



Habituation of Sexual Arousal in Sex Offenders: The Role of Cognitive Processes

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Abstract

Habituation of sexual arousal to deviant fantasy in a sample of sex offenders was examined. In addition self-reports of attentional and affective states were monitored to observe if changes in these states paralleled shifts in sexual arousal. Eight male sex offenders were presented with a constant deviant erotic fantasy described on audiotape. The same fantasy (habituation stimulus) was presented for 18 trials within a session followed by a different fantasy (novel stimulation) and then the habituation stimulus was presented again. Penile tumescence and subjective reports were used to measure sexual arousal. Skin resistance was recorded, as well as self-reports of how vivid the images were and how absorbed participants became in the depicted fantasy. A repeated measures analysis of variance showed that penile tumescence was the only dependent variable to vary significantly across habituation trials. Penile tumescence increased over trials and was higher at the end of the series than at the beginning. Attentional and affective responses did not change significantly or parallel the shifts in penile tumescence across the 18 trials of repeated stimulation. There were no increases in penile tumescence during novel stimulation or following the reintroduction of the original fantasy. These results contrast with those reported by Kounkounas and Over (1993) for nonoffenders of decreases rather than increases in sexual arousal paralleled by shifts in attentional and affective states. The discrepant findings are discussed with reference to the role of cognitive processes and the possibility that there are fundamental differences in the way sex offenders and nonoffenders process the information in erotic fantasy.

Keywords: Habituation; Male sexual arousal; Sex offenders; Deviant erotic fantasy; Penile tumescence; Erotic stimulation

INTRODUCTION

Habituation is a non-associative learning process in which the strength of a response decreases with repeated stimulation (Harris, 1943). In genuine habituation, as distinct from neural adaptation or

fatigue, the diminished response recovers when the stimulus is withdrawn for a period or when a novel stimulus is presented (Thompson & Spencer, 1966). A reduction in responding to repetitive stimulation

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has been observed in a wide variety of organisms including humans, where it has been typically studied in terms of autonomically mediated responses such as skin resistance or heart rate to sensory stimuli (Peeke & Herz, 1973; Peeke & Petrinovich, 1984; Siddle, 1983; Thompson & Spencer, 1966).

Habituation of the human sexual response has not been widely studied. In the few studies that have examined this phenomenon, participants are typically required to view the same erotic stimulus delivered as text, audio or film and presented repeatedly for a period of time either within the one session or across a number of sessions. In initial experiments, a reduction in sexual responding was observed when participants viewed either a collection of erotic material (Howard, Reifier, & Liptzin, 1970; Mann, Berkowitz, Sidman, Star, & West, 1974) or were repeatedly presented with similar material (Schafer & Colgan, 1977; Zillman & Bryant, 1984) across a number of days or weeks. The measures used in these studies included self-reports, heart rate, blood pressure, changes in penile volume, and urinary acid excretion.

The main difficulty with these studies was that their design failed to rule out fatigue as the factor responsible for the reduced levels of arousals. In better-controlled experiments, diminished responses to repeated erotic stimulation have been recorded. O'Donohue and Geer (1985), in a within-session study involving 40 males, exposed one group to the same 27 erotic slides presented at intervals of one minute and the second group to a variety of erotic slides. Although they found the extent of the decrements in penile tumescence and self reported sexual arousal for both groups were similar across the trials, habituation for the group exposed to the same stimulus was more rapid. Kelly and Musialowski (1986) introduced a novel stimulus following exposure to the same erotic film over four days and found both males and females reported lowered sexual arousal to it.

Meuwissen and Over (1990) exposed 8 females to the same erotic film or fantasy for 18 1-minute trials within one session, followed by the presentation of two different stimuli. Significant reductions in measures of subjective and physiological sexual arousal were recorded. Their study also monitored participants' reports of their clarity of imagery, and found that reduction in vividness paralleled changes in sexual arousal,

indicating that cognitive processes may attenuate habituation.

Other investigators have found that sexual arousal remains unchanged with repeated erotic stimulation. Julien and Over (1984) showed 24 men erotic films, slides, audio, and text across five days. The stimulation within a session on a given day was the same and consisted of eight 2-minute erotic episodes at intervals of 30 seconds. Although sexual arousal varied across segments within a session, no habituation was observed across sessions. Smith and Over (1987a) found no habituation when men engaged in the same structured fantasy (a fantasy involving a consensual sex act with a preferred partner) which was to be held constant over repeated presentations within a session. In one of the experiments, novel stimulation followed repeated exposure to the structured fantasy. There was some evidence that fantasy variation could result in high erotic salience being maintained thus blocking habituation. Lann and Everaed (1995) also found that females varied their fantasies due to boredom when presented repeatedly with the same stimulus.

