

The Habituation of Sexual Arousal

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The effects of two levels of stimulus intensity (medium and high) and two levels of stimulus variability (varied stimuli and constant stimuli) on the habituation of subjective and physiological sexual arousal were investigated in a 2 × 2 factorial design. Forty male volunteers served as subjects. It was hypothesized that, as compared to constant stimuli, varied stimuli would produce higher rates of response attenuation on indices of sexual arousal. This hypothesis was confirmed for both penile response and a subjective measure of sexual arousal. Second, it was hypothesized that stimuli of medium intensity would produce higher rates of response of attenuation on subjective and physiological indices of sexual arousal than would stimuli of high intensity. This hypothesis was partially confirmed for subjective arousal but was not confirmed for the physiological measure of sexual arousal. These results were interpreted as supporting the notions that sexual arousal to erotic stimuli decreases with repeated stimulus presentations and, since the experimental design properly controlled for physiological fatigue, that a habituation process is involved in this observed decrement. The implications of habituation for sex research are discussed.

KEY WORDS: habituation; sexual arousal; genital measures.

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INTRODUCTION

Habituation can be defined as a systematic decrease in the magnitude of a response with repeated presentation of an eliciting stimulus, when that decrease cannot be accounted for in terms of fatigue or receptor adaptation (Thompson and Spencer, 1966). The actual rate of habituation has been found to depend on a number of factors, including frequency of stimulation, stimulus duration, stimulus intensity, stimulus variability, number of previous habituation trials, and the characteristics of the individual being studied (O'Gorman, 1977; Thompson and Spencer, 1966). Habituation has been regarded as a form of learning—a learning not to respond. Deese (1958) suggests that habituation can be regarded as the most fundamental example of the permanent modification of behavior by repeated stimulation.

Traditionally, habituation has been of interest in three major areas in the literature concerning sexuality. One such area is in attempting to explain the Coolidge effect. The Coolidge effect is a label for the restoration of sexual behavior by a male sexually satiated with one female due to the introduction of a novel female (Dewsbury, 1981). The Coolidge effect is very pronounced in some species. In fact, if a ram is given new females after satiation, it can continue to copulate with at least 12 different ewes. In one report (Bermant and Davidson, 1974), the experimenters, rather than the rams, ended the experiment, because the experimenters became tired of shuffling sheep around. Investigators have explained the temporary decrease in sexual responsiveness following sexual intercourse as due not to physiological fatigue but to the male having habituated to his partner (Beach and Ransom, 1967; Bermant *et al.*, 1968).

The second major manner in which habituation has been of interest to sex researchers is as a potential methodological confound. Zuckerman (1971), in his review of physiological measures of sexual arousal, states, "Another problem is that of habituation. When the same type of stimulus is presented repeatedly over a lengthy series of trials, physiological responses are typically large to the first presentation and thereafter diminish in intensity. The reaction of the first trial may be as much a function of novelty or surprise as the nature of the stimulus itself" (p. 325).

Sex researchers studying other questions have often had to deal with habituation as an ancillary phenomenon. For example, Heiman (1977), although not directly interested in habituation, found that vaginal pressure pulse amplitude measured by photoplethysmography decreased significantly to the same stimuli across experimental sessions that were 2 weeks apart. Heiman also found that subjects' subjective evaluations of the stimulus's erotic value decreased across experimental sessions. Schaefer and Colgan (1977) pointed out that habituation can be especially troublesome in experiments

that employ a paradigm of exposure to erotic stimuli, treatment, then reexposure to the same erotic stimuli, and where a decreased response to the erotic stimuli is used as an index of treatment success. For example, they note that Tanner (1973) monitored changes in the penile response of homosexuals during shock avoidance trials while using erotic slides of nudes that "were not changed during the program" (Tanner, 1973, p. 214). In these studies, the effects of the treatment can become confounded with the effects of habituation (see also Rubin *et al.*, 1979; Schaefer *et al.*, 1976).

