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An Investigation of Lang's Bioinformational Approach with Sexually Functional and Dysfunctional Men[1]

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This research represents an initial attempt to extend Lang's (1979) bioinformational processing view of emotion to the realm of male sexuality—particularly psychogenic impotence. Sexually functional and sexually dysfunctional men received training in which they were shaped to incorporate physiological responses during imagery. Preceding and following this training, heart rate, penile tumescence, frontalis myotonia, and skin resistance were monitored while subjects imagined scenes differing in thematic content (fear, erotic, and neutral) and propositional structure (stimulus and/or response cues). In general, the results failed to replicate previous findings supporting this model. During fear scenes, only myotonia followed the predicted inverted-V pattern in which an increase in responding occurred while listening to the scene, a greater response while imagining the scene, and a decrement in response once imagery ceased. Similar responding did not occur on heart rate, skin resistance, or tumescence. With the exception of myotonia, subjects failed to differentiate between the stimulus and the response cues embedded in scripts. Results are discussed in the context of Lang's (1979) model as it may apply to sexual dysfunction.

KEY WORDS: sexual arousal; erectile dysfunction; bioinformational processing; emotional imagery; propositions.

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INTRODUCTION

Beck and Barlow (1984) recently conceptualized sexual dysfunction as a particular type of social phobia. In fact, certain types of sexual dysfunction meet the DSM-III-R's (American Psychiatric Association, 1987) diagnostic criteria for social phobia—anxiety in and avoidance of situations in which performance may be evaluated by others. The literature on sexual dysfunction also is replete with references to "performance anxiety" and "fear of failure" as factors contributing to dysfunctional performance. In addition, clinical experience with men who meet DSM-III-R's criteria for male erectile disorder reveals that they often evidence an avoidance of sexual interactions subsequent to the development of the disorder.

Anxiety has long been regarded as an important etiological and maintaining factor in sexual dysfunction (e.g., Kaplan, 1974; Masters & Johnson, 1970). However, much of the existing literature is characterized by anecdotal reports and conjecture with little objective analysis. A number of studies exist that actually disconfirm this view (Barlow, 1986). Under some conditions, anxiety operates to facilitate sexual arousal rather than inhibit its occurrence. Unfortunately, these earlier studies relied primarily on relatively normal and homogeneous groups of individuals (i.e., young college volunteers).

Sexually functional and sexually dysfunctional men seem to respond quite differently under conditions of anxiety. For example, several studies employing a shock threat paradigm have demonstrated that sexually functional men evidenced greater penile responding under conditions of shock threat (either contingent or noncontingent on erectile responding) than under a no-shock threat condition (e.g., Beck, Barlow, Sakheim, & Abrahamson, 1984, 1987). Conversely, sexually dysfunctional men evidenced decreased responding under shock threat conditions (e.g., Beck *et al.,* 1984; Jones, Bruce, & Barlow, 1986). These findings are inconsistent with popular theories emphasizing an etiological role of "anxiety" and suggest that increased autonomic arousal alone (i.e., anxiety) does not interfere with the sexual response cycle.

In keeping with Lang's (1977, 1979) reconceptualization of anxiety, the interference may stem from an interaction between the physiological and the cognitive components of anxiety. Specifically, the cognitive component, in the form of debasing cognitions or task-irrelevant thoughts, may operate through a process of distraction. The physiological arousal may serve to drive this process by facilitating information processing. A consequence of this interaction is an interruption in the arousal process (i.e., dysfunctional performance). If an individual's attention is focused on erotic or task-relevant cues, autonomic arousal enhances the processing of these cues thereby facilitating a functional performance. Thus, it is not the presence of heightened physiological arousal that interferes with sexual responding, but its interaction with the direction of attention.

These components of autonomic arousal and attentional focus have been incorporated into a working model of sexual dysfunction (Barlow, 1986). In this model dysfunctionals are engaged in a negative feedback loop whereby demands for performance elicit cognitive anxiety (i.e., negative affect and expectancies, perceived lack of control, inaccurate perception of erection) and subsequent focus on negative or task-irrelevant thoughts. This off-task focus increases autonomic arousal, increases efficiency of attentional focus, and ultimately, leads to a dysfunctional performance.

The literature concerning social phobia reveals some remarkable similarities to sexual dysfunction. That is, social phobics focus on off-task thoughts during a phobic situation, and increased autonomic arousal alone does not interfere with performance (Beck & Barlow, 1984). Together, these findings suggest that cognitive interference is a major contributor to impaired performance. Considerable empirical support exists for this conceptualization of social phobia (e.g., Sarason, 1982) and sexual dysfunction (Abrahamson, Barlow, & Abrahamson, in press; Geer & Fuhr, 1976).