Although the above studies attempted to control for fatigue as a confounding factor in habituation, none employed the procedure recommended for this purpose by Peeke and Petrinovich (1984). These authors contended that the best evidence for an active habituation process as distinct from fatigue is provided when a response is shown to decrease when the stimulus is repeatedly presented and to be reinstated when the stimulus is again presented following presentation of the novel stimulus. This method was adopted by Koukounas and Over (1993) who were able to demonstrate decrease in sexual arousal with repeated erotic stimulation and recovery following interruption by a novel stimulus. They also argued that individual variation in response decrements across trials may parallel changes in attentional and affective states and to some degree be contingent on them.

There is also some evidence that sexual arousal declines during repeated presentation of deviant erotic material (i.e., sexual material that depicts sex acts being either physically or psychologically forced on non-consenting adults or children). Although Ceniti and Malamuth (1984) did not directly study habituation, they did examine the effects on sexual arousal of repeated exposure to either sexual acts obtained from a non-consenting

party by physical force or sex acts between mutually consenting legally aged parties. Sixty-nine men participated in the study and prior to the experiment they were shown written and pictorial depictions of rape and mutually consenting intercourse. Participants were classified as either force-oriented or non-force-oriented on the basis of their penile tumescence responses to these depictions. The study demonstrated that sexual arousal declined for males classified as force-oriented during repeated presentation to both sexually deviant and non-deviant stimuli. However, for males in the same study classified as non-force-oriented a similar pattern was not evident.

The sexual arousal response of sexual offenders to repetitive exposure to deviant erotic material has not to our knowledge been previously investigated in a traditional habituation paradigm. It is therefore not known whether sex offenders habituate in a similar manner to nonoffenders, and in particular whether fantasy-induced deviant sexual arousal (i.e., sexual arousal induced by fantasies about either physically or psychologically forcing sex acts on non-consenting adults or children) diminishes with stimulation. Sex offenders are known to use deviant fantasies to maintain deviant sexual arousal patterns and behaviour (Evans, 1968; Goldstein, Kant, & Hartmen, 1973; Marshall, 1988; McGuire, Carslie & Young, 1965), and these deviant fantasies appear to retain high erotic salience despite repeated use. Some reconditioning techniques (masturbatory satiation) are used in the treatment of sex offenders to produce long-term habituation of sexual arousal by dissociating sexual stimulation and sexual gratification (see Laws & Marshall, 1991).

Studying the habituation of sexual arousal in sex offenders therefore provides an opportunity to monitor the role of cognitive factors. The influential role of cognitive processes such as fantasy, thought content, perception, and vividness of imagery, in shaping and determining the magnitude of sexual arousal patterns in nonoffenders has been well documented (Abrahamson, Barlow, Beck, Sakheim, & Kelly, 1985; Beggs, Calhoun, & Wolchick, 1987; Decker & Everaerd, 1988, 1989; Geer & Fuhr, 1976; McCauley & Swan, 1980; Przybyla & Byrne, 1984; Smith & Over, 1987b; Sue, 1979). It has also been acknowledged that cognitive factors play an important role in sex offending although there has

been a paucity of research in this field (Geer, Estupinan, & Manguno-Mire, 2000; Ward, Hudson, & Johnston, 1997). These authors in their review of empirical research have highlighted some differences between the way sex offenders and nonoffenders cognitively process sexual material. However, the differences are not clear in all respects and the empirical data supporting the differences appears limited. There appears to be only marginal differences between rapists and other males in respect to attitudes and beliefs about aggression towards women but the sex related beliefs of some types of child molesters are distinctly different from other males (see Ward et al., 1997, pp. 487- 488).

It is therefore timely to investigate the habituation of sexual arousal in sex offenders in order to assess whether their habituation responses are different or similar to nonoffenders and to examine the role of cognitive processes. The present study measured sexual arousal (penile tumescence and self-reported arousal) in a session across 22 trials while convicted sex offenders repeatedly engaged in a constant deviant erotic fantasy. An experimental paradigm similar to that of Koukounas and Over (1993) was followed. Participants were presented with the habituation stimulus (constant fantasy) followed by novel stimulation (two new different types of fantasies). The extent to which sex offenders felt sexually aroused, varied the vividness of the imagery and became absorbed in the fantasy was monitored. In addition skin resistance was recorded during erotic stimulation. We expect that the sexual arousal responses of sex offenders would diminish with repeated exposure to a constant deviant erotic fantasy and be associated with, and attenuated by, affective and attentional factors.

