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Use of an External Inhibition Procedure in the Treatment of Spider Phobic Subjects

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by

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Abstract

This research represented an extension of previous work on the therapeutic application of the external inhibition phenomenon, and sought to examine the effects of such a procedure on the verbal-cognitive, motoric, and physiological components of the anxiety response. To accomplish this, subjects were selected and treatment effects evaluated on the basis of changes elicited in each of the three response modalities by a specific fear stimulus. The relative effectiveness of the external inhibition treatment in modifying the multiple components of the anxiety response was examined by a comparison with procedures controlling for expectancy effects and repeated exposure to the phobic stimulus.

A series of hypotheses were derived which predicted that the external inhibition treatment would produce significant reductions in the self-report, behavioral, and physiological channels being assessed. It was also predicted that these reductions in anxiety for subjects receiving the external inhibition treatment would be significantly greater than those evidenced by subjects receiving procedures designed to control for expectancy effects and repeated stimulus exposures.

Subjects were 24 female undergraduate students enrolled at Virginia Commonwealth University who were selected from a pool of 316 females who answered the Spider Questionnaire (Klorman, Weerts, Hastings, Melamed, & Lang, 1974). Three separate selection criteria were utilized to help insure that only those subjects who were highly fearful of spiders were selected for participation in the study: (1) a total score on the SPQ that was within the upper 25% of the distribution of scores on the SPQ, (2) a distance score of at least 24 inches on a passive behavioral avoidance test (BAT), and (3) an increase in heart rate of at least 10% during the initial exposure to the spider. Eight subjects meeting these criteria were randomly assigned to one of three experimental groups: An External Inhibition group, a Graduated Exposure Group, or a Test-Retest Control group.

Following an initial pretreatment assessment, subjects in the External Inhibition group were exposed to the spider in a BAT format, and were presented with an external stimulus (white noise administered in 2-second pulses for 30-seconds at 95dbA) each time they began to feel anxious and stopped the advance of the spider. Graduated Exposure subjects received the same procedure without the external stimulus and were instead instructed to "relax" themselves whenever they began to feel anxious. Subjects in the Test-Retest group received no intervening procedure and simply sat quietly without the spider present for a comparable period of time.

Dependent measures consisted of pre- and posttreatment BAT scores, subjective distress ratings (SUDS) elicited by the spider, heart rate responding, skin conductance activity, and SPQ scores.

The results failed to provide any evidence of the relative efficacy of external inhibition in modifying phobic behavior. In all cases, the external inhibition treatment was found to be either ineffective or no more effective than the two control procedures in modifying the multiple components of the anxiety response. These findings are discussed in terms of various situational, procedural, and subject factors that may have contributed to the rapid habituation of anxiety among all three experimental groups, and thereby precluded the valid evaluation of potential treatment effects. The implications of these results for the external inhibition phenomenon and for analogue fear research are discussed.

Introduction

The concept of "anxiety" has long assumed a prominent position in the area of clinical psychology, both as an important and pervasive factor in functional behavior disorders and as a topic of investigation in applied clinical research. The result of this widespread attention has been a multitude of theoretical formulations which attempt to account for the development of anxiety-related disorders, as well as a variety of treatment techniques designed to modify this maladaptive form of behavior. In spite of the numerous proposals regarding the etiology and modification of the anxiety response, however, there has been little actual agreement in terms of the specific nature of the anxiety construct, and a corresponding lack of consensus as the most efficacious approach to assessment and treatment. As Hoch and Zubin (1950) noted: "Although it is widely recognized that anxiety is the most pervasive psychological phenomenon of our time and that it is the chief symptom in the neuroses and in the functional psychoses, there has been little or no agreement on its definition and very little, if any, progress in its measurement" (p.v.). While recent developments, particularly in the area of behavioral assessment, have done much to facilitate greater definitional specificity of the anxiety construct (e.g., Bernstein, 1973; Borkovec, Weerts & Bernstein, 1977), considerable disagreement remains regarding the precise characteristics of the anxiety response and widely divergent views continue to underlie the many current approaches to the assessment and treatment of this pervasive clinical problem.

The purpose of the present investigation is to evaluate the clinical effectiveness of an external inhibition procedure in the treatment of an anxiety-related, phobic disorder. Due to the many complexities inherent in the measurement and modification of the anxiety response, however, it will first be necessary to describe several of the traditional approaches which have been taken to this problem. Thus, discussed below are three of the more prominent theoretical models of anxiety, together with the implications that these models have had for assessment and treatment methodology. This will be followed by a discussion of the limitations of these approaches in terms of the complex nature of the anxiety response and suggestions for a more comprehensive, empirically-based assessment paradigm. Finally, the phenomenon of external inhibition will be discussed along with prior research which has employed this procedure as a treatment for anxiety-related, phobic disorders.

Theoretical Models of Anxiety

In reviewing the clinical literature, it becomes apparent that large theoretical differences exist with regard to the particular significance attributed to the anxiety response and the specific etiological mechanisms which are thought to underlie its development (e.g., Freud, 1936; Marks, 1977; Wolpe, 1958). Despite these divergent and often contradictory views, however, theories of emotionality have been rather consistent in conceptualizing anxiety as a complex response that is characterized by subjective feelings of tension and apprehension, physiological arousal, and avoidance or escape from the stressful stimulus or situation. Viewed from this perspective, anxiety may be regarded as a multidimensional construct involving three separate, but interacting, response channels: the verbal-cognitive, the physiologic, and the motoric (Bernstein, 1973; Borkovec et al., 1977; Lang, 1968; Malmo, 1957; Paul, 1969). Although anxiety has traditionally been conceptualized, either implicitly or explicitly, as a multiple system response, different theoretical formulations of the construct have tended to emphasize one or another component as being of primary importance, and substantial differences exist in terms of how these various theories view the interrelationships between response systems. These different theoretical emphases, in turn, have had a dramatic effect on approaches taken to the assessment and treatment of the anxiety response.

Phenomenological model of anxiety. Historically, anxiety was first conceptualized as being primarily a subjective feeling state characterized by fear and distress, and was defined only secondarily in terms of changes in overt motor behavior and physiological activity. Reflecting its roots in philosophical phenomenology, this model of anxiety presumes that some external stressor or stimulus directly alters the subjective state of the organism, producing the subjective feelings of fear, distress, and apprehension. It is this condition of "feeling" which then presumably mediates any observed changes in overt behavior and internal physiology (Lang, 1978). Since the subjective state and experience of the organism is considered to be of primary importance, it follows that assessment paradigms based on this model have relied heavily, if not exclusively, on the use of self-report data as the principal means of determining the presence of, or changes in, the anxiety response. As Lang (1978) has pointed out, however, "this approach poses clear and fundamental problems for psychological scientists...who seek to describe such phenomenon in objective terms.

By definition, a human feeling cannot be observed by anyone other than the person experiencing it. It can be subjected to a personal phenomenological analysis and a report of this analysis can be given to another person. However, there is no way that the primary observation can be shared" (p. 366). In order to circumvent the difficulties associated with the systematic study of these subjective states, an alternative method which has traditionally been employed by investigators adhering to the phenomenological model is to make observations of responses which can be quantified more directly and which covary with the verbal report of anxiety. As noted previously, the two response categories which have been held to covary with the subjective state of anxiety are overt behavioral acts and internal physiological activity. Thus, it is possible to obtain an objective measure of anxiety by placing subjects in a situation requiring avoidance or escape from fearful or noxious stimuli (e.g., Miller & Bernstein, 1972), or by recording physiological changes which occur in the presence of a specific anxiety-arousing stimulus (e.g., Klorman, Wiesenfeld, & Austin, 1975; Prigatano & Johnson, 1974; Sartory, Rachman, & Grey, 1977). In either case, however, the phenomenological model of anxiety would suggest that it is the initial change which occurs in the subjective state of the organism that directly mediates any observed changes in overt motor behavior or physiological responding. These latter response components merely provide an objective and quantifiable measure of the individual's internal, subjective experience of anxiety.

Physiological models of anxiety. In contrast to the phenomenological model's emphasis on subjective experience, other theoretical models of anxiety have focused on the changes in physiology which accompany the anxiety state. Among the first of these physiological models was the "peripheral theory" of emotionality posed by William James (1884, 1890). Reversing the basic premise of the phenomenological model that psychological state precedes physiological change, James suggested that this latter condition is evoked directly by affective stimuli, and that subjective experience comes only after the person perceives and evaluates the changes in his own bodily processes. According to James' theory, physiological and behavioral changes act back on, and produce changes in, the subjective state of the organism. In this case, feeling states are actually the person's perception of internal physiological activity. As Lang (1978) has noted, James' theory is historically significant for theories of emotionality and anxiety because it represents one of the first attempts at a behavioral conceptualization of emotion. By suggesting that feeling states can be explained in part by changes in behavior and physiology, James brought into serious question the primary, determining role of subjective experience in emotion.

Although important in that it represented a clear and decisive shift away from philosophical theorizing, James' theory was subsequently criticized by Cannon (1927, 1931) who maintained that the peripheral viscera were not fundamental to emotional expression as James had suggested. Central to Cannon's arguments were empirical demonstrations showing that surgical separation of the viscera from the central nervous system did not entirely eliminate emotional behavior as would be predicted from James' theory of peripheral feedback. As an alternative to James' visceral theory, Cannon proposed a thalamic theory of emotion in which the thalamus was seen as the brain structure where sensory impulses receive an emotional quality.

While significant in its own right, Cannon's theory of emotionality had a much larger impact in that it served to focus attention on the central nervous system and the brain mechanisms involved in emotional behavior, often to the exclusion of peripheral physiological activity. Thus, a substantial body of research subsequent to Cannon's work involved attempts to delineate the specific cortical structures and mechanisms responsible for emotional behavior and regulation (e.g., Papez, 1937, 1939; Maclean, 1949). It was not until the work of Moruzzi and Magoun (1949), however, that findings with a direct application to human behavioral and physiological data were reported. In their studies of the reticular activating system and its relation to EEG activity, these investigators found that electrical stimulation of the reticular formation in the cat produced substantial increments in cortical EEG frequency, as well as many of the autonomic and somatic responses associated with states of emotionality. Inspired by this finding of an apparent physiological substrate of emotional behavior, Lindsley (1951) subsequently proposed an activation theory of emotion which held that emotional intensity is directly related to the degree of cortical activation or arousal. According to this formulation, low levels of activation, such as those occurring during sleep, are characterized by slow frequency waves of relatively large amplitude, while waking states yield faster frequency, lower amplitude "alpha waves". Increases in emotion are associated with still faster cortical activity, with states of violent anger or rage producing low-amplitude, desynchronized activity of high frequency (Lang, 1971).