The third major manner in which habituation has been of interest to sex researchers is an interesting and important phenomenon in its own right. To date, the most extensive investigation of the habituation of sexual arousal in humans reported in the literature was conducted by Howard *et al.* (1970) under the auspices of the Commission on Obscenity and Pornography. The subjects in this investigation were 32 male university students. Each weekday for 3 weeks, 23 experimental subjects spent 90 minutes alone in a room that contained a large collection of pornographic films and texts, as well as nonerotic material. Subjects were free to attend to these materials. Sexual arousal was assessed by self-report, changes in penile volume measured with a strain gauge, and changes in urinary acid phosphatase levels. The subjects' interest in the erotic materials was assessed by monitoring the amount of time they spent attending to these materials. During this period, nine control subjects viewed only nonerotic films. During the first few experimental sessions, the subjects spent most of each session viewing the erotic material. However, by the eleventh session the proportion of time the subjects spent viewing the erotic material declined significantly. Moreover, Howard *et al.* (1970) found that, after the second week of the experiment, subjects' sexual arousal to this erotic material also began to decline. After the first 90-minute session, subjects' sexual arousal, as measured by the average levels of urinary acid phosphate, declined significantly. Data from the penile strain gauge revealed that subjects, across the pornographic films, showed less initial increase in penile circumference and less consistent maintenance of whatever level of tumescence was first reached. Subjects' reported interest in continuing to participate in the experiment also decreased steadily and significantly over the 3 weeks of the experiment. The authors interpreted these results as supportive of the hypothesis that repeated exposure to sexual stimuli results in decreased responsiveness.

However, Bancroft (1976) has criticized the design of this study. First, the penile strain gauge used was not calibrated, so baseline levels cannot be determined precisely, nor can the absolute amount of change. Furthermore, no statistical test was used to determine if the difference in penile tumescence between the experimental and the control groups was significant. The control group and the experimental group also were treated differently be-

yond the appropriate experimental manipulation. The experimental group consistently wore condoms, whereas the control group only wore condoms on two occasions. Bancroft points out that wearing the condom might have had sexual connotations for the subjects and might even have stimulated the penis.

The present study, using a 2×2 factorial design with two levels of stimulus variability (varied and constant stimuli) and two levels of stimulus erotic intensity (medium and high), permits the evaluation of the following hypotheses: (1) varied stimuli produce lower rates of reduction in penile responding and in subjective arousal than a constant stimulus; and (2) stimuli of high erotic intensity produce lower rates of habituation of penile responding and of subjective arousal than stimuli of medium erotic intensity.

This study represents an important extension of earlier work. The examination of two levels of stimulus variability, varied and constant stimuli, permits the evaluation of physiological fatigue as an alternative hypothesis to habituation (see Thompson and Spencer, 1966). Physiological fatigue was not controlled for in the study by Howard *et al.* (1970), and therefore their intrasession analyses of habituation are problematic. Relatively little habituation is expected to occur to the varied stimuli (where subjects view five different erotic slides), since habituation mainly occurs to a constant stimulus. Therefore, the varied-stimuli condition, by serving as a baseline by which response decrements to the constant-stimulus condition (where subjects repeatedly view the same slide) can be compared, functions as a control group for evaluating the fatiguing of the physiological system under study. Habituation can then be said to occur if the response decrement to the constant-stimulus condition is significantly greater than the response decrement to the varied-stimuli condition, as this would indicate that the decrement to the constant stimulus cannot be totally explained by physiological fatigue. This study will also be able to examine the effects of stimulus erotic intensity on the rate of habituation. As stimulus intensity has been consistently shown to affect the rate of habituation of other responses (Graham, 1973; Olst, 1971), this can serve as an important link to the habituation literature of other response systems. Finally, by simultaneously assessing both genital and subjective indices of sexual arousal, this study allows the examination of possible interrelationships between these two measures.

METHOD

Subjects

The data analyzed in this paper were derived from 40 males volunteers from 17 to 39 years of age ($M = 20.5$, $SD = 3.5$). Of these subjects, 37

were single and 3 were married. All subjects had previously experienced orgasm, and 35 subjects had experienced heterosexual intercourse. Subjects masturbated, on the average, more than once a week.

Subjects received either two extra-credit points toward their final grade in an introductory psychology course or \$5. Ten other subjects participated in this experiment, but their data are not included in the analyses due to either equipment problems ($N = 3$) or their failure to respond subjectively and physiologically ($N = 7$).