METHOD

Participants

Eight male sex offenders who had been convicted of sexual assault against adults and children were recruited to participate in the study. Three of the offenders had been convicted of sex offences against adult females, one against an adult male, and the remaining four had all been convicted of offences against children. Individuals suffering medical conditions or using drugs that would prevent an erection were excluded. Participation was by informed consent and participants were assured that information gained from the study

would only be used for the purposes of research and their identities would not be divulged. It was emphasised that results would not be made available to correctional authorities without the individual's consent. They were also informed they could terminate their participation in the study at any time. The project was approved by the Griffith University's Ethics Committee and the Queensland Corrective Services Research Unit prior to commencement.

Apparatus

Penile response was measured by a Barlow strain gauge (Barlow, Becker, Leitenberg, & Agras, 1970) that has been shown to be a reliable and valid instrument to measure changes in penile circumference (Rosen & Beck, 1988). Changes in resistance of the gauge resulting from variation in penile circumference were recorded using a Farrall-CAT400 system, previously successfully used to measure habituation of sexual arousal in males (O'Donohue & Plaud, 1991), and a 486 Windows format PC.

The Barlow strain gauge was calibrated permitting participants' responses to be expressed in millimetres of penile circumference. Skin resistance was measured from electrodes attached to the fingers using the Galvanic Skin Response module of the Farrall system. The module is an adaptive GSR, which means that the trace only shows changes in resistance, which were expressed in ohms.

The deviant erotic fantasies were played through a tape recorder connected to the computer and the CAT400UL system.

Procedure

Each test session lasted approximately 90 minutes and included an initial relaxation period, stimulus presentation, and an inter-stimulus period followed by debriefing. Testing occurred privately with only the participant and experimenter present. The subject was tested in a quiet, dimly lit room while seated in a chair with attached monitoring devices. Visual contact was not possible as the subject and experimenter were separated by a partition. Experimenter and subject communicated with each other through an intercom system and the erotic audiotape was played through a set of headphones.

Prior to testing, participants were given instructions on how to attach the devices. Each subject was seated in the test room, and the headphones were adjusted. The skin resistance transducers were attached to two of the subject's fingers by the experimenter. The experimenter then left the room, and the subject in private fitted the strain gauge around the shaft of his penis. The strain gauge was sterilised using a solution of activated gluteraldehyde (Cidex) prior to and following testing of each participant. Participants were instructed to sit in the chair and to relax as much as possible. During the relaxation period, calibration and equipment checks were carried out.

Prior to the erotic stimulus being presented, participants were instructed to attend fully to the fantasy being depicted in the audiotape. The content of the audiotape was developed following interviews with participants to ensure it would be sexually arousing. The audiotaped sexual fantasy depicted a scene in which one person made sexual advances to another. When the recipient of the advances displayed resistance more aggressive behaviour was used in order to gain compliance. The fantasy scenes were customised to reflect the subject's deviant fantasy preference in that it matched the age and gender of their preferred target.

Prior to testing, participants were asked to imagine that they were in fact the person initiating the sexual activity portrayed in the scene and to become as fully involved as possible. They were asked to focus on the nominated fantasy and employ this constantly without changing the content. Participants were instructed to permit themselves to become sexually aroused as the depicted fantasy induced sexual arousal. They were also instructed not to inhibit an erection and to remain as still and as comfortable as possible. They were advised not to touch their penis or monitoring devices as movement could produce artefacts in polygraph recording.

During the testing session the subject engaged in the same deviant erotic fantasy on 18 occasions (habituation trials). On the 19th and 20th trials two different audio fantasies were presented (novel stimulus). The initial erotic fantasy was reinstated on the 21st and 22nd trials (dishabituation). The audiotape of the deviant fantasy stimulus was presented for approximately 75 seconds, although for each tape only 60 seconds of responses were

included in the results so as to ensure consistency following technical difficulties. The tape was played through headphones at an intensity of normal conversation. Penile circumference and skin resistance was recorded continuously during erotic stimulation and the inter-stimulus period.