The empirical work of Moruzzi and Magoun (1949) and Lindsley's (1951) theoretical formulations led rather quickly to the adoption of activation theory as a physiological analogue of unitary "anxiety" theories of emotional and pathological behavior (Malmo, 1958, 1966). Hebb (1955), for example, proposed a variation of activation theory that attempted to account for the wide range of qualitative differences found in emotional behavior. He suggested that states of emotion are comprised of two primary elements: (1) an arousal or energizing function, and (2) a cue function that provides behavioral direction. Thus, according to Hebb, a strong emotion such as anxiety or fear involves both a high degree of physiological arousal and cortical mediational processes that produce avoidance or escape. Duffy (1962, 1972) has similarly proposed a theory of emotion based on Lindsley's earlier work in which she employs the terms "arousal" and "activation" to refer to variations in the individual's level of physiological and behavioral excitation. According to Duffy's formulation, behavior exhibits variation in only two basic respects: (1) the direction of the behavior, and (2) the intensity or arousal level at which this action occurs. While the former dimension is considered to be essentially dichotomous (approach-withdrawal), the latter dimension is thought to occur on a continuum, from a low point in deep sleep or coma to a high point in extreme excitement. The level of arousal or activation, then, is defined as "the extent of release of potential energy stored in the tissues of the organism" (Duffy, 1962, P. 17).

Although differing somewhat in form, the underlying assumption of each of the arousal-activation theories is that the intensity of emotional behavior is controlled by the central nervous system through the brainstem reticular formation. Thus, in the physiological model, all of the behavioral, subjective, and autonomic components of the anxiety response are thought to be the direct result of a high degree of central nervous system activation. Each of these response components is seen as being merely an effector system, representing the end-product of increased central nervous system activity.

Conditioning model of anxiety. While placing a similar emphasis on the physiological component of the anxiety response, conditioning-based models conceptualize anxiety as a learned response to specific classes of external stimuli. This is in marked contrast to the position of most arousal-activation theorists, who tend to view anxiety as reflecting a predisposition toward chronic overarousal of the central nervous system (e.g., Lader & Matthews, 1968; Malmo, 1966). Derived from early empirical work that demonstrated the experimental induction and "cure" of anxiety-like behavior in animals (Pavlov, 1927, Wolpe, 1958), the conditioning model regards anxiety as being a learned phenomenon that is acquired through the process of classical conditioning. In the traditional classical conditioning paradigm, a neutral stimulus (CS) is paired with a second stimulus (UCS) that consistently and reflexively elicits a specific response (UCR) from the organism. After a number of repeated pairings of the CS and the UCS, the previously neutral CS begins to elicit the response evoked by the UCS. This new response to the CS is termed the conditioned response (CR). Learning may then be tested in conditioning trials during which the CS is presented alone and is shown to reliably evoke the CR. In the aversive form of the conditioning paradigm (Bekhterev, 1932), a neutral CS such as a bell or buzzer is paired repeatedly with a naturally aversive stimulus such as an electrical shock. After a number of such pairings, presentation of the CS alone elicits those responses previously evoked only by the UCS (e.g., reflexive muscle contractions). Similarly, in the appetitive form of the paradigm (Pavlov, 1927), a neutral CS comes to elicit those responsed (e.g., salivation) which are reflexively elicited by the UCS (e.g., food) after repeated pairings of the two stimuli. In the final phase of the classical conditioning paradigm, the CS is presented repeatedly without the UCS and, after a number of such presentations, the CS will no longer reliably evoke the conditioned response. At this point, the response is said to be extinguished.

The classical conditioning paradigm described above is central to learning-based theoretical formulations of the anxiety response. In its simplest form, the conditioning model of anxiety assumes that some neutral stimulus (CS) acquires fear- and anxiety-arousing capabilities as a result of its being associated or paired with an innately aversive stimulus (UCS). Presentation of, or an encounter with, the previously neutral stimulus is then sufficient for the individual to experience a state anxiety and fear (Wolpe, 1958).

Mowrer (1947) extended the classical conditioning model of anxiety by proposing a theory that includes both a respondent and an operant component of fear behavior. In doing so, he provided a theoretical model that accounts not only for the anxiety experienced in relation to the feared or phobic stimulus, but also for the development and maintenance of subsequent avoidance behavior. According to Mowrer's two-factor theory, the first stage of fear acquisition follows Bekhterev's (1932) aversive classical conditioning paradigm. Thus, a neutral stimulus that does not itself evoke anxiety is paired with an innately noxious or fearful stimulus and, as a result, acquires such aversive connotations that its presence alone comes to produce increases in anxiety. The processes of stimulus and response generalization greatly increase the complexity and persistence of the maladaptive response, as the CS becomes associated with other neutral stimuli that become capable themselves of eliciting anxiety. This process of higher order conditioning may also extend to concrete objects, situations, words, or images, increasing further the complexity and variety of stimuli with anxiety-arousing capabilities. According to the second part of Mowrer's theory, the anxiety elicited by the previously neutral stimulus is experienced by the individual as an unpleasant and aversive state. The second stage of fear acquisition consists of learning responses which decrease or terminate the discomfort arising from the presence of the conditioned stimulus. These learned responses are termed avoidance responses and are said to be negatively reinforced because (1) they are accompanied by a reduction in subjective discomfort, and (2) they are subsequently performed with increasing frequency. As the individual comes to associate anxiety reduction with the performance of avoidance responses, these responses are performed consistently and repetitively such that the person seldom, if ever, comes into direct contact with the anxiety-producing stimulus. As a result, the conditioned fear response does not have the opportunity to be extinguished through exposure to the previously neutral, and objectively harmless, stimulus.

In summary, the conditioning model of anxiety suggests that a neutral stimulus acquires the arousal-producing capabilities of an innately noxious stimulus through the process of classical conditioning. The increased arousal evoked by the conditioned stimulus is experienced by the individual as an unpleasant or aversive state, and directly mediates the acquisition and performance of avoidance responses. These avoidance responses are then maintained through negative reinforcement (i.e., the termination of aversive arousal). Since an avoidance response is performed consistently in anticipation of contact with the feared stimulus, the anxiety response cannot undergo extinction through the individual's exposure to the CS in the absence of the UCS.

Assessment and Treatment Implications

As can be seen from the above discussion, there have been three principal models conceptualizing the relationship between the subjective, physiological, and behavioral components of the anxiety construct. While incorporating the notion of multidimensionality, each of these theoretical models has emphasized a particular response channel as fundamental to the experience and expression of the anxiety response. One approach, represented by the phenomenological model, views anxiety as being primarily a subjective state of fear and distress that gives rise to changes in internal physiology and overt motor behavior. Conversely, the arousal-activation theories of Lindsley (1951) and Duffy (1962, 1972) regard anxiety as being first and foremost a high degree of cortical or central nervous system activation. This increased cortical activation is then thought to produce the accompanying changes in the subjective, behavioral, and autonomic response channels. Similar in its emphasis on the physiological channel, the conditioning model presented above views anxiety as being a learned response that is acquired through the process of classical conditioning (Mowrer, 1947; Wolpe, 1958). According to this approach, a previously neutral stimulus is paired with an innately noxious or fearful stimulus and, as a result, acquires many of the same arousal-producing capabilities.

It is this increased autonomic arousal elicited by the conditioned fear stimulus which is presumed to produce the subjective state of fear and distress, and which mediates the acquisition and performance of avoidance behavior.

Although differing markedly in terms of direction of causality, a basic assumption of each of these theoretical models is that there is a rather complete degree of interdependence among the various response components comprising the anxiety construct. Stated differently, the underlying assumption of each of these approaches in that a singular response component is fundamental to the expression of anxiety and that, given the presence of this one component, the other systems characterizing the anxiety response will necessarily be activated. As Lang (1978) has pointed out, these theoretical assumptions regarding the nature of the anxiety construct have had profound implications for assessment and treatment methodology:

> "If we view anxiety empirically, as a complex of motor, verbal, and somato-visceral responses, it becomes obvious that the various treatment methods that we routinely employ are predicated on specific theoretical assumptions about the interaction among these three systems (Lang, 1978, pp. 370-371)."

Thus, if a complete degree of system interdependence is assumed, it necessarily follows that measurement or modification of only one system is sufficient for inferring the presence of, or producing change in, the remaining response components.

Traditional approaches to the assessment and treatment of anxiety-related disorders have operated on the basis of this "dependence hypothesis" (Lang, Rice, & Sternbach, 1972), wherein only a single response channel is targeted for measurement and modification. In the assessment process, the focus has typically been on state or trait measures of anxiety as assessed through the self-report channel (Borkevec *et al*., 1977). Consistent with the notion of system interdependence, the use of these instruments reflects the assumption that accurate assessment of self-reported anxiety will also provide an accurate indication of the potential for behavioral avoidance and the degree of physiological arousal. While, more recently, attempts have been made to provide simultaneous measurement of more than one response channel (e.g., Geer, 1966; Lang & Lazovik, 1963; Miller & Bernstein, 1972; Prigatano & Johnson, 1974), the predominant emphasis in both research and clinical practice continues to be on the unidimensional assessment of the anxiety construct.

Traditional approaches taken to the treatment of anxiety disorders and derived from the theoretical models discussed above have also been based on a "dependence hypothesis" regarding the relationship between response systems. Thus, the treatment of "anxiety" is typically directed toward one response component or another with the expectation that successful modification of that system will produce corresponding positive changes in the other two. Perhaps most representative of treatments based on the phenomenological model of anxiety is the psychodynamic approach to therapy which focuses on modification of the client's verbal behavior as a means of producing broad behavioral change. In this approach, the therapist attempts through verbal psychotherapy to alter the client's self-referent statements (e.g., "people don't like me") and predictive comments (e.g., "I know I will fail") in an effort to develop a completely new, and more adaptive, psycholinguistic structure for the client. The underlying assumption, however, is that successful modification of the client's verbal report will result in subsequent elimination of avoidance behavior and a reduction in physiological arousal (Lang, 1978). A similar rationale underlies therapies directed at modification of the client's maladaptive and irrational cognitions (e.g., Ellis, 1973; Ellis & Grieger, 1977) or negative self-statements (e.g., Meichenbaum, 1977; Meichenbaum & Cameron, 1972) as a means of producing positive change in all three response systems -- the verbal-cognitive, the motoric, and physiologic.

