terror and excitement. The man told her to unzip his trousers. As she did so, he forced her to her knees and brought her head to his groin. Johanna took his penis into her mouth. She didn't understand what she was doing, what she was feeling. She did everything he told her.

He told her to lie on her back and spread her legs. As she did, he picked up the knife and raised it over his head. For a moment, Johanna's heart seemed to stop. Blood was rushing to her head, and she began feeling faint.

The man stepped closer to her and suddenly with a swift plunge, drove the knife into the ground next to her hips. He knelt down between her legs, spread them wider, and lay down on top of her.

Johanna closed her eyes and tried to turn her head from side to side to avoid his tongue. When she opened her eyes, all she could see was the dark top of his head, his hair and the hand holding the knife. Now his whole weight came down on her making her flinch in pain. She closed her eyes again and felt his large penis inside her. Johanna tried to push him off but his powerful body forced her back to the floor.

The man seemed to ignore her attempts to free herself, and continued with his rhythmic thrusts. Johanna twisted and squirmed, pleading with him to stop. He took her violently, and they shook and trembled as he came inside her. Johanna fell away, crying

hysterically with a hatred like she had never known. The man got up, dressed, and walked out.

APPENDIX E

SELF-REPORT QUESTIONNAIRES

The Sexual Opinion Survey

Please respond to each item as honestly as you can. Place an X in the space that best corresponds to your own opinion. There are no right or wrong answers and your answers are completely anonymous.

1. I think it would be very entertaining to look at hard-core pornography.

I Strongly Agree :__ :__ :__ :__ :__ :__ :__ :__ : I Strongly Disagree

2. Pornography is obviously filthy and people should not try to describe it as anything else.

I Strongly Agree :__ :__ :__ :__ :__ :__ :__ :__ : I Strongly Disagree

3. Swimming in the nude with a member of the opposite sex would be an exciting experience.

I Strongly Agree :__ :__ :__ :__ :__ :__ :__ :__ : I Strongly Disagree

4. Masturbation can be an exciting experience.

I Strongly Agree :__ :__ :__ :__ :__ :__ :__ :__ : I Strongly Disagree

5. If I found out that a close friend of mine was a homosexual it would annoy me.

I Strongly Agree :__ :__ :__ :__ :__ :__ :__ :__ : I Strongly Disagree

6. If people thought I was interested in oral sex, I would be embarrassed.

I Strongly Agree :__ :__ :__ :__ :__ :__ :__ :__ : I Strongly Disagree

7. Engaging in group sex is an entertaining idea.

I Strongly Agree :__ :__ :__ :__ :__ :__ :__ :__ : I Strongly Disagree

8. I personally find that thinking about engaging in sexual intercourse is arousing.

I Strongly Agree :__ :__ :__ :__ :__ :__ :__ :__ : I Strongly Disagree

9. Seeing a pornographic movie would be sexually arousing to me.

I Strongly Agree :__:__:__:__:__:__:__:__:__:__: I Strongly Disagree
10. Thoughts that I may have homosexual tendencies would not worry me
at all.

I Strongly Agree :__:__:__:__:__:__:__:__:__:__: I Strongly Disagree
11. The idea of my being physically attracted to members of the same
sex is not depressing.

I Strongly Agree :__:__:__:__:__:__:__:__:__:__: I Strongly Disagree
12. Almost all pornographic material is nauseating.

I Strongly Agree :__:__:__:__:__:__:__:__:__:__: I Strongly Disagree
13. It would be emotionally upsetting to me to see someone exposing
themselves publicly.

I Strongly Agree :__:__:__:__:__:__:__:__:__:__: I Strongly Disagree
14. Watching a go-go dancer of the opposite sex would not be very
exciting.

I Strongly Agree :__:__:__:__:__:__:__:__:__:__: I Strongly Disagree
15. I would not enjoy seeing a pornographic movie.

I Strongly Agree :__:__:__:__:__:__:__:__:__:__: I Strongly Disagree
16. When I think about seeing pictures showing someone of the same sex
as myself masturbating it nauseates me.

I Strongly Agree :__:__:__:__:__:__:__:__:__:__: I Strongly Disagree
17. The thought of engaging in unusual sex practices is highly
arousing.

I Strongly Agree :__:__:__:__:__:__:__:__:__:__: I Strongly Disagree
18. Manipulating my genitals would probably be an arousing experience.

I Strongly Agree :__:__:__:__:__:__:__:__:__:__: I Strongly Disagree
19. I do not enjoy daydreaming about sexual matters.

I Strongly Agree :__:__:__:__:__:__:__:__:__:__: I Strongly Disagree

20. I am not curious about explicit pornography.

I Strongly Agree :__:_:__:__:_:__:__:_:__:__:_: I Strongly Disagree

24. The thought of having long-term sexual relations with more than one sex partner is not disgusting to me.

I Strongly Agree :__:_:__:__:_:__:__:_:__:__:_: I Strongly Disagree

SAL INVENTORY

Instructions: The experiences in this inventory may or may not be sexually arousing to you. There are no right or wrong answers. Read each item carefully, and then circle the number which indicates how sexually aroused you think you would feel if you actually experienced it. Be sure to answer every item. If you aren't certain about an item, circle the number that seems about right. The meaning of the numbers is given below:

- 1 adversely affects arousal, unthinkable, repulsive, distracting
- 0 doesn't affect sexual arousal
- 1 possibly causes sexual arousal
- 2 sometimes causes sexual arousal; slightly arousing
- 3 usually causes sexual arousal; moderately arousing
- 4 almost always sexually arousing; very arousing
- 5 always causes sexual arousal; extremely arousing

ANSWER EVERY ITEM

How you feel or think you would feel if you were actually involved in this experience

- | | | | | | | | |
|--|----|---|---|---|---|---|---|
| 1. When a loved one stimulates your genitals with mouth and tongue | -1 | 0 | 1 | 2 | 3 | 4 | 5 |
| 2. When a loved one fondles your breasts with his hands | -1 | 0 | 1 | 2 | 3 | 4 | 5 |
| 3. When you see a loved one nude | -1 | 0 | 1 | 2 | 3 | 4 | 5 |
| 4. When a loved one caresses you with his eyes | -1 | 0 | 1 | 2 | 3 | 4 | 5 |
| 5. When a loved one stimulates your genital with his finger | -1 | 0 | 1 | 2 | 3 | 4 | 5 |

6. When you are touched or kissed on the inner thighs by a loved one -1 0 1 2 3 4 5
7. When you caress a loved one's genitals with your fingers -1 0 1 2 3 4 5
8. When you read a pornographic or "dirty" story -1 0 1 2 3 4 5
9. When a loved one undresses you -1 0 1 2 3 4 5
10. When you dance with a loved one -1 0 1 2 3 4 5
11. When you have intercourse with a loved one -1 0 1 2 3 4 5
12. When a loved one touches or kisses your nipples -1 0 1 2 3 4 5
13. When you caress a loved one (other than genitals) -1 0 1 2 3 4 5
14. When you see poprnographic pictures or slides -1 0 1 2 3 4 5
15. When you lie in bed with a loved one -1 0 1 2 3 4 5
16. When a loved one kisses you passionately -1 0 1 2 3 4 5
17. When you hear sounds of pleasure during sex -1 0 1 2 3 4 5
18. When a loved one kisses you with an exploring tongue -1 0 1 2 3 4 5
19. When you read suggestive or pornographic poetry -1 0 1 2 3 4 5
20. When you see a strip show -1 0 1 2 3 4 5
21. When you stimulate your partner's genitals with your mouth and tongue -1 0 1 2 3 4 5
22. When a loved one caresses you (other than genitals) -1 0 1 2 3 4 5
23. When you see a pornographic movie (stag movie) -1 0 1 2 3 4 5
24. When you undress a loved one -1 0 1 2 3 4 5
25. When a loved one fondles your breasts with mouth and tongue -1 0 1 2 3 4 5

- | | | | | | | | |
|--|----|---|---|---|---|---|---|
| 26. When you make love in a new or unusual place | -1 | 0 | 1 | 2 | 3 | 4 | 5 |
| 27. When you masturbate | -1 | 0 | 1 | 2 | 3 | 4 | 5 |
| 28. When your partner has an orgasm | -1 | 0 | 1 | 2 | 3 | 4 | 5 |

Bentler Heterosexual Experience Scale

Please circle every number that describes a sexual activity that you have experienced at least once.

1. one minute continuous lip kissing
2. manual manipulation of female breasts, over clothes, by male
3. manual manipulation of female breasts, under clothes, by male
4. manual manipulation of female genitals, over clothes, by male
5. kissing nipples of female breasts, by male
6. manual manipulation of female genitals, under clothes, by male
7. manual manipulation of male genitals, over clothes
8. mutual manual manipulation of genitals
9. manual manipulation of male genitals, under clothes
10. manual manipulation of female genitals to massive secretions by male
11. manual manipulation of male genitals, by male
12. oral contact with female genitals, by male
13. oral contact with male genitals
14. sexual intercourse, face to face (ventral-ventral)
15. oral manipulation of female genitals, by male
16. oral manipulation of male genitals
17. mutual oral-genital manipulation
18. mutual manual manipulation of genitals to mutual orgasm
19. sexual intercourse, ventral-dorsal (rear entry)
20. oral manipulation of male genitals to ejaculation
21. mutual oral manipulation of genitals to mutual orgasm

How old are you? _____

Circle the last year of schooling you have completed.

1 2 1 2 3 4 1 2 3 4
CEGEP University (undergrad.) University (graduate student)

Occupation _____

Circle your marital status: single married separated
divorced remarried
unmarried but living with
parents

How many children do you have?

APPENDIX F
Analysis of Variance
Summary Table

<u>Source</u>	<u>DF</u>	<u>Mean Square</u>	<u>F</u>	<u>P</u>
Left-Corr				
SEX	1	4756.26	2.85	.10
AFFECT	1	9677.54	5.80	.02
S X A	1	1.13	.01	.97
ERROR	35	1667.66		
Right-Corr				
SEX	1	315.61	.92	.34
AFFECT	1	219.68	.64	.42
S X A	1	1026.63	3.00	.09
ERROR	35	341.24		
Left-Zyg				
SEX	1	8195.62	4.93	.03
AFFECT	1	60.76	.03	.85
S X A	1	2047.14	1.22	.27
ERROR	35	1677.34		
Right-Zyg				
SEX	1	2421.15	4.73	.03
AFFECT	1	400.06	.78	.38
S X A	1	522.46	1.02	.31
ERROR	35	511.03		