During the inter-stimulus interval of 90 seconds participants provided a verbal rating of the extent to which they had felt sexually aroused during the preceding fantasy segment. Ratings were made on a 9-point scale ranging from ‘not sexually aroused’ to ‘wildly sexually aroused’. In addition, during each inter-stimulus interval participants rated the extent to which they became involved or absorbed in the events depicted in the preceding erotic audio fantasy. These ratings were made on a 9-point scale that covered the range from ‘not absorbed’ to ‘fully absorbed’. Participants also provided a rating on a 9-point scale from ‘not vivid’ to ‘highly vivid’ of the extent to which they had formed vivid images of the events depicted in the fantasy.

Data Reduction

During the 1-minute deviant fantasy stimulus period physiological measures for penile circumference in mm and skin resistance in ohms were recorded. Penile circumference measures were converted to percentages by the Advanced Statistics Program, which formed part of the computer software. Mean physiological measures for penile circumference and skin resistance were calculated for each of the 22 1-minute stimulus periods by recording the measures at each 5-second period and averaging the data. The means for consecutive pairs of trials were then averaged to provide nine data points for the habituation phase (Trial Blocks 1-9), one for the novelty phase (Trial Block 10) and one for the dishabituation phase (Trial Block 11).

The self-report ratings of the extent to which participants felt sexually aroused, absorbed, and formed vivid images during each of the 22 stimulus periods were expressed as percentages and averaged over trials as with the psychophysiological data.

RESULTS

Data analysis examined change in the five dependent variables (penile tumescence, subjective arousal, absorption, vividness of imagery, and skin resistance) over the 11 trial blocks. Analysis was

directed to comparisons in the three phases of the experiment. Phase 1 was the habituation phase and included Trial Blocks 1 to 9. All nine trial blocks were included and then the data re-analysed using only Trial Blocks 1 and 9. Phase 2 involved the introduction of the novel stimulus on Trials 19 and 20 (Trial Block 10), and the analysis here compared response magnitude on Trial Block 9 and 10. Phase 3 was the dishabituation phase in which the original stimulus was reintroduced on Trials 21 and 22 (Trial Block 11). Analysis compared response magnitude on Trial Blocks 9 (final Trial Block of the habituation phase) with Trial Block 11. These analyses allowed the response measure to be examined in terms of the definition of habituation argued for in the Introduction: decrease in response magnitude with repeated stimulus presentation, either on the first nine trial blocks or the less sensitive test of Trial Blocks 1 versus 9; response to novelty (Trial Block 10 versus 9); and dishabituation (Trial Blocks 11 versus 9).

Penile Tumescence

The distribution of the data for penile tumescence was skewed. A square root transformation reduced the skew by a factor of 3. Data analysis therefore proceeded using transformed scores. Figure 1 presents the data for the penile circumference measure. Inspection of Figure 1 indicates an increase in response magnitude during the initial series, at least up to Trial Block 6, no change in response magnitude on the novelty trials, and little difference between the dishabituation trials and the final trials of the initial series. ANOVA on magnitude of response on the first nine trial blocks indicated a significant effect for repeated stimulation, $F(2.052, 14.366) = 4.636$, $EMS = 2.125$, $p = .027$. (The df in this and subsequent repeated measures analyses were adjusted by the Greenhouse-Geisser correction to protect against the violation of the homogeneity of covariance assumption.).

Analysis of trend for response magnitude over trials indicated a significance quadratic component, $F(1, 7) = 6.77$, $p = .035$. No other components were significant. The quadratic trend can be seen in Figure 1 to arise from the increase in response magnitude up to Trial Block 5 followed by a levelling out of response magnitude. Comparison of response magnitude over Trial Blocks 1 and 9 indicated that the magnitude on Trial Block 9 was larger than on Trial Block 1, $t(7) = -2.398$, $p < .048$.

ANOVA comparing Trial Blocks 9 and 10 showed no significant effect for novelty, $F(1, 7) = .686$, $p > .05$. ANOVA on Trial Blocks 9 and 11 also failed to show a significant dishabituation effect $F(1, 7) = .004$, $p > .05$.

To summarise, penile tumescence increased over trials in the initial series of repeated stimulation reaching a peak over Trial Blocks 4, 5, and 6 and was higher at the end of the series (Trial Block 9) than at Trial Block 1. There was no novelty effect and a slight and statistically non-significant dishabituation effect.