Differing only in the specific target of treatment, other therapeutic approaches focus their attention on modification of the physiological component of the anxiety response. For example, treatments derived from the arousal-activation models are based on the assumption that anxiety is the result of a chronic overarousal of the central nervous system (Lader & Matthews, 1968; Malmo, 1966). This increased cortical arousal, in turn, is thought to produce the behavioral, subjective, and autonomic changes which characterize the anxiety response. Since cortical overarousal is regarded as the primary problem, however, treatment is typically directed at modification of the higher integrating centers of the central nervous system through various pharmacological interventions (e.g., benzodiazepines). On the other hand, the conditioning model of anxiety views this response as being a learned phenomenon, in which a neutral stimulus acquires the arousal-producing capabilities of some innately noxious or aversive stimulus. Treatments derived from this model are therefore typically directed toward modification of the autonomic responses which are elicited by the conditioned stimulus and which are thought to mediate subjective distress and avoidance behavior. Often this treatment is in the form of systematic desensitization (Wolpe, 1958) or other counterconditioning procedures in which an antagonistic response such as relaxation is used to "counter" the autonomic arousal elicited by the fearful stimulus. Regardless of the particular treatment and theoretical rationale, however, the expectation in both of these approaches is that successful therapy will produce more than just a physiological change and will effectively alter the remaining components of the anxiety response.

Finally, there are treatments designed to directly modify motor deficits and the overt behavioral avoidance characterizing the anxiety response. In this form of treatment, the therapist's task is to shape approach behaviors to the feared stimulus (e.g., Bandura, 1971) or to train new adaptive skills that will permit the client to perform more effectively in the feared situation (e.g., Caldwell, Calhoun, Humphreys, & Cheney, 1978; Hersen & Eisler, 1976). The focus in this approach is on first changing these large behavioral units, with the expectation that physiological activity and self-report anxiety will "catch-up" to behavioral performance without themselves becoming a target of treatment (Lang, 1978).

As attested to by their wide clinical application, each of these therapeutic approaches have been at least somewhat successful in the treatment of anxiety-related disorders, with modification of a single response channel often producing improvement in the remaining components of the anxiety response (e.g., Ellis, 1977; Lang, 1978; Rimm & Masters, 1974). Such findings of broad, cross-channel reductions in anxiety following change in a single response component would seem to be consistent with theoretical models which postulate the presence of a high degree of system interaction. Evidence from several lines of experimental research have also supported the notion of system interdependence among the various components of the anxiety response. The work of Schachter and his colleagues (Schachter, 1964; Schachter & Singer, 1962; Schachter & Wheeler, 1962), for example, demonstrates quite clearly several important features of intersystem influence in emotional behavior. Following Cannon (1927) in his argument that emotional states are undifferentiated in autonomic pattern, Schachter (1964) went on to suggest that the individual's cognitive set actually determines the unique character of an emotional response:

> "Granted a general pattern of sympathetic excitation as characteristic of emotional states, granted that there may be some differences in pattern from state to state, it is suggested that one labels, interprets, and identifies this stirred up state in terms of the characteristics of the precipitating situation and one's apperceptive mass. This suggests, then, that an emotional state may be considered a function of a state of physiological arousal and of a cognition appropriate to this state of arousal. The cognition, in a sense, exerts a steering function. Cognitions arising from the immediate situation as interpreted by past experiences provide the framework within which one understands and labels his feelings. It is the cognition which determines whether the state of physiological arousal will be labeled as 'anger', 'joy, fear, or whatever." (Schachter & Singer, 1962, p. 380).

Thus, according to Schachter's (1964) two-factor theory, anxiety is the product of two interacting processes: (1) a state of physiological arousal, and (2) the cognitive evaluation and labeling of this arousal as "anxiety". Since both factors are considered necessary for the individual to experience anxiety, modification of either should presumably alter the person's affective experience. The interactive nature of these two factors in determining emotional behavior was demonstrated in an early study by Schachter and Singer (1962). An experiment was designed to test three hypotheses related to the interaction of cognitive factors with a state of physiological arousal: (1) when an individual experiences a state of physiological arousal for which he has no immediate explanation, he will cognitively label the arousal in terms of the situation he is in and the cognitions available to him; (2) when an individual experiences a state of physiological arousal for which he has a completely appropriate explanation, he will not attempt to label his feelings in terms of the alternative cognitions available; and (3) in a particular situation, an individual will not label his feelings as emotion unless he experiences a state of physiological arousal. To test these hypotheses, subjects were told they were participating in a study designed to assess the effects of a new vitamin on their vision, but were actually given injections of either epinephrine or a saline solution. The subjects receiving epinephrine were then divided into three groups according to the instructions they received as to the effects of the drug. One group was told the actual side effects of the drug, the second group was told nothing about the side effects, and the third group was misinformed as to what side effects to expect. Following the injection and the appropriate instructions, the subjects were left alone in the room with a confederate who exhibited one of two preplanned modes of behavior - either euphoria or anger. Observations of the subject's behavior during the time they were with the confederate and post-experiment self-reports of mood and physical state were employed as measures of arousal and emotionality. The results clearly supported the first two hypotheses. During the euphoria condition, subjects not informed or misinformed about the effects of the drug behaved more euphorically and indicated greater self-reports of euphoria than subjects in the informed group. Similarly, noninformed subjects in the anger condition displayed significantly more anger than either the informed or the placebo subjects. The evidence supporting the third hypothesis, however, was "consistent but tentative" (p. 396). Some subjects in the noninformed and misinformed groups showed no evidence of increased emotionality, while others who had not received epinephrine at all (placebo group) exhibited signs of euphoria and anger. While Schachter and Singer's (1962) study has been criticized on both methodological and conceptual grounds (Lang, 1971; Lazarus, 1968), the implication that cognitive set interacts with physiological arousal in determining emotional behavior is nevertheless significant for theoretical and therapeutic models based on a dependence hypothesis of system interaction.

Similar to Schachter (1964), Lazarus (1967, 1968) has emphasized the interaction of physiological and cognitive factors in determining the nature of an emotional response. More specifically, Lazarus' cognitive-appraisal theory (Lazarus, 1968) suggests that anxiety is a function of the individual's perception and appraisal of the specific stimulus properties of a situation in terms of its personal relevance and significance for him. In agreement with Duffy (1962), cognitive-appraisal theory considers the physiological component of anxiety to be a rather unidimensional phenomenon, but also proposes that this state may be either increased or decreased by cognitive responses. Lazarus and his colleagues have reported a series of studies which clearly demonstrate the interactive nature of the verbal-cognitive and physiological components of the anxiety response. Speisman, Lazarus, Mordkoff, and Davison (1964) employed a silent film as a fearful stimulus and created three different sound tracks in order to compare their impact with that of the silent version. One of the sound tracks, called the trauma track, pointed out the fearful aspects of the film, while the other two were designed to encourage defensive interpretations of the film so as to reduce anxiety. Heart rate and skin conductance were recorded continuously throughout the film, and self-report measures of mood and tension were obtained following completion of the film. Results indicated that the trauma track produced increases in physiological activity, particularly with respect to the skin conductance measure, while the defensive sound tracks reduced evidences of an anxiety response. Although neither self-report measure showed much evidence of differences between the experimental conditions, the pattern was generally one of greater anxiety during the trauma track. Overall, anxiety was greatest in the trauma condition, next in the silent condition, and significantly less in the defensive sound track conditions. Thus, modification of the cognitive channel through information designed to influence subjects' beliefs or expectations about the fearful stimulus was found to alter responsivity to that stimulus in the physiological, as well as the verbal-cognitive, channels. These results, along with those obtained in subsequent similar research (e.g., Gilmore, 1981; Lazarus & Alfert, 1964; Lazarus, Opton, Nomikos, & Rankin, 1965; Mangelsdorff & Zuckerman, 1975), demonstrate quite clearly the ability of cognitive variables to influence the physiological component of the anxiety response and provide further evidence of a high degree of system interaction in emotional behavior.

Graham and his colleagues (Graham, 1962; Graham, Kabler, & Graham, 1962; Graham, Stern, & Winokur, 1958; Stern, Winokur, Graham, & Graham, 1961) have also provided support for the notion of system interdependence by demonstrating the controlling function of language over physiological activity. In a series of classic studies, these investigators gave normal subjects waking or hypnotic suggestions to assume emotional attitudes which had previously been found to be associated with specific psychosomatic syndromes (e.g., Raynaud's disease, urticaria, essential hypertension). Using scripts developed from interviews with patients afflicted by these disorders, Graham's group administered the "attitude" instructions to subjects while several different physiological systems were monitored. In general, the results of these studies showed that significant physiological responses were evoked when subjects were instructed to experience these different emotional attitudes. More importantly, however, physiological change was found to be specific to the same organ systems that were afflicted in the parallel patient group. For example, diastolic blood pressure increases were reliably associated with the hypothesized hypertension script, while skin temperature increased in response to the urticaria "attitude" and decreased with suggestions of the Raynaud's "attitude". Similar demonstrations of the controlling function of the verbal-cognitive channel over physiological activity have also been reported by Sternbach (1964) and Melamed (1969).

Considered together, the research presented above provides rather convincing evidence of the existence of significant system interdependence in emotional behavior. The demonstration of reliable covariation between systems and of change in emotional behavior following modification of a singular response component would seem to support the use of assessment and treatment methodologies predicated on a dependence hypothesis of system interaction. Despite this supporting evidence, however, there exists a substantial and compelling body of research which suggests that the interaction between response systems, if it exists at all, is at best, only partially complete. The research pointing to the presence of system independence in emotional behavior will be discussed below, followed by the implications of this research for the assessment and treatment of anxiety disorders.

System Independence

As noted previously, the anxiety construct has traditionally been regarded as a multiple-system response comprised of the motoric, verbal-cognitive, and physiologic response channels. Moreover, the various theoretical models from which many of the current approaches to assessment and treatment have been derived view these multiple channels as reliable covariants of one another, such that activation or diminution of one system is invariably accompanied by a similar change in the remaining systems. In spite of this presumed covariation, however, correlations among the three response channels in anxiety are usually reported as being rather low (Borkovec, Stone, O'Brien, & Kaloupek, 1974; Lacey, 1959; Lang & Lazovik, 1963; Martin, 1961). Borkovec et al. (1977) examined the concordance among response channels in a series of five anxiety studies which reported intercorrelation matrices among and between multiple measures of the three components of the anxiety response. The target behaviors in these studies included snake phobia (Borkovec & Craighead, 1971), speech anxiety (Paul, 1966; Woy & Efran, 1972), and social anxiety (Borkovec et al., 1974; O'Brien, 1975). Representative measures in the self-report channel included the Fear Thermometer (Walk, 1956), the Anxiety Differential (Husek & Alexander, 1963), the Autonomic Perception Questionnaire (Mandler & Kreman, 1958), Paul's (1966) Personal Report of Confidence as a Speaker (PRCS), and Endler, Hunt, and Rosenstein's

(1962) S-R Inventory of Anxiousness. Among the physiological measures recorded in these studies were heart rate, pulse rate, and palmar sweat print. Measures of the motoric or overt behavioral channel consisted of Paul's (1966) Timed Behavioral Checklist (TBCL), speech disfluencies, percentage of speaking time, ratio of disfluencies to speaking time, and distance from the feared stimulus as determined by a behavioral avoidance test. In evaluating the correlations among these various response measures, Borkovec et al. (1977) found that correlations within a particular response domain were more frequently significant than correlations obtained between response channels. This was especially true for the self-report measures, which yielded significant correlations in all five studies. The correlation coefficients obtained between response domains, however, were found to be only rarely significant and generally tended to be quite low. Thus, while there was some evidence of concurrent validity with respect to measures assessing the verbal-cognitive channel of anxiety response, the authors were forced to conclude that the "different instruments within and especially between response domains are measuring different aspects of behavior called 'anxiety'" (p. 403).