Apparatus

The experimental laboratory consisted of two adjoining rooms in the Psychology Department. Experimenter and subject were in separate rooms during the course of the actual experiment; communication was maintained with the use of an intercom system. The subject placed either a mercury-in-rubber strain gauge or a Barlow surgical spring strain gauge (Barlow *et al.*, 1970) behind the coronal ridge of the penis in the privacy of the experimental chamber. The type of strain gauge used was equally distributed across groups. Two types of strain gauges were used in this study because the only Barlow strain gauge in our laboratory was inadvertently destroyed during the course of the experiment. The experimental chamber also contained a comfortable lounge chair in which the subject was seated throughout the experiment and in front of which there was a back-reflecting screen for slide presentation. All the other equipment was located in a separate room with the experimenter. The mercury-in-rubber strain gauge was connected to a Parks Electronic model 271 plethysmograph, which fed into a Beckman Type R411 dynograph. Changes in penile circumference resulted in resistance changes in the strain gauge, and these resistance changes were displayed on the polygraph. Strain gauges were sterilized before each use in activated gluteraldehyde sold commercially as Cidex 7.

Subjects were asked to complete three questionnaires: (1) a sexual experience and attitude questionnaire (developed in our laboratory); (2) the Semantic Differential Measure of Emotional State (Mehrabian and Russell, 1974); and (3) a questionnaire developed for this experiment that assessed subjects' experiences with sexually oriented materials.

Stimulus Materials

The stimulus materials were ten color slides. These slides were chosen on the basis of a pretest of 26 slides using a different set of subjects from the same student population. These 26 slides depicted an assortment of erotic scenes commonly found in sexually explicit magazines. The five slides receiving the highest ratings of erotic intensity on a 7-point Likert scale were chosen

for the high erotic-intensity condition ($M = 5.2$, or "slightly high," $SD = 1.7$), and the five slides with the lowest ratings of erotic intensity were chosen for the medium erotic-intensity condition ($M = 2.7$, or "moderate," $SD = 1.7$). A repeated-measures ANOVA revealed that the ratings of the erotic intensity of these two sets of slides were significantly different ($F(1, 7) = 14.82, p < .001$). The slides in the high-erotic conditions all depicted attractive heterosexual couples engaged in oral or genital sexual activity. These scenes were similar to ones commonly found in hard-core pornographic magazines. The slides in the medium erotic-intensity condition all contained only an attractive nude or seminude female model, as commonly found in *Playboy* or other magazines of this type.

Procedure

To help subjects make an informed decision about whether to participate in this experiment, they first participated in an introductory session in which all experimental procedures were explained in detail. Subjects were told that they would be asked to complete a battery of questionnaires that measured sexual history and attitude, and personality variables. They were also shown the experimental chambers, the polygraph, and the penile strain gauge, and were told of the sterilizing procedures. Subjects were assured of privacy, anonymity, and confidentiality, and it was stressed that they could withdraw from the experiment at any time. Any questions were answered at this time.

Subjects were then asked if they would like to schedule a tentative future appointment to participate or if they preferred to think it over and contact us. Appointments were scheduled for at least 24 hours later, so that the subject could have some time to reconsider. No pressure was exerted on anyone to participate.

Random assignment to the four groups and to the slides or slide was carried out before data collection. The strain gauge was also calibrated before the data collection for each subject by noting the magnitude of pen displacement to a precision machined standard of several known circumferences. All subjects were seen by a male experimenter.

On arrival at the laboratory for the actual experiment, the subjects read and signed an informed consent form and completed the three questionnaires mentioned above. The subjects then entered the experimental chamber and were told to put the strain gauge around the penis, against the body wall, once the experimenter had left the room. The subjects were also told about the specifics of the slide presentation. A 5-minute baseline was then recorded in order to determine each subject's basal response level. The slide present-

tation began immediately after this baseline period. Each slide was shown for 1 minute with a 1-minute interstimulus interval. Immediately after the presentation of each slide, the subjects were asked over the intercom to indicate verbally on a Likert scale how sexually aroused they felt. The Likert scale contained seven points: 1, extremely high; 2, very high; 3, slightly high; 4, moderate; 5, slightly low; 6, very low; 7, not at all.

There were four experimental groups: (1) constant stimulus/medium intensity—this group viewed a single slide of medium erotic intensity; (2) constant stimulus/high intensity—this group viewed a single slide of high erotic intensity; (3) varied stimuli/medium intensity—this group viewed a series of five slides of medium erotic intensity; and (4) varied stimuli/high erotic intensity—this group view a series of five slides of high erotic intensity. For those subjects who saw five slides, the initial order of presentation was determined on a random basis. At the end of the set of five slides, the slides were simply presented again in the same order.