Recently, Lang (1979, 1983) developed an information-processing theory of emotions in general and phobias in particular. Lang contends that emotions form networks, stored in the form of propositions, that are accessed by information processing mechanisms. *Stimulus propositions* provide information about certain objects and situations. *Response propositions* are responses, both physiological and behavioral, that are relevant to the object or situation. *Meaning propositions* interpret the stimulus and response information and essentially define the event's significance. The likelihood of accessing an emotion is increased by presenting information that maximizes the number of propositions matched. Thus, cognitive events are thought to determine the experience and expression (both behaviorally and physiologically) of an emotional response in specific stimulus contexts.

Several studies testing this model have demonstrated differential responding in subjects who are trained to attend exclusively to response cues or stimulus cues while imagining a variety of scenes (Lang, Kozak, Miller, Levin, & McLean, 1980; Lang, Levin, Miller, & Kozak, 1983; Robinson & Reading, 1985). Response-trained subjects who listened to and actively imagined scenes containing response propositions evidenced the greatest responding (particularly heart rate). Conversely, those exposed to stimulus cues and stimulus-trained subjects showed no appreciable changes in physiological activity. Finally, subjective ratings of arousal were highest when scripts contained cues for responding. The type of training was of little consequence.

Although the majority of Lang's experimentation has focused on snake phobics, his theory may extend to other emotional responses and may be of benefit to theorizing and research in the realm of human sexuality. In particular, it may apply to sexual arousal and complement Barlow's (1986) working model of sexual dysfunction by explaining the entrance into and progression through the positive and negative feedback loops that characterize sexual function and dysfunction. When the sexual arousal network of functionals is accessed (i.e, information is perceived which matches the structure encoded in memory), it includes positive affect (meaning propositions), erotic cues (stimulus propositions), and penile tumescence (response propositions). For dysfunctionals, however, the network may be comprised of negative affect, lack of erection, and nonsexual cues. If this is the case, it suggests that the feedback loops for functionals and dysfunctionals are fundamentally different. That is, the sexual information structure for functionals may be coded differently from that of dysfunctionals.

To date, only one study has attempted to extend Lang's model to sexual arousal. In a sample of 60 college females, Steinberg (1986) attempted to replicate Lang's work using his methodology. Subjects were trained to attend to response or stimulus cues embedded in scenes differing in thematic content (fear, erotic, neutral). Heart-rate responding, but not genital vasocongestion, followed the predicted inverted-V pattern. Although these results are somewhat discouraging, this study represents the first attempt at applying Lang's model to sexuality and merits replication.

Thus, the purpose of this investigation had two related goals. The first goal was to extend Lang's (1979) model of emotional experience to the realm of male sexuality in hopes of further understanding the functional and dysfunctional sexual arousal process. The second goal was to replicate the findings of Lang *et al.* (1980) as they pertain to emotional imagery. The following hypotheses were derived from the above theoretical formulation: (1) physiological responding will be lower at the first test session for all subjects; (2) during the second session, responding on all physiological measures will be greater to scenes containing response cues and will follow an inverted-V pattern; and (3) penile responding should be less for dysfunctionals than functionals, particularly at the final test session.

METHOD

Subjects

Sexually functional ($N = 6$) and psychogenic dysfunctional ($N = 6$) males served as subjects in this study. The dysfunctional (SDs) subjects were referred by local urologists for a psychophysiological assessment of their sexual functioning. A psychodiagnostic interview during the initial screening session revealed that all SDs met DSM-III's (American Psychiatric Association, 1980) criteria for inhibited sexual excitement (i.e., DSM-III-R male erectile disorder) but not for any other Axis I or II disorder. These subjects ranged in age from 34 to 58 years ($\bar{X}$ = 50.2 years, SD = 8.57 years). Sexually functional (SFs) men, recruited by newspaper advertisements and paid $75 for their participation, were matched with SDs on age, marital status, and socioeconomic status (SES). These subjects ranged in age from 34 to 55 years ($\bar{X}$ = 49.7 years, SD = 8.28 years). All subjects were of heterosexual orientation (Kinsey rating of 0 or 1) and were currently involved in a sexual relationship.

A standardized physical examination was administered to all subjects. For SDs, the purpose of the examination was to rule out the possibility of organic factors contributing to their erectile failure. SFs received the same examination for comparison purposes. In addition to obtaining medical history and use of medications known to correlate with impotence, bulbocavernosus reflex, peripheral neuropathy, and penile blood flow, using the Doppler procedure (Veleck, Sniderman, Vaughan, Sos, & Muecke, 1980) and Parks Model 802-A Doppler, also were assessed. Finally, all subjects were screened for the absence of major psychopathology using the Psychiatric Diagnostic Interview (Othmer, Penick, & Powell, 1982) and were excluded from participation if they met any of the clinical criteria.