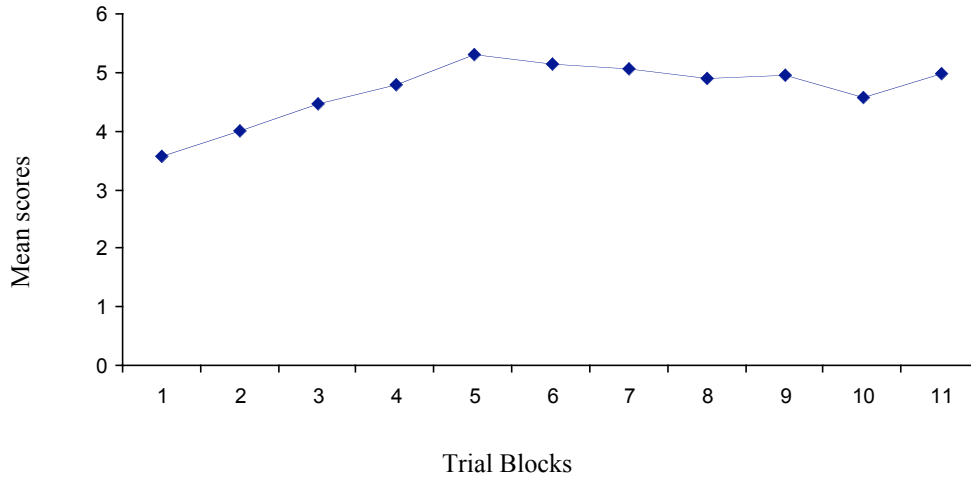


Figure 1. Mean Square Root Transformed Percentage Scores for Penile Tumescence during Repeated Stimulation (Trial Blocks 1-9), Novel Stimulation (Trial block 10) and Reintroduction of the Repeated Stimulus (Trial Block 11).

Skin Resistance

A square root transformation of the skin resistance data made little difference (skew was marginally increased) and hence analysis used the untransformed scores. Figure 2 presents the data for the skin resistance measure averaged over blocks of two trials. There was no statistically significant effect for Trial Blocks 1 to 9, $F(2.052, 14.366) = .600$, $EMS = .113$. Nor were there significant effects for novelty (Trial Blocks 9 & 10), $F(1, 7) = .304$, $p = .598$.

Comparison of response magnitude on Trial Block 9 with that on Trial Block 11 (dishabituation) showed no significant difference, $F(1, 7) = .145$, $p = .715$. There was no significant difference when the mean on Trial Block 1 was compared with that on Trial Block 9, $t(7) = .872$, $p = .412$.

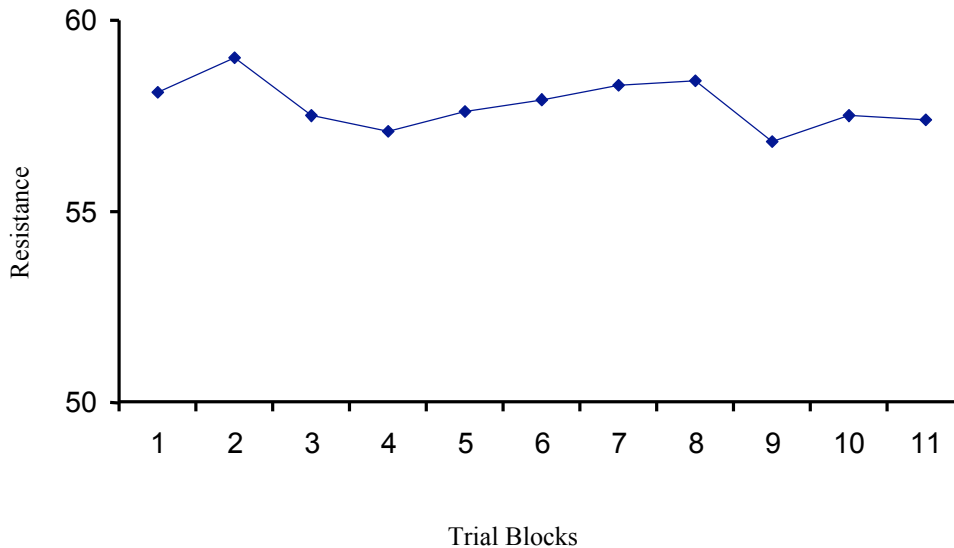


Figure 2. Mean Change in Resistance During Repeated Stimulation (Trial Blocks 1-9), Novel Stimulation (Trial Block 10) and Reintroduction of the Repeated Stimulus (Trial Block 11).