While the poor interrelationships between response systems in anxiety have often been attributed to the use of inadequate or inappropriate measurement procedures (Kallman & Feuerstein, 1977), the frequency with which they occur would seem to warrent their consideration as genuine phenomena. In addressing this issue, Lang (1968, 1977) proposed that the three systems comprising the anxiety response are at least partially autonomous, with each modality being capable to some extent of changing independently. Specifically, he suggests that "emotional behaviors are multiple system responses -- verbal-cognitive, motor, and physiological events that interact through interoceptive (neural and hormonal) and exteroceptive channels of communication. All systems are controlled or influenced by brain mechanisms, but the level of the important centers of influence (cortical or subcortical, limbic or brainstem) are varied, and like the resulting behaviors, partially independent" (Lang, 1971, p. 108). As a result of this imperfect coupling between response systems, the different channels comprising the anxiety response may often, or even typically, fail to respond simultaneously or to the same degree to a given stimulus complex. It is quite possible, therefore, to generate emotional cognitions without physiological arousal, avoidance behavior without autonomic mediation, or physiological activation and behavioral avoidance without cognitive labeling (Bandura, 1971; Lang, 1971). Given Lang's suggestion that some degree of system independence exists in emotional behavior, it seems highly unlikely that perfect correspondence will invariably be obtained between the motoric, verbal-cognitive, and physiological components of the anxiety response.

The role of individual differences in the expression of anxiety has also been implicated as a factor contributing to the lack of concordance between response channels (Bandura, 1971; Borkovec, 1973; Lang, 1968, 1971). In this regard, Lang (1971) has suggested that the various components of the anxiety response are capable of being shaped separately and at different times by different environmental influences. Thus, rather than developing all at once as several theoretical positions would suggest (e.g., Freud, 1938; Wolpe, 1958), emotional responses may also be constructed one component at a time as the organism develops:

> ". . .states of general or organ-specific sympathetic activity could develop through a fortuitous occurrence of negative or positive reinforcers in the environment, in concert with specifically vulnerable developmental stages. . .In these cases, no explicit language behavior or motor acts may be attached to the stimulus-response sequence. Nevertheless, stimulation of the gut produces an aversive psychophysiological state. Of course, language components could be added to the sequence later through further conditioning, or as a function of behavioral or semantic generalization from emotional learning in other situations. On the other hand, individuals may develop emotional responses out of primarily verbal learning experiences. Thus, parents may reinforce the statement 'I am afraid' in specific stimulus contexts. The child may learn to emit the language response reliably. However, whether the verbal statement becomes associated with behavioral acts or autonomic activity, depends on other learning. Similarly, it is possible that emotions might be started from. . .avoidance behavior, and the language and autonomic activity added later" (Lang, 1971, pp. 108-109).

Lang's (1971) analysis implies that the specific topography of the anxiety response is dependent to a large extent on the idiosyncratic learning history of the individual. These individual differences in the acquisition of the various components of the anxiety response, in turn, likely contribute a great deal to the typically low concordance rates obtained between response channels. More importantly, however, differences in the acquisition of the various response components suggests that individuals will likely vary widely in terms of which system or systems play the primary, functional role in the expression and maintenance of the anxiety response (Borkovec, 1973). It might be expected, therefore, that some individuals will exhibit maximal responsivity in a singular channel without any accompanying changes in the remaining response components. For example, self-reports of intense anxiety may be evoked by exposure to a specific phobic stimulus with little actual physiological arousal or behavioral avoidance being measured. Similarly, an individual may exhibit marked increases in both self-reported anxiety and physiological activity, but show little or no evidence of overt behavioral avoidance (Bernstein, 1973; Borkovec et al., 1977; Lang, 1968; Miller & Bernstein, 1972). In either case, the notion of individual differences in the expression of anxiety is directly contrary to conceptions based on a dependence hypothesis of system interaction.

The role of individual differences has also been emphasized within response channels, particularly with respect to the physiological component of the anxiety response. As discussed previously, arousal theories of anxiety (Duffy, 1962, 1972; Lindsley, 1951; Malmo, 1958) consider the physiological activity in emotional behavior to be a rather unidimensional phenomen that is either increased or decreased in a uniform manner. Since central nervous system activation is thought to lead directly to sympathetic arousal, this theoretical position would predict a high degree of concordance between physiological response systems. Traditionally, however, correlations among physiological measures, whether under conditions of rest or stress, have been found to be relatively low, with one physiological variable seldom accounting for more than ten percent of the variance in predicting the response of another system (Lang, 1971). In an extensive review of the literature on physiological measures of anxiety, Martin (1961) concluded that the available research provides "little ground for optimism that these variables will correlate very highly, if at all" (p. 243). The poor relationships between physiological systems have been variously attributed to the use of inappropriate measures in assessing specific systems or to the intercorrelation of different types of response measures (Lang, 1971). Duffy (1972), for example, has suggested that the typical finding of a lack of concordance between physiological variables is due to the inappropriate use of intercorrelations based upon groups of subjects. Providing some support for this assertion, a number of studies (Lazarus, Speisman, & Mordkoff, 1963; Schnore, 1959) have reported high, positive correlations between physiological response systems when within subjects, or intracorrelational methods were employed.

While the lack of correspondence between physiological variables in anxiety may be due, in part, to inadequate or inappropriate measurement procedures, the frequency with which low correlations are obtained remains extremely high even when such errors in measurement are taken into account (Lang, 1971). Of particular relevance to this issue, J.I. Lacey and his colleagues (Lacey, Bateman, & VanLehn, 1953; Lacey & Lacey, 1958a, 1958b) conducted a series of studies dealing with physiological reactivity to stressful stimuli and found evidence of considerable variability in individual physiological response patterns evoked by the same stressor stimulus. For example, some subjects were found to exhibit concordant heart rate and skin conductance increases when alerted for an oncoming stress, while others showed marked activity in only one or the other system. Based upon these findings of individual differences in physiological activity, Lacey (1959, 1967) proposed the concept of "response stereotypy" to refer to the reliable repetition of individual patterns of physiological responding within and across stimulus situations. Thus, according to Lacey, some individuals tend to respond in such a way that maximal activation occurs in the same physiological system regardless of the particular stimulus or situation.

Moreover, the individual's entire pattern of activation or hierarchy of physiological responses may be reproduced from one stimulus situation to another. In addition to individual differences in the maximally reactive physiological variable and in the specific hierarchy of responses in activation, it also appears that there are substantial individual differences in the degree of response stereotypy. Some individuals, termed "rigid reactors", appear to respond to every stressful stimulus or situation with a highly consistent response hierarchy. Other persons, however, have been shown to be "random reactors" and respond to different stimulus situations with a differing hierarchy of physiological responses (Lang et al., 1972). Restated more simply, the concept of response stereotypy suggests that a sizeable proportion of subjects have a strongly "preferred" physiological response channel or channels and will tend to respond with maximal activation in this system(s) within and across stimulus situations. Consistent with the notion of system independence, the concept of response stereotypy implies that not every physiological system can be expected to respond to the same degree for all subjects in a given stimulus situation. This suggests that no single physiological system will have a simple, indicant relationship to psychological constructs such as anxiety and seriously questions assessment procedures in which only a singular system is employed as a measure of anxiety response (Lang, 1971).

The view that generalized, nonspecific physiological arousal occurs in anxiety has also been refuted by studies demonstrating that specific psychological states are often associated with unique patterns of physiological responding (Ax, 1953; Funkenstein, King, & Drolette, 1954; Schachter, 1957; Weerts & Roberts, 1975). This latter phenomenon has been termed "situational stereotypy" and points to the importance of the environmental context in determining the precise pattern of physiological activity in emotional behavior. In an early study, Ax (1953) examined 14 physiological variables in subjects exposed to fear- and anxiety-inducing situations, and found significant differences between the conditions on seven response measures. The anger condition resulted in greater increases in diastolic blood pressure, muscle potentials, and number of skin conductance responses, and greater decreases in heart rate than the fear condition, which produced greater increases in skin conductance levels, respiration rate, and number of muscle action potentials. Ax interpreted the pattern of physiological activity in the fear condition as being consistent with that produced by the hormone epinephrine, and the pattern produced by the anger condition as being similar to a combined epinephrine-norepinephrine effect. Providing further support for the notion of situational stereotypy, Davis (1957) found that the pattern of physiological activity differed considerably in tasks requiring simple motor responses, temperature stimulation, or attention to emotionally toned slides. Of particular interest was the finding that, despite the arousing nature of some of the stimuli used, not all of the physiological systems responded in a purely sympathetic direction. For example, male subjects who were shown slides of female nudes exhibited the expected increases in skin conductance levels, but displayed significant decrements in heart rate responding. Lacey and his colleagues (Lacey, 1959; Lacey, Kagan, Lacey, & Moss, 1963) have subsequently demonstrated such "directional fractionation" in a variety of other situations and have proposed an alternative to the arousal hypothesis in which the pattern of autonomic responding is directly related to the quality of the organism's transactions with the environment. Specifically, Lacey (1967) has pointed to a relationship between cardiovascular activity and the organism's "acceptance or rejection" or environmental input that appears to be at least partially independent of the overall level of physiological activity. According to this view, organisms neither passively take in nor simply become aroused by neutral or stressful stimuli, but rather engage in specific transactions with each stimulus in all response systems, including the physiological. The nature of the particular transaction in each case depends upon the specific characteristics of the stimulus involved. For example, some stimuli by their aversive nature (e.g., cold pressor task) tend to evoke a perceptual-cognitive rejection of the stimulus situation, while others (e.g., rapid mental arithmetic) require an intense internal cognitive focus. Both of these cognitive processes have the effect of increasing blood pressure and produce cardiac acceleration (Borkovec et al., 1977). Stimuli that merely evoke attention or interest, on the other hand, are most often associated with substantial reductions in both blood pressure and cardiac rate. Lacey (1967) has described a mechanism whereby increases in heart rate and blood pressure, mediated by the baroreceptors of the aorta and carotid sinus, alter the electrical activity in the brainstem and cortex, and thereby modify the characteristics of the organism's overt behavior. Thus, the increased heart rate elicited by an anxiety-arousing or fearful stimulus sends a signal, via the baroreceptors in the aortic arch, to the central nervous system that has the effect of deactivating the cortex and reducing arousal and attention to the threatening stimulus in the environment. In this view, the autonomic nervous system is not merely an effector system as indicated by arousal theory, but actually provides feedback to the central nervous system that serves to alter the arousal level of the organism. The mechanism that Lacey (1967) hypothesizes as operative in anxiety is similar to the notion of a defensive reflex (Graham & Clifton, 1966; Sokolov, 1963) which is elicited by high intensity stimuli and characterized by heart rate acceleration, cephalic vasodilation, and a reduction in the ability to discriminate and process external input.