Measures

Physiological Measures. All physiological responses were recorded using a Grass Model 7 polygraph. A Grass 7-P1 preamplifier coupled with a mechanical strain gauge (Barlow, Becker, Leitenberg, & Agras, 1970), positioned midway down the shaft of the penis, was used to measure penile circumference (PC). Heart rate (HR) was monitored using a 7-P44 preamplifier and Beckman electrodes attached to the subject's chest. Skin resistance (SR) was measured via a 7-P1 preamplifier and Beckman electrodes attached to the palmar surface of the first and second digits of the subject's nondominant hand after cleaning with alcohol. Frontalis electromyogram (FEMG) was measured using 7-P3 and 7-P10 preamplifiers and Beckman silver–silver chloride electrodes attached to the forehead approximately 2.5 cm above the center of each eye with a ground electrode midway between them. The forehead was cleaned prior to electrode placement with a mildly abrasive cleanser and alcohol.

Poststimulus Measures. Immediately following each script period, subjects rated the vividness of their imagery to the last script. This measure was modeled after Lang *et al.* (1980) and consisted of a 23-sec film of a stickman figure gradually decreasing in focus. Subjects were instructed to press a signal marker, which marked the polygraph, when the clarity of the stickman matched the vividness of their fantasy. Following this rating subjects rated valence, control, and arousal using a 5-point scale developed by Hodes, Cook, and Lang (1985) that contained three anchored items: (1) happy–unhappy, (2) excited–calm, and (3) controlled–in control. Subjects also rated their percent of full erection and feelings of anxiety (0-100).

Questionnaire. Prior to participation, all subjects completed the Questionnaire on Mental Imagery (QMI) as revised by Sheehan (1967). The QMI is a 35-item scale designed to assess an individual's ability to form images in seven modalities: visual, cutaneous, auditory, kinesthetic, gustatory, olfactory, and organic.

Design and Procedure

After the initial screening session, subjects returned to the laboratory on three more occasions, each separated by a period of 1 to 3 days. The first visit lasted approximately 3 hr and included the first test session and the first training session. The second training session comprised the second visit and took approximately 60 min. The last visit took about 2 hr and consisted of the final testing session. All of these sessions were individually administered by the first author. See Fig. 1 for a flow chart outlining these procedures.

Training Sessions. The first part of these sessions consisted of progressive relaxation training involving tension–release cycles in eight muscle groups. This was done to reduce background physiological levels and variability.

The remainder of both training sessions was devoted to imagery training. All 12 subjects received response training only. The training protocol was that devised by Lang *et al.* (1980). One script, however, was modified from a college language laboratory to a museum in an attempt to reflect an activity likely more significant to the older subjects in this study. The content of these scripts included fear and neutral scenes but not erotic scenes. All scenes contained both stimulus and response propositions (cues). After the script was read aloud by the experimenter, the subject was asked to imagine and actively participate in the scene described as vividly as possible for 20 sec. A description of the scene was requested after each image and reports of physiological involvement during the imagery (that coincided with response propositions embedded in the text) were verbally reinforced.

Test Sessions. The second and fourth visits to the laboratory included the two test sessions which preceded and followed the imagery training sessions. These test sessions took place in a private, dimly lit room located adjacent to the equipment room. After reading and signing an informed consent

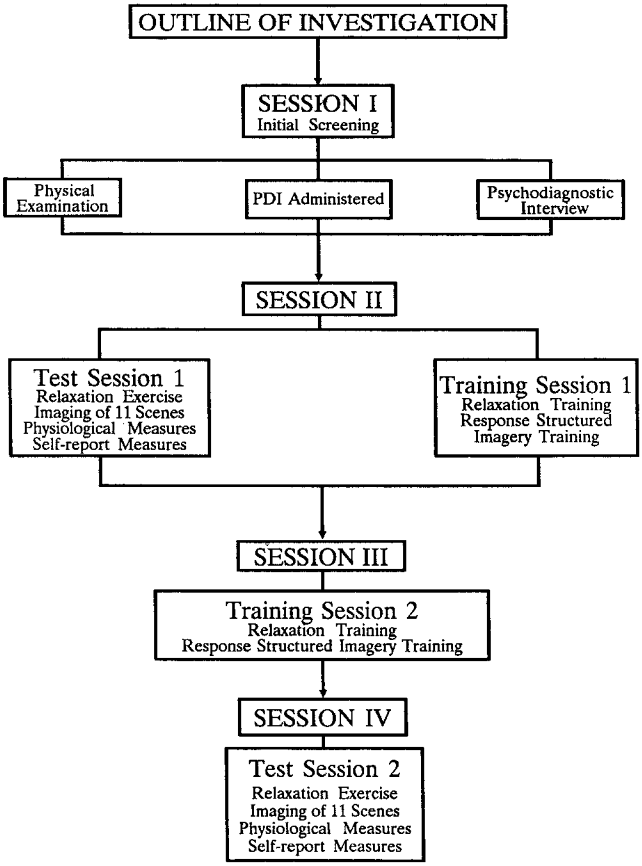

Fig. 1. Flow chart of experimental procedure.