The procedure described above for slide presentation (1-minute stimulus duration with a 1-minute interstimulus interval) was then repeated until the subject habituated or up to a maximum of 27 stimulus presentations. Habituation was considered to have occurred if three conditions were satisfied: (1) penile tumescence was near baseline level (diameter of the penis within 1 mm of baseline); (2) no increase in penile tumescence was detectable for two sequential slide presentations; and (3) the subject had given two consecutive ratings of either of the two lowest ratings on the Likert scale of subjective sexual arousal. The change in penile circumference was calculated by subtracting the maximum point obtained during the stimulus presentation from the maximum point obtained during the stimulus presentation from the maximum point obtained from the last 5 seconds of the immediately preceding interstimulus interval. When the slide presentation was completed, subjects were told to remove the strain gauge and were then debriefed.

RESULTS

A repeated-measure ANOVA was used to analyze the physiological and subjective data, and η^2 was computed for significant effects. The dependent variable for the physiological measure of sexual arousal was the change in penile circumference, and the dependent variable for the subjective measure was the Likert scale rating. For the physiological measures of sexual arousal, there was a significant main effect for stimulus intensity ($F(1, 39) = 6.63$, $p < 0.025$, $\eta^2 = 0.153$) such that stimuli of high intensity produced larger amounts of penile circumference changes than stimuli of medium intensity; but there was no significant effect for stimulus variability. The within-subjects

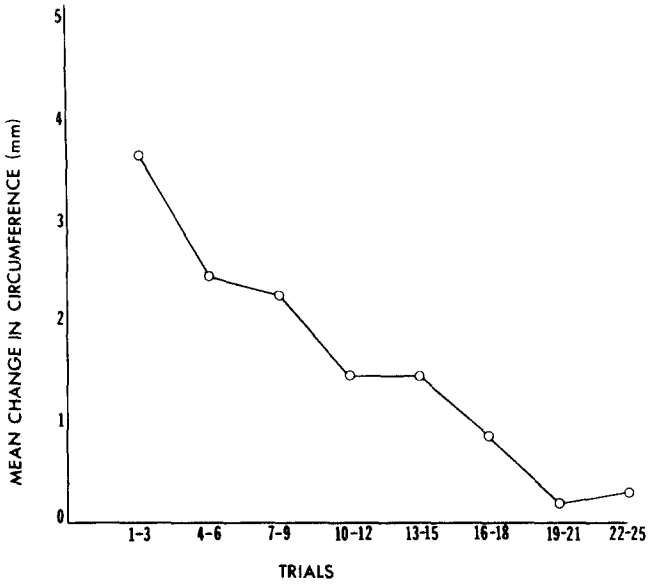


Fig. 1. Penile response over trials.

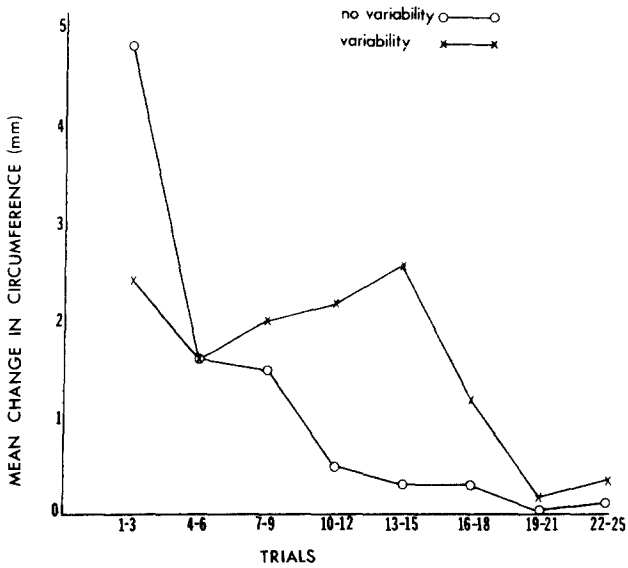


Fig. 2. Stimulus variability and penile response.

analysis revealed a significant trials effect ($F(24, 960) = 386, p < 0.0005, \eta^2 = 0.088$), with responding decreasing over trials (see Fig. 1), and a significant trials by stimulus variability interaction ($F(24, 960) = 2.48, p < 0.001, \eta^2 = 0.055$), such that the constant-stimulus condition resulted in less responding over trials (see Fig. 2). The trials by stimulus intensity interaction and the triple-order interaction failed to reach significance.