Subjective Response Measures

A number of transformations were applied to the raw data but these had little effect and hence the raw data were used for analysis. Figure 3 presents changes in the three subjective response measures, again averaged in blocks of two trials. For sexual arousal there was no significant effects for the initial repeated stimulation series, $F(2.432, 17.026) = 1.035$, $EMS = 740.026$ nor were there effects for novelty, $F(1, 7) = 4.202$, $p = .080$ or dishabituation, $F(1, 7) = .960$, $p = .360$. For absorption the effects for the initial repeated stimulation series, $F(2.497, 17.476) = .881$, $EMS = 1291.802$, and dishabituation, $F(1, 7) = .017$, $p = .901$ were non-significant. There was, however, an effect for novelty, $F(1, 7) = 9.269$, $p = .019$.

The same was true for vividness of imagery, with the effects for repeated stimulation, $F(2.792, 17.476) = 1.499$, $EMS = 929.581$ and dishabituation, $F(1, 7) = .242$, $p = .638$ non-significant, but the effect for novelty significant, $F(1, 7) = 6.479$, $p = .038$. There were no differences when the means of subjective response measures on Trial Block 1 were compared with those on Trial Block 9. The t-tests were: sexual arousal, $t(7) = 1.066$, $p = .332$; absorption, $t(7) = 1.407$, $p = .202$; and vividness of imagery $t(7) = .876$, $p = .410$. It is also apparent from Figure 3 that vividness of imagery, subjective arousal, and absorption all decreased in four of the last five trial blocks of the habituation phase.

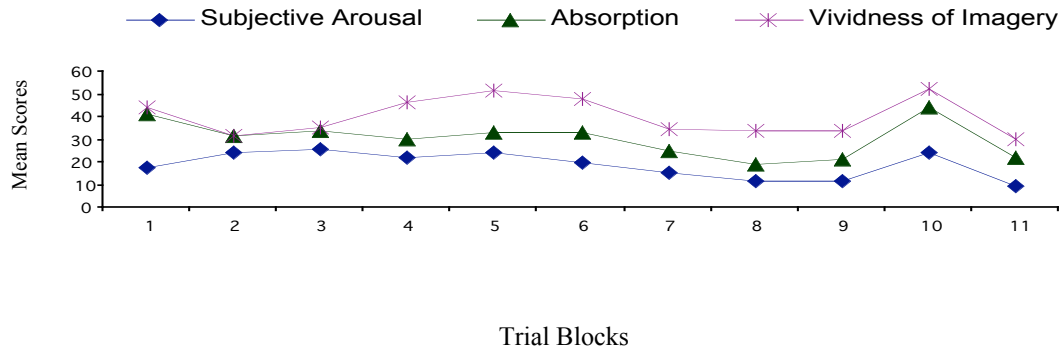


Figure 3. Mean Percentage Scores for the Subjective Response Measures During Repeated Stimulation (Trial Block 1-9), Novel Stimulation (Trial Block 10) and Reintroduction of the Repeated Stimulus (Trial Block 11).

Correlation Analysis

Response measures were correlated at each trial block to examine the extent of association among them. Few correlations were statistically significant

and those that were involved one or more of the subjective response measures. There were no statistically significant correlations between any of the subjective response measures and penile tumescence on any trial block.

Dependent Measures

Table 1
Summary of the Results for each Dependent Measure during the Stimulus Repetition, Novelty and Dishabituation Phases.

Measure	Stimulus Manipulation		
	Stimulus Repetition	Novelty	Dishabituation
Penile Tumescence	Increase	No effect	No effect
Skin Resistance	No effect	No effect	No effect
Subjective Arousal	No effect	No effect	No effect
Absorption	No effect	Increase	No effect
Vividness of Imagery	No effect	Increase	No effect

Table 1 summarises the results for each measure in terms of those aspects of the definition of habituation: effect of repetition, novelty, and dishabituation. Inspection of Table 1 shows there was no evidence that sexual arousal induced by deviant fantasy is subject to habituation. Penile tumescence did not decrease over the initial series of repeated stimulation, but, in fact, increased and was significantly higher at the end of the series than at the beginning. There was no response to novelty and no dishabituation. Subjective sexual arousal showed an initial increase and then decreased

across the remaining trials in the initial series but the change was not statistically significant. There were no effects of novelty or dishabituation. Skin resistance did not vary significantly across the initial series and there was no evidence of novelty or dishabituation.

Although the absorption measure decreased across the initial series, this was not significant. There was, however, a significant increased response to novelty but no dishabituation. Vividness of imagery initially decreased in the first two trial

blocks, and then increased before declining across the last four trial blocks of the initial series. The variations in the initial series were not statistically significant. There was a significant novelty effect but no dishabituation.