form, the subject was instructed to remove his clothes, drape a sheet around himself, place the strain gauge in private, and signal the experimenter when he was ready. The electrodes for HR, SR, and FEMG then were placed. The subject then was given the following taped instructions:

> Following the relaxation exercise, you will hear several different scenes. Imagine each scene as vividly as possible while it is being described. At the end of this narration, continue to imagine the scene as vividly as possible starting at the beginning of the description. When you hear the first tone, stop imagining the scene and concentrate on relaxing your muscles completely. When you hear the second tone, open your eyes and make your ratings. Do you have any questions?

All subjects received 11 scenes to imagine, the first of which was neutral, served as practice, and was not used in later analyses. Each scene was presented according to the following format: a 50-sec *rest* period, 50 sec during which the scene was presented (the *read* period), 30 sec to *image* the scene, 30 sec to *recover*, and untimed poststimulus ratings.

Test Script Content. Two scenes were neutral in content and contained only stimulus propositions. Eight scenes involved Fear Content. The Neutral and Fear scripts were taken directly from Lang *et al.* (1980). Eight scripts were of explicitly sexual content. Half of the Erotic and Fear scenes contained both stimulus propositions and response propositions (Response scripts) that referred to the cardiovascular, skeletomuscular, genital, sweat, respiratory, and ocular systems. The remaining half contained stimulus propositions only (Stimulus scripts). To equate for length, filler material was added. All scenes were presented in a pseudo-random order. That is, although chosen and presented in a random fashion, each subject received two Neutral scenes, four Erotic scenes (two Stimulus scripts and two Response scripts), and four Fear scenes (two Stimulus scripts and two Response scripts).

Data Reduction. Physiological and self-report data were hand-scored and then transformed into meaningful units via an LSI-11 microprocessor. A random 10% reliability check indicated that calculations were error free. During the test sessions, data samples for HR, SR, FEMG, and PC were collected in the following manner. The last 30 sec of the rest and read periods and the 30-sec image and recover periods were divided into three 10-sec epochs. This was done to keep the number of samples consistent across measurement periods within each scene presentation. This resulted in 12 means, 3 each for the rest, read, image, and recover periods. To reduce between subjects' variance due to basal differences and basal changes over time, the mean values for each measurement period were converted to change scores by subtracting the imagery trial rest period value from the read, image, and recover period scores for each physiological measure.

Data Analyses. Group (2) × Test Session (2) × Content (3) × Period (3) analyses of variance (ANOVAs) with repeated measures on the last three factors were used to analyze the four physiological measures. Because the number of scripts differed across Content, analyses were performed separately for Response scripts and Stimulus scripts. Within each Content, Group (2) × Test Session (2) × Script (2) × Period (3) ANOVAs were conducted to assess differential responding to Stimulus and Response scripts. Identical analyses were performed on the poststimulus measures although the period factor was omitted. In cases where significant main effects and lower-order interactions were included in significant higher-order interactions, only the latter are reported. Duncan's post hoc comparisons were utilized at the .05 significance level for all significant main effects and interactions.

RESULTS

Physiological Measures

To determine equivalence of responding during the different scripts within each content, five Group (2) × Scene (4) × Period (3) ANOVAs with repeated measures on the last two factors were performed. No significant differences were found. Therefore, data were collapsed across scenes but not propositions.

Heart Rate. Since HR increases often accompany penile tumescence, analyses of covariance, using maximum change in PC per script, were initially used for HR data. However, since the covariate failed to reach significance in any of these analyses, traditional ANOVAs were used. In additon, analyses of baseline HR levels revealed no significant group differences.