As Kallman (1975) has pointed out, the principal difference between arousal theory and the situational stereotypy hypothesis appears to be one of generality of response versus specificity of response in anxiety. While arousal theory suggests that an organism will tend to respond as a whole, or in an "all-or-none" fashion, Lacey and his colleagues maintain that there is a high degree of individual and situational specificity on the biological level. According to this model, the body does not simply respond as a whole unit, but rather each physiological system's reactivity is related to the specific stimulus conditions that precipitated the response.

In addition to the discordance found between and within response channels in anxiety, system independence is also apparent when emotional behavior is attenuated through therapeutic intervention. As Lang (1971) has observed, "with a reduction in intensity, systems are often diminished in an unbalanced way, and evidence of arousal may actually disappear from one system and not another" (p. 108). Rachman and Hodgson (1974) have proposed the term "desynchrony" to refer to these differential changes in the various components of the anxiety response that vary independently or inversely over time. There is considerable evidence that desynchronous patterns are produced by different intervention strategies (Hodgson & Rachman, 1974; Lang, 1978). Matthews (1971), for example, has indicated that systematic desensitization, as a treatment for anxiety disorders, engenders a specific sequence of emotional response changes. Specifically, he suggests that autonomic arousal to fear imagery is reduced first through use of deep muscle relaxation and that this leads to a reduction in self-reported anxiety during the therapy session. These changes then permit the client to approach the actual feared stimulus in the naturalistic context and this, in turn, produces a reduction in autonomic reactivity to the phobic object. The final step, according to Matthews (1971), involves the diminution of self-reported anxiety in the actual fear situation.

Based on the hypothesis that a high level of demand partially uncouples the behavioral response system from the other response channels (Hodgson & Rachman, 1974), Rachman and Hodgson (1974) have similarly suggested that desensitization and flooding (Marks, 1974) treatments differentially affect the synchrony of changes which occur across response systems in anxiety. The procedure followed in systematic desensitization requires that the client signal whenever anxiety is experienced and immediately terminate the phobic image. This treatment thus represents a "low-demand" condition and, as such, typically produces relatively little desynchrony between behavioral and autonomic/subjective measures of fear. Changes in the behavioral channel, however, will still tend to lag behind changes in the other response components. Flooding, on the other hand, requires the client to maintain the phobic image even after anxiety begins to increase and thus constitutes a "high-demand" condition. Accordingly, this treatment more often produces a desynchronous pattern of change, with initial reductions occurring in avoidance behavior followed by slower change in the physiological and subjective components.

There also appears to be a considerable degree of individual variability in terms of the specific pattern of desynchrony produced by a particular therapeutic intervention. In a treatment study involving systematic desensitization, Lang and Lazovik (1963) repeatedly found that some subjects exhibited relatively rapid changes in overt motor behavior (i.e., less avoidance of the feared stimulus), but showed no initial reductions in self-reported fear on questionnaire measures. Other subjects, however, displayed quite rapid diminution of self-reported anxiety, while continuing to exhibit marked behavioral avoidance. Lang (1978) has similarly reported that the correlations among verbal and behavioral measures of anxiety rarely exceed .30 following systematic desensitization, even among subjects showing initially high concordance between response channels. Thus, subjects who learn to be less avoidant during treatment do not necessarily report reduced feelings of anxiety and, conversely, subjects who come to report less fear do not always exhibit reduced behavioral avoidance. In perhaps the best demonstration of individual differences in patterns of desynchrony, Schroeder and Rich (1976) administered systematic desensitization to fifteen phobic subjects. Behavioral, verbal report, and physiological measures of fear were obtained after each therapy session, and the order and rate of change among the three channels were assessed. Based on their findings, the authors concluded:

> "The initial variable in unraveling the fear response appeared to be idiosyncratic to the individual subject. Some subjects initially showed more cognitive changes,

> others more behavioral change, and still others more autonomic changes. It is clear that changes in one system could not be considered primary in initiating changes in the other fear systems" (p. 198).

These findings, like those discussed earlier regarding the lack of concordance between response channels, argue strongly against a dependency model of anxiety in which one response channel is taken as a reliable indicator of the presence or change in the remaining response components. Moreover, the concept of response desynchrony would indicate that we cannot expect, on an *a priori* basis, to produce broad, cross-channel reductions in anxiety through the use of any particular treatment technique. The implications of these findings for assessment and treatment methodology will be discussed in the following section.

Assessment and Treatment Implications

In the discussion above, the view has been presented that anxiety is a multidimensional construct defined jointly by motoric, verbal-cognitive, and physiological responses. It has also been noted that traditional theoretical formulations of this construct have emphasized one or another component as being of primary importance in the elicitation and manifestation of the anxiety response. These theoretical conceptions, in turn, have led to the use of assessment and treatment methodologies based on a dependence hypothesis of system interaction in which only a singular system is targeted for measurement and modification. The assumption underlying these approaches is that a rather complete degree of system interdependence exists among the various components of the anxiety construct, such that activation or diminution of a singular system will invariably lead to similar changes in the other two response elements. Given this assumption, it necessarily follows that assessment and modification of a single response channel is sufficient for inferring the presence of, or producing change in, the remaining components of the anxiety response. Thus, for example, it is expected that the presence of subjective discomfort as assessed through the self-report channel is, in itself, reflective of a high degree of autonomic arousal and indicative of a potential for behavioral avoidance. Similarly, with regard to treatment strategies, it is expected that the use of direct suggestion, relaxation and conditioning techniques, or cognitive restructuring will produce positive changes in systems other than the one directly targeted for modification. Undoubtedly, these approaches to assessment and treatment may often be both valid and effective, as there does appear to be some degree of system interdependence and change in one system may very well have implications for change in the other two (e.g., Graham, 1962; Lazarus, 1967, 1968; Schachter, 1964; Valins & Ray, 1967).

While there are many examples of dramatic successes in which, for example, a new cognitive set may broadly modify the whole range of emotional responding, the failures of the expectations of the dependence hypothesis are equally dramatic and frequent (Lang _et al_., 1972). The evidence cited above concerning the typically low correlations obtained both between and within response channels indicates that these three systems are at least partially independent and that activity in one modality cannot be taken as veridical evidence of similar activity in the other response channels. Moreover, the concept of response stereotypy (Lacey, 1967) suggests that there are considerable individual differences in terms of the maximally responsive variable within the physiological domain, while other evidence similarly indicates that individuals will likely vary widely in terms of which response channel (motoric, verbal-cognitive, physiological) plays the primary determining role in the anxiety response (Borkovec, 1973; Borkovec et al., 1977; Lang, 1971). Finally, the notion of emotional desynchrony (Rachman & Hodgson, 1974) implies that different therapeutic interventions may produce their maximal impact on different components of the anxiety response and that individuals often differ dramatically in terms of their own pattern of response desynchrony.

Considered together, this evidence points to an apparent dissociation between the three systems comprising the anxiety response and constitutes a major difficulty for those who would equate the three or use changes in only one system to define the presence or absence of "anxiety". In view of the existence of some degree of independence between response channels, the traditional unidimensional approach taken to assessment and treatment would seem to be much too narrowly conceived. Given the present state of our knowledge, an assessment and treatment methodology directed at multiple systems would appear to be not only warranted on the basis of empirical evidence, but also ultimately more valid and effective in the treatment of anxiety-related disorders (Eysenck, 1979; Lang, 1968, 1971). While such a multiple system approach to assessment and treatment has several important methodological implications for both clinical practice and experimental research (e.g., Borkovec et al., 1977, Lang, 1971; Lang et al., 1972), its application to the latter area will be emphasized in the following discussion since it relates most directly to the focus of the present investigation.

As it pertains to analogue fear research of the type to be proposed in the present study, a multisystem assessment paradigm must include a thorough assessment of all three response modalities for each individual subject prior to the start of treatment. Considering the wide individual differences in terms of which response system or systems play the primary, functional role in the anxiety response, it is necessary to determine, prior to treatment, which modality or modalities are of functional importance in defining and maintaining this response for the particular subject(s) under investigation. In this regard, Lang (1971) has noted that "a coincidence of activity in more than one system is what we most confidently refer to as emotion, and a highly generalized response characterizes states of intense affect" (p. 108). Thus, while clients in the clinical setting may often exhibit reactivity that is restricted primarily to a single response domain, it becomes crucial in analogue fear research to select only those subjects who display high levels of anxiety across all three response channels. Only in this manner can the precise effects of any experimental intervention be adequately evaluated in terms of its capacity to effectively modify all relevant response components. This point has been emphasized by Bernstein and Paul (1971) who strongly state that "it is encumbent upon E to employ as Ss only persons who can be shown to display significant and therefore clinically relevant increases in physiological arousal and cognitive distress (i.e., anxiety) as a result of the presumed eliciting stimulus object" (p. 228). As Borkovec (1973) has pointed out, however, subjects in most analogue studies are typically matched on self-report or behavioral measures alone, with physiological reactivity being only rarely assessed or controlled. Reflecting the pervasive influence of the dependence hypothesis, these studies, by their exclusion of physiological measures, employ phobic selection criteria which in no way directly assess a response system that is considered to be of major importance in the definition of anxiety. It is quite likely, therefore, that much of this research has included few subjects for whom physiological reactivity and internal cues are functionally important in their fear behavior (Borkovec, 1973).