DISCUSSION

The present study sought to examine habituation of sexual arousal (penile tumescence and subjective reports) induced by fantasy in a sample of males convicted of sexual offences. A procedure previously used by Koukonas and Over (1993) to demonstrate habituation of sexual arousal to fantasy in nonoffender males was used, but with deviant fantasy being employed here. The operational definition of habituation adopted was that of Peeke and Petrinovich (1984) and required that response decrease over repeated presentation of the stimulus in an initial series, the response recover when a novel stimulus is presented, and a response to the initial stimulus be dishabituated when it is again presented following the novel stimulus. Measures of skin resistance, an autonomic measure of arousal not specific to sexual activation, was obtained as well as measures of cognitive processing of the fantasy material, viz absorption and vividness of imagery, to determine the role of cognitive mediation.

In addition to failing to show habituation of sexual arousal, no association was demonstrated between changes in sexual arousal and changes in the cognitive processes of absorption and vividness of imagery. Penile tumescence and the cognitive measures were differentially sensitive to different stimulus manipulations: penile tumescence varied with stimulus repetition but not novelty; absorption and vividness of imagery varied with novelty but not stimulus repetition. Furthermore, there were no significant correlations between penile tumescence and the cognitive measures over the trial blocks. This pattern of results is not consistent with mediation of changes in sexual arousal by the processes reflected in the cognitive measures.

The present study was modelled on Koukonas and Over’s (1993) experiment in which habituation of penile tumescence was studied in response to fantasy and changes in absorption and vividness of imagery were monitored. Contrary to the present results, in their study penile tumescence was found to decrease in response to repetition, to recover with novelty, and to show subsequent

dishabituation. The changes in penile tumescence in their study were paralleled by changes in absorption and vividness of imagery. It is tempting to propose that the difference in findings between the Koukonas and Over (1993) study and the present one are due to the nature of the samples studied: normal males in the case of Koukonas and Over (1993) and deviant males here.

Such a proposal draws support from findings elsewhere (Crepault & Couture, 1980) that some sexual fantasies retain strong erotic valence despite continual use and that sex offenders in particular prefer to use the same deviant fantasy repeatedly. That is, the differences between the two studies may reflect fundamental differences in the way the two groups process the information in erotic fantasy. For sex offenders, erotic fantasy may generate a positive feedback effect on arousal whereas for nonoffenders fantasy is initially arousing but with repetition begins to lose its erotic salience. There is some limited empirical support for the notion that sex offenders and nonoffenders differ in the way they cognitively process sexual material (see Geer, Estupinan, & Manguno-Mire, 2000; Ward, Hudson, & Johnston, 1997).

The pattern of change in penile tumescence in the present study was consistent with sensitisation, in the Groves and Thompson (1970) sense: an increase in magnitude of the response resulting from activation of the stimulated and unstimulated neural pathways. In their model, habituation, the decrementing process in the stimulus-response pathway, is opposed by sensitisation. Which process prevails depends on the intensity of the stimulus, with strong stimuli promoting sensitisation that is greater than the habituation. It may be that as a result of experience, or for some other reason, sensitisation rather than habituation is the more likely effect of fantasising in sex offenders, whereas the reverse is true in nonoffenders. The failure of skin resistance to habituate in the present study, given that habituation of this response is typical in response to stimulus repetition (Siddle, 1983), may indicate the over-ride of the habituation process by strong excitation of the stimulated and unstimulated neural pathways as proposed here.

Before accepting such a hypothesis for further testing, however, a full examination of the literature and the limitations of the present study are

warranted.

Failure of habituation of penile tumescence to fantasy in normal males has been reported in one other study (Smith & Over, 1987a), although the procedure in that study did not include a test for reinstatement of response to the iterative stimulus following novel stimulation. Smith and Over (1987a) noted that image clarity for both high vividness and low vividness participants in their study remained stable during repetitive erotic stimulation, but that low vividness participants had low sexual arousal at the start of testing, making it difficult to establish decrements. The participants with vivid imagery had sufficient sexual arousal to assess decrements during repeated stimulation. Vividness remained stable throughout the session, for these participants, suggesting that high vividness of imagery may block habituation.