During Response scripts, a Group × Content × Test Session interaction [$F(2, 16) = 4.33$, $p = .0313$] emerged. As depicted in Fig. 2, post hoc

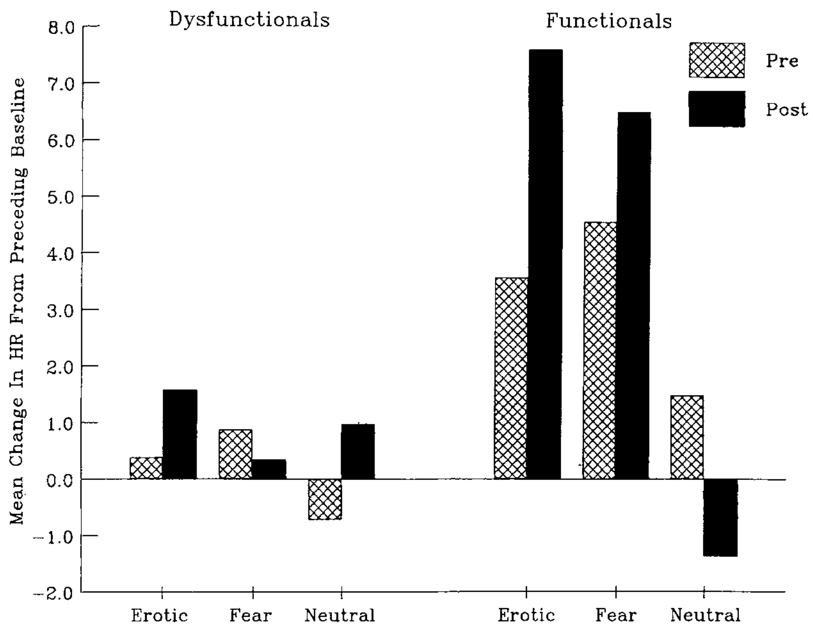

Fig. 2. Mean change in heart rate during response scripts as a function of group, content, and test session.

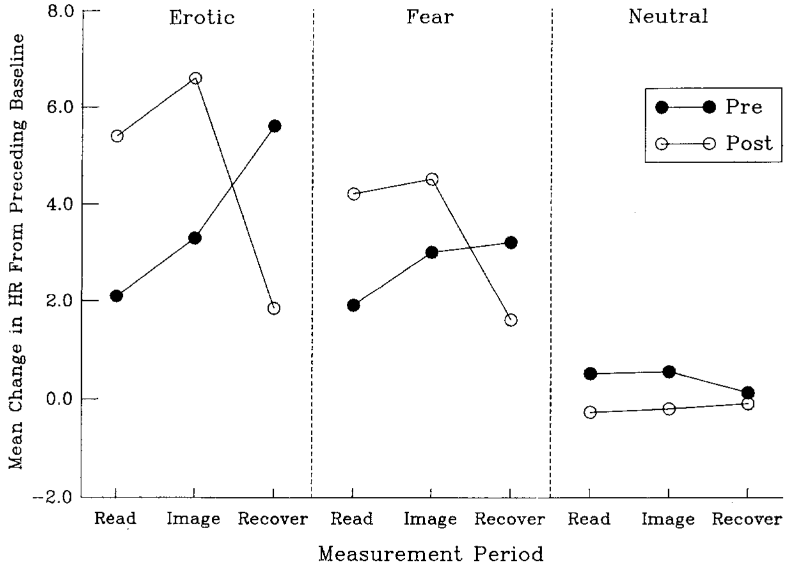

Fig. 3. Mean change in heart rate as a function of content, test session, and measurement period.

analyses of this interaction revealed that (1) HR increased during Fear and Erotic scenes, but not Neutral scenes, at the first Test Session; (2) HR increased at the final Test Session but only during Erotic scenes; and (3) only SFs evidenced these changes—SDs showed no appreciable change in HR to any of the scenes.

Contrary to expectation, similar findings emerged during Stimulus scripts. A Group × Content × Test Session interaction [$F(2, 16) = 5.80$, $p = .013$] revealed that HR increased during Erotic scenes but not Fear and Neutral scenes. In addition, only SFs evidenced these changes.

In analyses comparing Stimulus with Response scripts, a Test Session × Period interaction was significant for Erotic scenes [$F(2, 16) = 3.67$, $p < .05$], and approached significance during Fear scenes ($p < .09$). No differences occurred during Neutral scenes. Post hoc analyses of Erotic scenes revealed a trend for HR to increase from pre- to posttraining during the read and image periods. As shown in Fig. 3, a similar pattern emerged for Fear scenes. Mean HR responding did not differ significantly between Stimulus and Response Scripts, although HR was slightly greater during Fear scenes with Response propositions.