Since response covariation cannot be assumed, either between or within channels, a thorough pretreatment assessment requires careful examination of all relevant response systems. In terms of the verbal-cognitive channel, if the target problem has already been labeled by the client or subject as involving anxiety, then, regardless of its basis, the cognitive response system has, by definition, been implicated (Borkovec et al., 1977). A wide variety of self-report measures can be used, however, for purposes of subject selection or for obtaining information pertaining to the specific type and intensity of anxiety being experienced. Self-report measures of anxiety consist of two basic types. First, there are general questionnaires that require the client or subject to rate the presence, absence, or degree of anxiety experienced in relation to a variety of potentially fearful situations or objects (e.g., Geer, 1965; Klorman, Weerts, Hastings, Melamed, & Lang, 1974; Wolpe & Lang, 1964). The second type of self-report measure involves specific rating scales thay may be used to assess the degree of discomfort experienced during recent or current exposure to an anxiety-evoking situation (e.g., Walk, 1956; Wolpe, 1969). The adequate assessment of anxiety must also include measurement of overt motor responses to determine the nature and strength of avoidance behavior and/or performance deficits in situations involving the feared stimulus. Within this domain, Paul and Bernstein (1973) have distinguished between assessment of "direct" anxiety which focuses on the observable effects of physiological arousal on overt behavior, and "indirect" assessment which involves measures of avoidance or escape from anxiety-evoking stimuli. An example of direct assessment is Paul's (1966) Timed Behavioral Checklist (TBCL) which is used to assess overt anxiety in a public-speaking situation, and measures behaviors reflecting both interference with performance and the observable effects of arousal on behavior. Indirect behavioral measures include a number of variations of the Behavioral Avoidance Test (BAT) which provides quantification of subjects' escape or avoidance of the feared object or situation (e.g., Lang & Lazovik, 1963; Levis, 1969; Miller & Bernstein, 1972). Finally, each subject's physiological reactivity should be assessed by focusing on whether disruptions or increases in physiological arousal occur in response to the anxiety-evoking stimulus. Although assessment of the physiological channel has included measures such as cardiovascular activity, electrodermal responses, respiration, and electromyographic potentials (e.g., Borkovec et al., 1974; Craighead, 1973; Fracher, 1978; Lang, Melamed, & Hart, 1970; Rimm & Bottrell, 1969; Watson, Gaind & Marks, 1972), assessment procedures are very often reported that obtain recordings in only a singular physiological system as a means of measuring sympathetic arousal and anxiety (Borkovec et al., 1977; Lang, 1971). The concept of response stereotypy (Lacey, 1967), however, requires the sampling of multiple physiological systems in order to insure a valid assessment (Kallman & Feuerstein, 1977). While any individual subject may exhibit significant responsivity in a specific physiological system, this is a highly individualized phenomenon and subjects will very likely differ dramatically in terms of their maximally responsive biological system. It is necessary, therefore, to obtain an adequate sampling of each subject's physiological activity by using multiple, simultaneous measurements during the time the subject is exposed to the anxiety-evoking or fearful stimulus.

In addition to a thorough assessment of all three response channels, the concept of situational stereotypy discussed earlier implies that behavior occurs within a given environmental context rather than representing an underlying biological or personality trait (cf. Mischel, 1968). This suggests that the assessment of the various components of the anxiety response is valid only in relation to a specific set of environmental or stimulus events. Situational stereotypy, therefore, necessitates the evaluation of each subject's reactivity in all three response channels to a specific and individualized complex of fearful stimuli (Kallman & Feuerstein, 1977). Thus, assessment of anxiety may be carried out while the subject is performing in an anxiety-arousing situation (e.g., Borkovec et al., 1974; Paul, 1966), when exposed to a specific phobic stimulus (e.g., Craighead, 1973; Geer, 1966; Wilson, 1967), or when imagining a fear-eliciting scene (e.g., Grossberg & Wilson, 1968; Lang et al., 1970). In each case, however, measurements in all three response systems are obtained for each subject in relation to a specific set of stimulus events.

A multisystem perspective of anxiety also has several important implications for approaches to treatment and treatment evaluation. While effective intervention requires modification of all relevant response systems (Lang, 1971), the concept of response desynchrony indicates that different therapeutic techniques may be most effective in modifying certain maladaptive response components. As noted earlier, specific techniques have been found to produce maximal, initial change in one or another component of the anxiety response. Systematic desensitization, for example, typically produces relatively rapid changes in the subjective and physiological channels, with behavioral change occurring only more slowly. Flooding treatments, on the other hand, most often produce initial reductions in overt avoidance behavior followed by slower change in the subjective and physiological response systems

(Grey, Sartory, & Rachman, 1979; Rachman & Hodgson, 1974). More importantly, intervention strategies appear to differ markedly in terms of their ability to produce any substantial cross-channel reductions in anxiety, either initially or after an elapsed period of time (Hodgson & Rachman, 1974). Attempts to change attitudes through verbal psychotherapy, for example, have not been notably successful in effecting change across response channels. While such techniques are often found to produce positive change within the verbal-cognitive channel, there is many times only limited generalization to the other response systems (e.g., Greenwald, 1965; Rachman, 1968). A number of behaviorally-based treatment methods, however, have been shown to yield significant effects across response channels. Lang, Lazovik, and Reynolds (1965), for instance, found that progress up the hierarchy during systematic desensitization correlated with increased approach behavior ($r = .40$), reduction in subjective fear ($r = .50$), and improvement on a rating scale ($r = .60$). In studies employing modeling procedures, Bandura, Blanchard, and Ritter (1969) obtained a positive correlation ($r = .58$) between changes on a snake avoidance test and changes on a measure of attitudes toward snakes. Similarly, Bandura, Jeffery, and Wright (1974) found that subjective fear change correlated positively with behavioral change ($r = .61$) and with attitude change ($r = .75$) following use of a participant modeling procedure.

These findings seem to indicate that specific treatment techniques will often exert a maximal effect on a singular component of the anxiety response and may be relatively ineffective in modifying others. As Borkovec et al. (1977) have pointed out, however, the "absence of strong relationships among measures in research on the outcome of therapy has not prevented use of selected data on which conclusions are based. All too often, the results of a therapy study indicate theoretically predicted changes in one or two measures and no changes in other measures, even within the same domain; the investigator may draw conclusions from the few predicted outcomes. In the absence of a more reasonable approach, there is nothing else the investigator can do ..." (p. 403). The multidimensional view of anxiety presented in the present paper would suggest, however, that broad conclusions regarding the efficacy of any treatment technique should not be made on the basis of one or only a few measured changes. As the eventual aim of any intervention strategy should be concordant changes in all three response modalities, a therapeutic technique which alters only one response system while failing to modify the other two should be regarded with little enthusiasm (Hodgson & Rachman, 1974). This point has been strongly emphasized by Borkovec et al. (1977) who succinctly state that a "failure to modify every response component contributing to the client's problem must be viewed as incomplete treatment" (p. 404).

The finding of differential treatment effects on the various components of the anxiety response points to a second, related treatment implication of a multisystem perspective of anxiety. Since treatment techniques likely differ in terms of which response component is maximally affected, as well as in their capacity to produce broad, cross-channel reductions in anxiety, conclusions regarding the effectiveness of a specific technique cannot be based on the assessment of only one or two response channels. As noted earlier, however, this approach has characterized most traditional assessment paradigms, in which change in a singular response system (usually the verbal-cognitive) is employed as the sole measure of therapeutic effectiveness. The failure to adequately assess change in all three response channels appears to be especially prevalent with respect to the physiological domain. Relatively few studies have incorporated measures of autonomic activity among their posttest improvement indices, despite the fact that the treatment techniques being evaluated (e.g., systematic desensitization) depend to some extent on classical autonomic conditioning paradigms for their theoretical underpinnings (Borkovec, 1973). The view of anxiety as a multidimensional construct, involving three separate but interacting response components, requires that adequate treatment evaluation be based upon a thorough assessment of all three response modalities. The concept of response desynchrony, in particular, necessitates consideration of the degree of concordant changes occurring among the verbal-cognitive, behavioral, and physiological channels in response to a specific intervention strategy. It is important to know both which response system is initially modified by the treatment method employed and the extent to which this change generalizes to other response channels (Hodgson & Rachman, 1974). This means, therefore, that there are at least three different types of measures required in the assessment of therapy outcome for anxiety-related disorders -- self-report, behavioral, and physiological. As Eysenck (1979) has noted, any assessment paradigm which fails to take all three response systems into account "is doomed to be partial, incomplete, and impossible to evaluate as a measure of improvement" (p. 79).

In the following section, the phenomenon of external inhibition will be presented and discussed both from a theoretical perspective and in terms of its application to the treatment of anxiety-related, phobic disorders. This literature will then be evaluated in terms of the multisystem model of anxiety presented above.

External Inhibition

As a treatment approach for anxiety or phobic disorders, techniques based on the phenomenon of external inhibition are derived from the classical conditioning model of anxiety presented previously (Mowrer, 1947; Pavlov, 1927; Wolpe, 1958, 1969). As noted, the classical conditioning model essentially argues that maladaptive anxiety in humans is the result of the pairing of an anxiety response with some objectively neutral or harmless stimulus. While a large number of treatment techniques have been developed from the conditioning model of anxiety (e.g., Stampfl & Levis, 1967, 1968; Wolfe, 1958), treatment methods based on external inhibition have only recently begun to receive attention (e.g., Kleinman, 1979; Spiro, 1981). There does, however, appear to be some support for such an approach from theoretical, clinical, and experimental studies.

In his early lectures on conditioned reflexes, Pavlov (1927) described a phenomenon which he labeled "external inhibition" that was found to occur during conditioning trials whenever an extraneous stimulus was introduced to the experimental room. Specifically, Pavlov observed that an autonomic reflex (e.g., salivation) which had been acquired through classical conditioning would be significantly weakened or disappear entirely if some "extra" or "disturbing" stimulus appeared during subsequent conditioning trials. The types of stimuli to which Pavlov was referring included extraneous sounds entering from the outside, sudden changes in the level of illumination in the experimental room, or drafts carrying new odors to the dogs.

Pavlov's (1927) theoretical explanation of the process of external inhibition is related directly to his hypotheses concerning the mechanisms involved in conditioned reflexes. According to Pavlov, conditioned reflexes acquired through classical conditioning, as well as unconditioned reflexes, result from "certain definite external stimuli acting on the organism and its necessary reflex reactions" (p. 16). These "reflex reactions" are thought to occur via the neural transmission of a signal that is evoked by the stimulus, carried along a definite path to the central nervous system, and back out to the peripheral effector systems. Thus, brain involvement in this case centers primarily on the processing of these stimulus-evoked signals and involves increased neural excitation or "a state of nervous activity in some definite part of the brain". This mechanism of signalization, whereby the signals evoked by specific stimuli are processed, is presumably the primary task of the central nervous system.