The present study found no substantial changes in vividness of imagery across the initial series of repetitive deviant erotic fantasy. If the participants in the present study were vivid imagers (no test of individual differences in imagery was administered that would establish this), then failure of habituation could be interpreted as the result of the blocking effect of imagery that was maximised. This, however, does not account for the increase in penile tumescence, only the failure to show a decrease.

There are a number of other possible reasons for the finding in the present study that sex offenders did not demonstrate habituation to repetitive deviant erotic stimulation. Participants may have varied their fantasy across trials despite instructions to maintain a constant fantasy. Sex offenders are generally not regarded as the most cooperative participants. The novelty effect of fantasy variation encourages continuous response recovery that would enable participants to maintain stable rates of absorption, vividness of imagery and sexual arousal.

Smith and Over (1987a) and Laan and Everead (1995) reported fantasy variation of the constant stimulus in their studies. Enquires immediately following testing in the present experiment provides some support for this contention. One of the participants admitted that in order to prevent boredom he varied the fantasy towards the end of the initial series of repetitive stimulation (Trials Blocks 6-9).

Although an interpretation of the present findings in terms of sensitisation of sexual responding in sex offenders is possible, it is also possible to interpret them in a way consistent with Koukounas and Over (1993). They proposed that, when the stimulus is repeatedly presented, the resulting decline in physiological arousal is accompanied by changes in attentional and affective states. The effect of the changes is that the participant experiences a shift from a participant perspective to a spectator one, i.e., from being involved with the stimulus to simply observing it. This shift in attentional and affective states across the trials of repetitive stimulation influences the rate of habituation. Although these cognitive processes are independent of the underlying neural basis of habituation, they are superimposed on the underlying mechanisms, and attenuate the rate of habituation.

Over and Koukounas (1995) proposed that sexual arousal fails to habituate when information processes regulating sexual arousal remain stable during repeated stimulation, whereas habituation occurs when these processes change as a consequence of repeated erotic stimulation. The present study gives some support to this proposal as it found no habituation of sexual arousal and the affective and attentional states remained largely stable during repeated stimulation. The support, however, depends on the interpretation of null results. Moreover, the present study was limited in that it did not measure attentional and affective states independently and consequently the nature of the relationship between cognitive processes and habituation of sexual arousal remains unclear.

The present study had a number of limitations that need to be addressed in future research. First, only a small sample of sex offenders was studied. Sample size is a problem in research of this kind, as volunteers proved difficult to obtain. Probably for this reason previous work with non-offender populations has used sample sizes of the order employed here (Smith & Over, 1987a). Second, there was no sample of nonoffenders with whom the offender group could be compared. This is more of a difficulty. As the present study is the first reported of its kind with sex offenders, it was considered necessary to describe the pattern of changes as a first step and ensure fatigue was ruled out as a reason for any response decline. The apparent differences in responding to those reported in a nonoffender sample now warrants further

study, which should include an explicit comparison group.

A third limitation of the study reported here is that several of the measures relied on self-report. Given the lack of cooperation frequently encountered with offender samples, more objective measures of attentional and affective states would provide a stronger basis for drawing inferences. The eye blink startle reflex and reaction time to a probe stimulus would provide more objective and independent measures of affect and attention (Over & Koukounas, 1995).

Over and Koukounas (1995) proposed that in light of the studies that have demonstrated attention and positive affect change in association with sexual arousal during repeated stimulation, a model of habituation encompassing more complex information processing needs to be developed. An information-processing model would explain habituation of sexual arousal in terms of an adjustment in level of response to accommodate changes in cognitive processes. However, to date it has only been demonstrated that changes in cognitive states and sexual arousal parallel one another during repeated stimulation. The extent to which cognitive processes contribute to habituation remains to be ascertained.

More research is required to investigate the nature of the relationship between cognitive processes and habituation of sexual arousal with the view to discovering possible causal connections. This will best be achieved in an experimental paradigm where attentional and affective states are measured independently while the stimulus is kept constant. This would demonstrate if the changes in sexual arousal during repeated stimulation occur while participants’ maintained constant attentional focus. To date no study has been able to accomplish this successfully. Therefore, causal connections between cognitive processes and rates of habituation have not been established.

Future studies, which focus on discovering the precise nature of the relationship between the processes of cognition and habituation, are required. Identification of a causal relationship between the two would provide a basis for the development of an information-processing model of habituation. Further investigation of possible differences between sex offenders and nonoffenders in habituation of sexual response to erotic fantasy

should be explored. Such investigation could examine the difference between sensitisation and habituation, but should be pursued within the theoretical and empirical framework developed by Over and his colleagues.

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