Penile Circumference. Contrary to expectation, no group differences emerged with respect to genital responding. However, Content × Period interactions were statistically significant for both Response scripts [$F(4, 36) =$

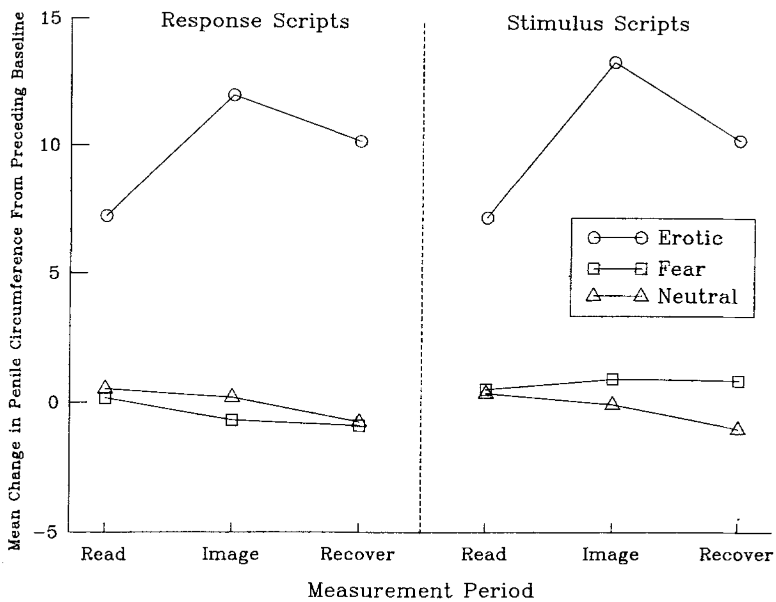

Fig. 4. Mean change in penile circumference as a function of script and measurement period.

3.57, $p < .015$] and Stimulus scripts [$F(4, 36) = 3.71$, $p < .013$]. Greenhouse–Geiser corrections for violation of sphericity reduced both of these effects to $p = .045$. Post hoc analyses of these interactions revealed that PC was greatest to Erotic scenes irrespective of propositional content. Minimal changes in PC occurred over measurement period in response to scenes of Fear and Neutral content. These changes were revealed to be non-significant by post hoc comparisons. During Erotic scenes, however, the pattern of responding resembled an inverted V. As shown in Fig. 4, there was a significant increase in PC during the read period, a greater response during the image period, and a reduction in response during the recover period. No differences emerged between Stimulus and Response scripts or across Test Sessions.

Frontalis Electromyogram. Unlike PC, no differences were expected in FEMG at the pretraining Test Session. However, increased myotonia was expected during the Fear and Erotic scenes containing response propositions. These predictions were partially confirmed. During Response Scripts, a significant Content × Test Session × Period interaction [$F(4, 36) = 3.06$, $p < .03$], emerged. Post hoc comparisons revealed that FEMG increased at the final Test Session but only significantly during the read and image periods of Fear scenes. As depicted in Fig. 5, responding during Erotic scenes also resem-

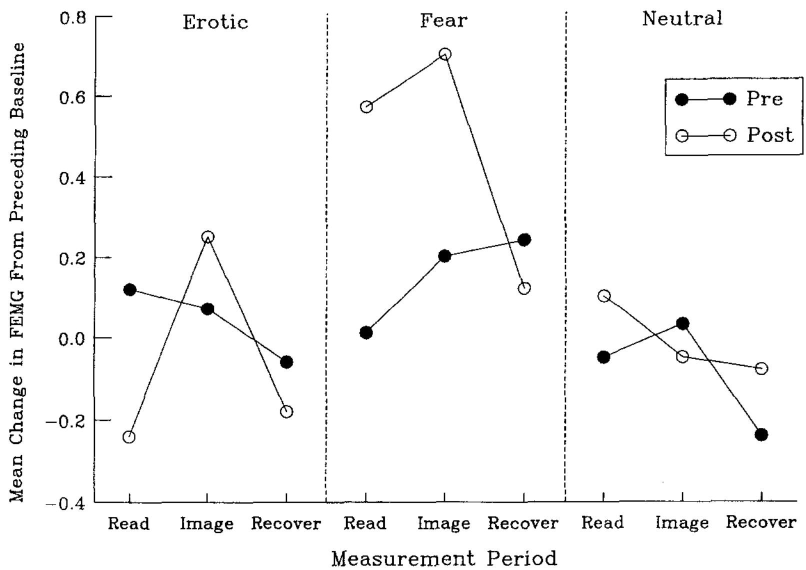

Fig. 5. Mean change in frontalis electromyogram during response scripts as a function of content, test session, and measurement period.

bled an inverted V, although responding during the read period was less at the final Test Session. As predicted, these findings did not emerge during Stimulus scripts.

Skin Resistance. Hypotheses regarding this dependent measure were similar to those for FEMG. These predictions were not confirmed. No significant differences emerged across any of the independent variables with respect to SR responding.