For the subjective measures of sexual arousal, there was a significant trials effect ($F(26, 1040) = 11.80, p < 0.0005, \eta^2 = 0.216$), with the magnitude of subjective responding decreasing over trials (see Fig. 3). There was also a significant trials by stimulus variability interaction ($F(26, 1040) = 2.33, p < 0.005, \eta^2 = 0.042$) such that the varied-stimuli condition maintained less responding over trials (see Fig. 4). There was also a significant trials by stimulus intensity interaction ($F(26, 1040) = 3.60, p < 0.005, \eta^2 = 0.066$) showing that high stimulus intensity began higher and showed more habituation than medium intensity (see Fig. 5). The triple-order interaction failed to reach significance.

A Pearson product moment correlational analysis was used to determine the covariation between physiological sexual arousal and subjective sexual arousal. A significant correlation across subjects for the first trial was obtained ($r = 0.447, df = 39, p < 0.005$). The correlations between the geni-

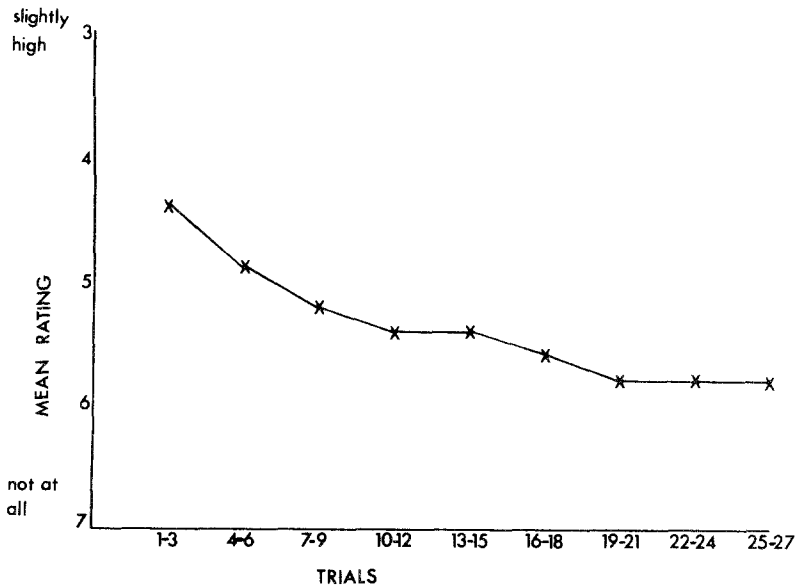


Fig. 3. Subjective response over trials.

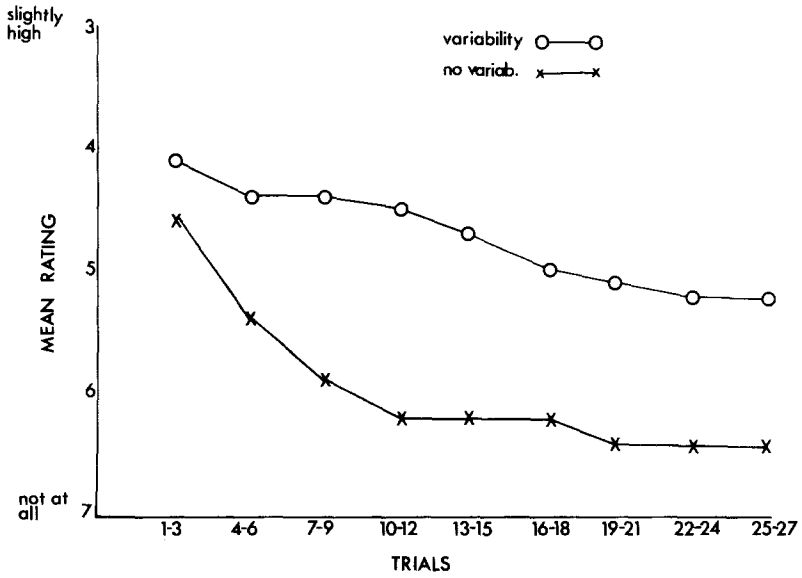


Fig. 4. Stimulus variability and subjective response.