In discussing the inhibition of conditioned reflexes, Pavlov (1927) maintained that these responses could be inhibited "internally", as when cessation of the unconditioned stimulus and repeated presentations of the conditioned stimulus alone leads to a weakening of the reflexive response. In addition, these responses can be inhibited "externally" as a result of some extraneous stimulus intruding between the conditioned stimulus and the reflexive response. In both cases, inhibitory activity is produced in the signalization area of the brain and inhibits performance of the conditioned response. With regard to the processes involved in external inhibition, Pavlov (1927) suggested that the initial reduction in the strength of the conditioned response may be attributable, in part, to the elicitation of an investigatory or orienting reflex that directly inhibits the conditioned reflex. He noted further, however, that external, inhibiting stimuli could be effective even after they ended. As Pavlov (1927) states, "every stimulus, however rapidly it may disappear, is effective not only while it lasts, but also for some time after its cessation while its after-effect lasts" (p. 45). Since, by definition, the investigatory reflex would be expected to cease when the extraneous stimulus is terminated, the continued decrements in the strength of the conditioned reflex cannot be accounted for solely on the basis of the initial investigatory reflex. Pavlov also suggested that "different extra stimuli...produce after-effects of different lengths", and that the effect of "exciting an extra reflex will...vary according" to whether "the conditioned reflex has only freshly been formed or has already been firmly established" (p. 45). By this latter statement, Pavlov is suggesting that an older, more established reflex is less likely to be inhibited by external stimuli than a response which has been learned more recently. In summary, Pavlov's theoretical explanation of external inhibition is that, "no sooner does any extra nervous excitation occur in the central nervous system than it immediately makes its presence felt in diminishing or abolishing conditioned reflexes, but temporarily only, as long as the causative stimulus or its after-effect is present" (p. 47).

A related phenomenon observed by Pavlov (1927) was that of "disinhibition", in which presentation of an extraneous stimulus during extinction trails results in an increase in the strength of the conditioned response. In hypothesizing about the mechanisms underlying the process of disinhibition, Pavlov stated, "all the considerations... permit us to regard the temporary restoration (by an extra stimulus) of the reflex which is in the process of extinction, or which is already extinguished, as based upon the removal of an inhibitory process. We describe this phenomenon as a dis-inhibition...a temporary removal of inhibition" (p. 57).

Several early studies (Hunter, 1935; Switzer, 1933) provided empirical evidence that a conditioned response could be "disinhibited" by application of an extraneous stimulus during extinction trials, and thereby indirectly supported the notion of external inhibition as well. Wenger (1936), however, was the first investigator to demonstrate these analogous phenomena using human subjects. Accepting the premise that disinhibition and external inhibition each result from the application of an external stimulus, with the former occurring when the stimulus is applied during the inhibitory phase of conditioning and the latter when the stimulus is presented during the excitatory phase, Wenger reasoned that the same stimulus applied at different times should produce opposite results. Pavlov (1927) had expressed a similar thought when he stated, "We have seen that the very same extra stimuli which when they evoke strong extraneous reflexes produce external inhibition of the positive conditioned reflexes, produce, when the effect is weak from the start or weakened by repetition, disinhibition of the conditioned reflexes which were made to undergo extinction" (P. 67). To demonstrate that both disinhibition and external inhibition could be produced by the same stimulus, Wenger paired the presentation of a low level light stimulus with a mild electrical shock to the foot. The galvanic skin response (GSR) was employed as the dependent measure of strength of conditioning and a tactile vibrator, applied to the dorsal surface of the subjects hand, constituted the extraneous stimulus. Once conditioning was firmly established, the tactile vibrator was applied for

.70 seconds followed, 19.94-seconds later, by presentation of the conditioned stimulus alone in order to test for external inhibition. This same procedure was then repeated 38-seconds later. In the disinhibition phase, extinction trials were first conducted with the conditioned stimulus being presented alone every 38-seconds. Tactile stimulation was then substituted for a presentation of the conditioned stimulus, with the light again being presented alone after 19.94-seconds. Following a two minute interval, this same procedure was repeated. In keeping with Pavlov's (1927) hypotheses regarding the effects of these two related phenomena, Wenger's criterion for external inhibition was that "the conditioned electro-dermal response to light following vibratory stimulation should be smaller in recorded amplitude than the mean of the immediately preceding and following responses to light alone" (pp. 449-450). Conversely, the criterion for demonstrating disinhibition effects was "that the response to light following vibratory stimulation should be greater in recorded amplitude than that of the approximately extinguished response on the preceding test" (p. 450). Wenger's results were consistent with these criteria, showing that both disinhibition and external inhibition resulted from the application of the same extraneous stimulus at different points in the conditioning process.

Razran (1939) subsequently investigated the effects of a different extraneous stimulus (a buzzer) on a conditioned salivary response in human subjects. Similar to Wenger (1936), Razran was interested in studying the effects of applying an external stimulus at different stages of the conditioning process, from no extinction to nearly complete extinction of the conditioned response. After conditioning of the salivary response had been well established and following two nonreinforced trials (i.e., presentation of the conditioned stimulus without the unconditioned stimulus), application of the external stimulus resulted in an average decrement of 53% in the strength of the conditioned response. Since Razran was also interested in demonstrating a disinhibition effect, he continued to apply the extraneous stimulus during subsequent extinction trials and found, as expected, that the conditioned response increased to as much as three times its previous amplitude. From these results, Razran concluded that the external stimulus had, indeed, produced a dual effect in that it had both "suppressed the existing conditioned salivation (and) restored the loss of conditioned salivation resulting from extinction" (p. 651).

These early studies thus demonstrated that external inhibition and disinhibition were not merely artifacts produced by Pavlov's unique procedures, but rather are replicable effects which are related to the principles of classical conditioning and observable under many different conditions (Kleinman, 1979). Despite the apparent empirical validity of these phenomena, however, the concepts of external inhibition and disinhibition received relatively little subsequent attention from researchers for a number of years. In 1964, Pennypacker reintroduced the notion of external inhibition and pointed out that many important details of Pavlov's procedure had not yet been adequately evaluated by previous research. Specifically, Pennypacker (1964) noted that, while Pavlov had presented the external stimulus and conditioned stimulus simultaneously, other investigators had applied external inhibitors at times when the conditioned stimulus was not present. The purpose of Pennypacker's (1964) study was to test Pavlov's original paradigm with human subjects in order to "verify the inhibitory properties of a novel stimulus presented <u>with</u>, rather than instead of, the conditioned stimulus" (p. 34). Pennypacker employed a mild intensity light stimulus to which he conditioned an eyeblink response. The external inhibitor consisted of a 1,000Hz. tone presented at an intensity of approximately 70 db and introduced at the midpoint of the CS-UCS interval. Results indicated that presentation of the extraneous stimulus produced a "large decrement" in the subsequent eyeblink response. Moreover, even in those instances when the external stimulus did not completely inhibit the conditioned eyeblink, it was found to dramatically alter the latency "not only of the conditioned response produced in its immediate presence but of the subsequent conditioned responses as well" (p. 38). In discussing these results, Pennypacker concluded that "the introduction of an extra stimulus during that portion of the interval of delay which is commonly thought to be excitatory will generally inhibit the production of a conditioned response" (p. 39). Like Pavlov, Pennypacker attributed these effects to the elicitation of an orienting reaction to the novel external stimulus which directly inhibits the conditioned response.

While the preceding studies demonstrate that decrements in a conditioned response can be produced by the introduction of an extraneous stimulus, clinical applications of this phenomenon have been rather limited. Indeed, no therapeutic applications of external inhibition were reported until Wolpe and Lazarus (1966) cited the unpublished work of Philpott who had been attempting to produce desensitization without the use of muscle relaxation. Wolpe (1973) subsequently described in some detail Philpott's method of using mild electrical shock rather than relaxation for inhibiting conditioned anxiety:

> "Encircling the patient's forearm are two saline-soaked gauze strips, 1½ in. wide, one just above the wrist and the other about 3 in. higher. Each strip is held in place by a stainless steel alligator clip connected to

> the source of current - a 90 volt dry cell whose output is controlled by a 50,000 ohm variable resistor...Pulses are delivered by therapist pressing on a soft push-button switch for about half-a-second. The level of current correct for the patient is that which is strongly felt without being aversive. Once the appropriate level of shock has been established, the desensitization procedure is begun. First, the weakest item in the hierarchy is presented alone once or twice to the patient's imagination in order to determine (how aversive it is). He is then asked to imagine the scene again and to signal by raising his index finger when it is well-defined. At this point, the therapist administers two brief stimuli of the pre-determined strength separated by about a second" (pp. 148-149).

This procedure was then repeated with successive hierarchy scenes until the patient was able to imagine them without experiencing any subjective anxiety.

Wolpe and Lazarus (1966) modified Philpott's procedure slightly and applied it in the treatment of patients with pervasive anxiety. Strongly felt, but not aversive, electrical current was administered in one second pulses 8 to 10 times per minute over a 20 to 30 minute period. Patients reported a gradual reduction in anxiety from this procedure, often reaching as low as "0" on the Subjective Units of Disturbance (SUD) scale (Wolpe, 1969). After a low level of anxiety had been attained, the therapist administered a systematic desensitization procedure similar to that employed by Philpott, with two or three electrical pulses presented during each hierarchy scene. Although requiring more scene presentations than standard desensitization, the results indicated substantial reductions in the anxiety response to hierarchy items. In their discussion, Wolpe and Lazarus stated that "these effects may be due to Pavlov's external inhibition" (p. 146), but provided no further elaboration. Consistent with a Pavlovian view of external inhibition, Kleinman (1979) suggested that a possible theoretical explanation of these findings is that "the anxiety is the result of an excitatory state elicited by previously conditioned...stimuli, and that the application of the electrical stimulus inhibits the conditioned anxiety response" (p. 21).

Singh (1976) also reported using electrical shock in a desensitization procedure to treat a phobic disorder. Singh's client was a 25-year-old female who was fearful of riding in a car with her husband, especially when he had been drinking. The client also reported feeling anxious and uncomfortable whenever her husband drank in front of her. At the start of each treatment session, electrodes were attached to the client's forearm and a level of electrical current that was strong enough to be distracting, but too weak to be painful, was determined. A scene from the previously constructed 12-item hierarchy was then presented, with the client raising her index finger when she had the scene clearly imagined. At that point, two electrical pulses, one second apart were administered by the therapist. Approximately 10 trials of this combination of scene and shock were presented at five second intervals, following which the client's level of anxiety was again assessed as she imagined the scene without the shock. Two to four hierarchy items were presented in this manner during each treatment session, with the complete procedure requiring a total of ten 30-minute sessions. The results showed that the anxiety evoked by individual hierarchy items was typically reduced to "0" within the ten scene-shock presentations and that this reduction in anxiety generalized to anxiety-arousing in vivo situations. Moreover, results of a 16-month follow-up indicated that this improvement had been maintained.