Poststimulus Measures

Contrary to expectation, no differences emerged in reported vividness of imagery. However, several subjects reported at debriefing that they had difficulty using the television stickman to make vividness ratings. Several differences were found with respect to Arousal, Valence, and Control. On ratings of Valence (1 = happy; 5 = unhappy), significant Content × Test Session interactions emerged for Response scripts [$F(2, 14) = 10.16, p < .002$], and Stimulus scripts [$F(2, 14) = 13.01, p < .0006$]. Post hoc comparisons confirmed that subjects felt most happy during Erotic ($\overline{X} = 1.49$, SD = .65) and Neutral scenes ($\overline{X} = 1.86$, SD = 1.00) and most unhappy during Fear scenes ($\overline{X} = 3.83$, SD = .74), particularly at posttraining. Although not statistically significant, there was a trend for SDs to report more negative affect during Erotic scenes [$F(1, 7) = 4.46, p = .07$]. No changes occurred during Neutral and Erotic scenes and no differences were found between Stimulus and Response scripts.

On subjective ratings of arousal (1 = excited; 5 = calm), results were similar to those for Valence. Specifically, main effects of Content emerged for both Response scripts [$F(2, 13) = 37.05, p < .00001$] and Stimulus scripts [$F(2, 13) = 31.02, p < .00001$]. Subjects rated themselves as more "excited" during Fear and Erotic scenes compared to Neutral scenes. These findings were confirmed by post hoc comparisons. No differences were found with respect to Stimulus and Response propositions embedded in the text.

Analyses of subjects' ratings of Control revealed a significant main effect of Content for Response scripts [$F(2, 12) = 8.17, p < .01$] and Stimulus scripts [$F(2, 14) = 9.44, p < .01$]. Post hoc comparisons revealed that subjects felt equally controlled during Fear ($\overline{X} = 2.97$, SD = 1.00) and Erotic scenes ($\overline{X} = 3.82$, SD = 1.11) and felt significantly greater control during Neutral scenes ($\overline{X} = 4.68$, SD = .36). No differences between Stimulus and Response scripts were statistically significant.

During Fear scenes with Response propositions, subjects felt more Anxious [$F(2, 18) = 23.72, p = .00001$] than during Erotic and Neutral scenes. Results were similar for Stimulus scripts, except that subjects felt equally anxious during Fear and Erotic scenes. This was due primarily to lower levels of self-reported anxiety during Fear scenes with Stimulus propositions. Subjects also reported greater erections during Erotic scenes with Response cues [$F(2, 18) = 17.97, p < .0001$]. Subjective ratings of Stimulus scripts followed a similar pattern. Post hoc comparisons of a Group × Content interaction revealed that SFs rated themselves as more erect [$F(1, 9) = 8.03, p < .02$] than SDs despite no group differences in penile tumescence.

Questionnaire on Mental Imagery

A one-tailed independent groups *t* test was performed on total QMI scores. The results of this analysis revealed that the mean score of SDs ($\overline{X}$ = 86.2, SD = 5.6) did not differ significantly from that of SFs ($\overline{X}$ = 91.83, SD = 31.00).

DISCUSSION

The main hypothesis was that response-structured imagery training would be associated with an increase in efferent activity during fear and erotic scenes with response cues but not during neutral scenes. In general, this was not supported. Increased physiological arousal occurred during fear and erotic scenes regardless of propositional structure. There was no synergistic relationship between response-structured imagery training and response scripts as hypothesized. This is highly inconsistent with Lang's (1979) bioinformational theory.

One exception to this failure to replicate was responding on FEMG. As predicted, myotonia increased at the final test session but only during the read and image periods of fear scenes with response cues. However, similar findings did not emerge during comparable erotic scenes.

Despite the similarity of responding to scenes differing in propositional structure, subjects evidenced a consistent pattern of increased FEMG, HR, and PC during read and image periods of fear and erotic scenes. The increment in physiological responding from pre- to posttraining is some indication that subjects learned to process imagery even though they failed to discriminate between propositions.

The most plausible explanation for such an outcome is the design of the study itself which differed in one important way from other studies investigating Lang's model. In this experiment a pre–post design was used. Because subjects participated in two test sessions, some overlap in imagery scenes occurred. For example, in Session 1, a subject may have listened to the response structured version of a particular script, while at the final test session heard the stimulus structured version (or vice versa). This overlap may account for the lack of differential responding to stimulus and response scripts as subjects, thinking they were listening to the same scripts, failed to recognize the subtle differences in propositional structure. In fact, at debriefing, several subjects commented on the "repetition" of the scenes across test sessions. Of course, a measure of proposition discrimination would have helped answer this important question.