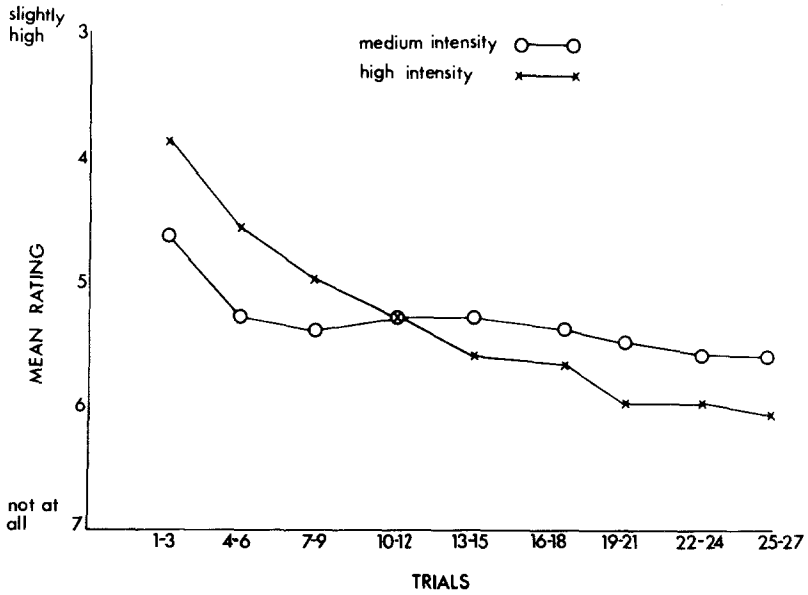


Fig. 5. Stimulus intensity and subjective response.

tal and subjective measures decreased as responses habituated, due, at least in part, to reduced response variability.

A Pearson product moment correlational analysis was also used to assess covariation between questionnaire responses and physiological and subjective responding. Penile responding was significantly correlated with (1) population density of childhood residence ($r = 0.368$, $df = 39$, $p < 0.025$), (2) frequency of masturbation during the last year ($r = 0.434$, $df = 39$, $p < 0.005$), and (3) estimation of total number of masturbatory episodes ($r = 0.301$, $df = 39$, $p < 0.05$). Subjective responding was only significantly correlated with the population density of childhood residence ($r = 0.474$, $df = 39$, $p < 0.005$).

DISCUSSION

The results of this study clearly indicate that sexual arousal to erotic stimuli decreases with repeated stimulus presentations. This result is consistent with the findings of Heiman (1977), Rubin *et al.* (1979), and Schaefer *et al.* (1976). In addition, however, the results of this study provide support for the notion of a habituation process that at least partially accounts for the observed decrement in sexual arousal.

The hypotheses that a constant stimulus would produce higher rates of decreases of physiological and subjective responding over presentations than would varied stimuli were confirmed. The confirmations of these hypotheses were necessary in order to rule out physiological fatigue as a rival hypothesis to habituation, since an observed decrement in responding could very plausibly be attributed to efferent fatigue. However, since the varied-stimuli condition demonstrated that a relatively higher magnitude of penile responding was indeed possible, the larger decrement in responding to the constant stimulus cannot be attributed solely to a fatigue process but can be, at least partially, explained by a habituation process. The physiological data of penile responding were slightly less clear on this point than the subjective data, as the two subjects who had the highest initial physiological responses were in the constant-stimulus condition. However, with the exception of these data the physiological data indicate that the constant-stimulus condition results in a higher rate of response decrement than does the varied-stimuli condition. This finding represents an important extension of previous studies whose designs failed to control for physiological fatigue (cf. Howard *et al.*, 1970).

It is also important to note that the magnitude of both subjective and physiological responding also decreased in the varied-stimuli condition. This was not unexpected, as it was thought that some response attenuation would

occur to varied stimuli due to both physiological fatigue and, although to a lesser extent than in the constant-stimulus condition, to habituation. The design of this study does not allow further analysis of the relative contributions of these two factors to the response decrements found in the varied-stimuli condition. Further, the design of this study does not allow more detailed analyses of the actual habituation curves. However, the progression of the habituation process is an important matter for further research.

The finding that sexual arousal does habituate provides empirical support for the concerns of Schaefer and Colgan (1977) and Zuckerman (1971) that habituation can serve as a methodological confound in sex research. Researchers in the future need to be mindful of designs that utilize repeated exposure to the same or similar stimuli. In these designs, treatment effects can easily become confounded with habituation effects.

The results of this study indicate that there is a need to control for the effects of habituation by utilizing a control group that does not receive any experimental treatment but rather is exposed just to the same stimuli as other experimental subjects. This "habituation control" can be used to assess the effects of repeated exposure to the experimental stimuli and thus to assess the relevancy of habituation.

The hypotheses concerning the rate of habituation and stimulus intensity are more difficult to evaluate. The literature on the habituation of other response systems indicates that stimuli of high intensity produce lower rates of habituation than stimuli of lower intensity (Olst, 1971). In the present study, this relationship was hypothesized to hold for the habituation of both physiological and subjective sexual arousal. However, the results of this study failed to provide support for the hypothesis that stimuli of high erotic intensity would produce lower rates of habituation of physiological sexual arousal than stimuli of medium erotic intensity. Furthermore, the data from this study only partially supported this hypothesis with subjective sexual arousal. The data indicated that, for the first 12 presentations, stimuli of high erotic intensity were consistently associated with a higher magnitude of subjective responding than stimuli of medium erotic intensity. However, from trial 13 to trial 27, stimuli of medium erotic intensity were associated with a higher magnitude of subjective response. The latter part of this relationship was unexpected and is not consistent with the literature on habituation.

It is possible that the data from this study failed to support the hypothesized relationships between erotic intensity of the stimulus and physiological and subjective habituation because of problems in defining *erotic intensity of a stimulus*. The habituation literature of other response systems, e.g., that of the orienting response, can define stimulus intensity on physical dimensions such as loudness that have a nonarbitrary zero point and hence are ratio scales. These ratio scales have the advantage of allowing the precise

determination of quantitative differences among levels of stimulus intensity. However, the erotic intensity of a stimulus is not a physical dimension and does not have a nonarbitrary zero point. Since erotic intensity defies this precise quantification, it is possible that the two levels of erotic intensity were not sufficiently different. Furthermore, the perception of erotic intensity varied considerably across individuals, reflecting their diverse and idiosyncratic preferences. Although the pretest ratings of the stimuli used in this study resulted in significant differences between the two levels of stimulus intensity, it is important to note that the raters in the pretest viewed all the stimuli, whereas the actual experimental subjects viewed only the stimuli that were appropriate to their assigned experimental condition. The raters in the pretest might have been influenced by the wide range of stimuli to which they were exposed; and the experimental subjects, being naive to this range of erotic stimuli, might have had different perceptions of the erotic intensity of a particular stimulus. These problems might be partially corrected by pretesting the erotic stimuli on each experimental subject to determine idiographic levels of erotic intensity.

Although the mean levels of subjective arousal obtained in this study were fairly high, the mean levels of physiological arousal obtained were somewhat disappointing. Response decrements due to habituation would have been more dramatic given higher initial changes in penile circumference. However, the relatively low levels of initial physiological arousal might have been due to the stimulus modality utilized in this study. The slides, although quite sexually explicit and rated highly by subjects in the pretest, might be an inferior modality to sexually explicit audiotapes for producing higher initial levels of arousal (Heiman, 1977). Future studies might explore the effects of other stimulus modalities.

The significant correlation of 0.447 between physiological sexual arousal and subjective sexual arousal is within the range of correlations commonly found (Korff and Geer, 1983). The significant correlations between questionnaire responses concerning subject variables and physiological and subjective response are difficult to interpret, since no pattern is readily discernible. Furthermore, the small sample size used in this study does not provide a sufficient sampling of the range of subject variables to justify any strong conclusions. However, these correlations can serve as preliminary indications for further research.

In conclusion, this study provided empirical support for the notion that sexual arousal, as measured by both a physiological index and a subjective index, systematically decreases in magnitude over stimulus presentations. Furthermore, the design of this study, by eliminating physiological fatigue as an alternative hypothesis, provided an unconfounded demonstration of the intrasession habituation of sexual arousal.

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