The basic predictions regarding HR were not confirmed. It was expected that both groups would evidence HR increments posttraining but only during fear and erotic scenes with response cues. However, responding was similar during scenes differing in propositional structure. In addition, HR increments occurred only during erotic scenes at the final test session. This finding was due primarily to SFs since no changes were evidenced in SDs. This may have occurred for functionals as part of the sexual response cycle since increments were evidenced only in erotic scenes. However, one would have expected similar increments in SDs, particularly since no group difference emerged in PC data.

This is the first study from our lab in which SDs evidenced this direction of desynchrony between cardiovascular and genital responding, both under control of the autonomic nervous system. Typically, when HR increments are evidenced in the absence of corresponding increases in tumescence, anxiety is assumed to be responsible for the elevated heart rate.

However, SDs evidenced tumescence in the absence of corresponding HR increments. It may be that imagining the erotic scenes was not perceived as a demand for performance by the dysfunctional subjects. Thus, their attention may have been diverted away from processing negative performance cues. Therefore, tumescence may, in a sense, have been disinhibited, although not to a degree sufficient to evoke HR increments.

Support for Lang's theory also is equivocal upon examination of the tumescence data. It was postulated that PC would increase at the final test session during erotic scenes with response cues. This hypothesis was not supported. Subjects evidenced penile tumescence to all erotic scenes; no differences emerged with respect to test session or propositional structure. This finding is consistent with research by Steinberg (1986), who attempted to apply this model to young functional women. This result cannot be due to a ceiling effect as only two subjects (one from each group) reportedly achieved a full erection. PC data confirmed these reports.

The fact that no group differences emerged in tumescence suggests, initially, that the sexual arousal network does not differ between SFs and SDs. However, this result must be interpreted carefully. Meaning propositions are held to define the stimulus and response data. Therefore, it is entirely possible that a different sexual arousal network was activated for SDs based on their interpretation of the situational context. As opposed to an actual sexual situation, there was little "demand for performance" in the experimental setting. In fact, five of the six SDs reported feeling no "pressure" to get sexually aroused. Thus, defining the situation in a different way may have activated a different, or somewhat modified emotion network (i.e., one that includes tumescence). Furthermore, based on subjective reports, subjects paid attention to these scenes and tried to imagine them as vividly as possible. This may represent a shift in attentional focus that was enhanced further by no pressure to attain an erection. Thus, through a process of distraction, less attention was focused on negative cues and arousal was facilitated. Some support for this interpretation exists based on other studies demonstrating that SDs and SFs respond differentially to neutral and performance related distractions. That is, under conditions of neutral distraction, tumescence decreases for SFs and increases for SDs. The opposite pattern holds true for performance related distraction (Abrahamson *et al.,* in press).

The lack of significant findings with respect to SR are particularly disturbing in light of results from previous studies. For instance, Lang *et al.* (1980) found a consistent decrease in SR from the preceding baseline across the three measurement periods. This was replicated in a later study (Lang *et al.,* 1983). However, during imagery training sessions, subjects in this study repeatedly reported difficulty in actively incorporating this response into their imagery.

In conclusion, the results of this study did not replicate previous research investigating Lang's information processing view of emotions (e.g., Lang *et al.,* 1980, 1983; Robinson & Reading, 1985). The results of this study must be interpreted cautiously in light of methodological limitations. The sample size was small, resulting in a low power to detect differences. In addition, the methodology used in this study (i.e., pre–post design) differed from that in previous investigations. Such limitations may have rendered replication difficult.

An alternative explanation for these results is that Lang's bioinformational model simply is not testable with current research methodology. Lang (1984) admits that relying on psychophysiological responses as the primary dependent variable is difficult because of its imprecise nature. Although the structure of emotional imagery, may, indeed, be propositional as Lang contends, the results of this and other studies may simply reflect demand characteristics inherent in the experimental situation. That is, subjects were explicitly trained to incorporate physiological responses into their imagery. Thus, the pattern of results may simply reflect their ability to respond to this demand.

Despite the apparent inability to replicate previous work investigating this model, this study, together with that of Steinberg (1986) on young females, represent the first attempts at extending Lang's model to human sexuality. Both studies suggest some avenues for future exploration in this area. First, direct comparison of scenes that differ in arousing qualities may prove fruitful for understanding the role of these variables as they pertain to network activation. This would seem particularly important since genital vasocongestion occurred in this study and that of Steinberg (1986) irrespective of training or propositional structure.

Second, further delineation of the role of such variables as training and propositional structure may explicate more clearly the sexual arousal network of SFs and SDs. In particular, the incorporation of demands for erections into the erotic scenes may activate a different arousal network in these two groups of subjects. This would be especially interesting in light of the findings of Jones *et al.* (1986) and Beck *et al.* (1984) that SDs and SFs respond very differently under similar conditions of shock threat.

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