Spiro (1981) described an unpublished work in which she employed external inhibition procedure in the treatment of a sex phobic client. The client was a 39-year-old, married woman who reported a 20-year history of sexual problems in which intercourse was associated with severe anxiety attacks and various physical symptoms (e.g., headache, backache). This aversion to intercourse had generalized over the years to the point where she was unable to engage in any kind of sexual activity with her husband. Treatment by external inhibition was selected when the client was unable to relax sufficiently to use relaxation as a counter-anxiety response in systematic desensitization. In order to circumvent the problems associated with the fairly rapid habituation of humans to mild electrical shock, a white noise stimulus was employed as the external inhibitor. During each treatment session, the client was asked to imagine scenes from a 22-item thematic hierarchy targeted to sexual activity with her husband. When she signaled that the image was clear, the white noise was presented through earphones in two second pulses for 30-seconds. The client was then asked to imagine the scene again without the white noise and anxiety levels were recorded. Spiro reported that anxiety was usually absent after about four trials of this procedure, and by the end of the eighth session, the client was able to imagine the highest item on the hierarchy with no reported anxiety. This was apparently the first time the client had been able to even imagine sexual interaction with her husband without experiencing overwhelming anxiety. Generalization of these effects in vivo could not be determined, however, because of her husband's refusal to interact with her sexually when she requested him to do so.

The clinical case studies reviewed above provide rather convincing evidence that external inhibition can be used to successfully inhibit the anxiety associated with fear imagery in systematic desensitization, and suggest that such a procedure may be effective as a treatment for anxiety or phobic disorders. Despite this evidence, however, there have been relatively few controlled outcome studies investigating the clinical efficacy of procedures based on external inhibition. To date, only four such studies have been conducted (Kleinman, 1979; Spiro, 1981; Wilkins & Domitor, 1973; Yulis, Brahm, Charnes, Jacard, Picota & Rutman, 1975), and only two of these (Kleinman, 1979; Spiro, 1981) have actually referred to external inhibition in describing their treatment procedures.

Although not labelled as such, Wilkins and Domitor (1973) provided the first controlled study in which external inhibition was used to modify phobic behavior. Based on the assumption that shifts in attention (e.g., when instructed to relax, imagine the hierarchy scene, relax, stop imagining, and relax) are responsible, in large part, for the effectiveness of systematic desensitization (c.f. Wilkins, 1971), these investigators hypothesized that <u>any</u> instructed attention shifts (IAS) away from the fear-provoking scene and toward another stimulus (e.g., a tone) might function equally well to reduce anxiety. To test this hypothesis, Wilkins and Domitor compared an IAS procedure, systematic desensitization, and a control group in which subjects imagined scenes from their childhood. The IAS procedure used was similar in most respects to the clinical applications of external inhibition described earlier, in that a hierarchy was constructed, subjects imagined fearful scenes in ascending order, and external stimulus (i.e., a tone) was presented. Unlike previous studies, however, subjects were instructed in advance to attend to the external stimulus. Performance on a behavioral avoidance test following treatment indicated that the desensitization and IAS procedures were equally effective in reducing anxiety and both showed significant improvement relative to the control group.

Yulis et al. (1975) subsequently compared traditional systematic desensitization using muscle relaxation with an IAS procedure that paired hierarchy items with an auditory stimulus "in order to train subjects to shift their attention in a controlled way from the phobic stimulus through an external stimulus" (p. 174). The latter treatment was similar to the procedure employed by Wilkins and Domitor (1973), except that in place of a tone, a one-minute musical selection was presented as the external stimulus. Thirty-one different musical selections were used, with a different piece of music accompanying each hierarchy item presented. The groups consisted of snake phobic subjects selected on the basis of their responses on a modified version of the Fear Survey Schedule (Wolpe & Lang, 1964) and a behavioral avoidance test (BAT). Results indicated that the two treatment groups showed significant improvement on both the Fear Survey Schedule and the BAT, as well as on a "Physiological Reaction Questionnaire". Yulis et al. (1975) interpreted their results as supporting Wilkins' (1971) hypothesis that the only necessary condition for systematic desensitization is "the controlled attention shifts in the instructed imagination of fear relevant scenes, which specifically allows a refocusing of attention directed towards the threatening situation" (p. 176).

As can be seen, both of these IAS procedures conform to the external inhibition paradigm, in that an external stimulus is presented during imagination of anxiety-arousing scenes. Neither study, however, refers directly to this concept in describing their treatment procedures, placing the primary emphasis instead on the cognitive element of controlled attention shifts. Thus, these authors suggest that teaching subjects to switch their attention away from the phobic object to another stimulus (e.g., a tone or music) leads to a reduction in the anxiety response because of the refocused attention on the fear-eliciting stimulus.

Kleinman (1979) conducted a study that was designed to both "test Pavlov's theoretical position on external inhibition. . . (and) evaluate the possible clinical application of external inhibition to reduce previously conditioned (i.e., _not_ laboratory-conditioned) anxiety in human beings" (p. 24). Based on Pavlov's assertion that "_any_ extra excitation" should "make its presence felt", Kleinman also sought to demonstrate that the use of two different stimuli as external inhibitors (light and sound) would be equally effective in modifying phobic anxiety. Forty-five male and female subjects who reported being fearful of cockroaches on a modified version of the Fear Survey Schedule (Wolpe & Lang, 1964) and a behavioral avoidance test (BAT) were randomly assigned to three experimental groups: (1) external inhibition with sound, (2) external inhibition with light, or (3) a control condition receiving "_in vivo_ desensitization without relaxation". In the group receiving external inhibition with sound, the phobic stimulus (i.e., a glass bowl containing cockroaches) was brought progressively closer to the subject until he or she reported feeling uncomfortable. At that point, a 1,000 Hz. tone delivered at an intensity of 70 db was presented through a speaker mounted one foot behind the subject's head. One administration of the sound as an externally inhibiting stimulus was defined as a 30-second presentation with the tone alternately on and off for two second periods. When the subject felt sufficiently comfortable, the phobic stimulus was again moved closer and the procedure was repeated. Each subject received a total of 15 sound presentations. An identical procedure was employed with the group receiving external inhibition with light, except that the extraneous stimulus consisted of a 75 watt light bulb in a nine inch, white reflector directed toward the subject from a distance of approximately 18-inches in front of, and nine inches above, the subject's eyes. The "*in vivo* desensitization" procedure was designed to control for nonspecific therapeutic effects by providing subjects with the expectations that this form of "treatment" would be effective in reducing their anxiety (c.f. Marcia, Rubin, & Efran, 1969). Subjects in this group were simply instructed to relax during presentation of the phobic stimulus and were told that this state of relaxation would result in their fear being "deconditioned". Post-treatment assessment indicated that subjects receiving external inhibition with sound exhibited significant reductions in anxiety on both self-report and behavioral avoidance measures, and that this reduction was significantly greater than that displayed by subjects in the control condition. The self-report and BAT scores of subjects receiving external inhibition with light fell about halfway between those of the sound and control groups. This resulted in no significant differences being obtained between the light and sound, or light and control, groups. This latter finding was attributed to a possible methodological confound, as the cockroaches tended to respond to the presentation of light with occasional short bursts of activity which may have resulted in subjects being re-sensitized to the phobic stimulus. As Kleinman stated, "Although the light treatment may have been effective, the results are thus confounded by the additional anxiety aroused by the movement of the cockroaches during the exposure of some of the subjects to the light pulses" (p. 54).

Kleinman concluded that his findings lend direct support to "Pavlov's hypothesis that an external stimulus presented with a conditioned stimulus may inhibit a previously conditioned response and may continue to have aftereffects beyond the removal of the new external stimulus" (p. 59). Further, he maintained that his results contravene a strict cognitive interpretation such as that proposed by Wilkins and Domitor (1973) and Yulis _et al_. (1975), since he was able to obtain essentially the same effects without instructing subjects to shift their attention to the extraneous stimulus. In discussing possible explanations for the effectiveness of his procedure, Kleinman hypothesized that two interrelated factors may have been responsible for the therapeutic effects of external inhibition. First, he suggested that presentation of the extraneous stimulus initially diminishes the strength of the conditioned fear response by momentarily diverting the subject's attention away from the phobic object, making it a less salient and subjectively less powerful stimulus. This decreased attention, in turn, is experienced by the subject as a reduction in anxiety or discomfort in the presence of the feared stimulus. As a second factor contributing to the effectiveness of external inhibition, Kleinman suggested that this reduced anxiety or discomfort becomes associated with and conditioned to the presence of the phobic object, resulting in further reductions in subjective fear during subsequent presentations of the anxiety-arousing stimulus. Thus, according to Kleinman's formulation, "external inhibition is effective in reducing phobic anxiety because it diminishes the evocative power of the phobic object by drawing the subject's attention from it, while concurrently conditioning the anxiety-relief or reduced-anxiety feeling to the phobic stimulus" (pp. 60-61).

In order to clarify the specific nature of the stimuli necessary to reduce phobic responses, Spiro (1981) conducted a study which evaluated the relative efficacy of qualitatively and quantitatively different stimuli within the external inhibition paradigm. Specifically, she hypothesized that biologically distracting stimuli (i.e., white noise) in two different intensities would be more effective in reducing phobic anxiety than either cognitive coping statements or graduated exposure to the feared stimulus. Thirty-two subjects who indicated a fear of snakes on a modified version of the Fear Survey Schedule (Wolpe & Lang, 1964) and a behavioral avoidance test (BAT) were randomly assigned to one of four experimental groups: (1) external inhibition (loud), (2) external inhibition (soft), (3) confidence-building coping suggestions, or (4) a graduated exposure control group. For subjects receiving the external inhibition (loud) treatment, the phobic stimulus (a glass terrarium containing a harmless snake) was brought progressively closer until the subject reported feeling anxious or uncomfortable. At that point, the white noise stimulus was presented through earphones at an intensity of approximately 95 db. One administration of the sound as an externally inhibiting stimulus was defined as a 30-second presentation with the white noise alternately on and off for two-second periods. When the subject again felt sufficiently comfortable, the phobic stimulus was once more brought progressively closer and the procedure was repeated. Each subject received a total of 15 sound presentations. An identical procedure was employed with subjects in the external inhibition (soft) group, except that the white noise stimulus was presented at an intensity of approximately 75 db. Subjects receiving confidence-building coping suggestions were exposed in an identical manner to the phobic stimulus, but were presented with an extraneous stimulus consisting of pre-recorded coping suggestions. Cognitive coping statements were presented for approximately two-seconds, alternating with two-second periods of silence during each 30-second presentation. A total of six coping statements were used and were chosed to include: (a) preparation for the stressor ("Don't worry, you're in control here, just relax and take it easy"), (b) coping with feelings of arousal and agitation ("Breathe deeply, breathe gently, breathe rhythmically"), and (c) self-reinforcement ("So far, so good, you're doing fine"). As in Kleinman's (1979) "*in vivo* desensitization" procedure, the graduated exposure control group was designed to control for nonspecific therapeutic effects by providing subjects with the expectation of treatment effectiveness. Subjects in this group were simply instructed to relax during presentation of the phobic stimulus and were told that this state of relaxation would result in their fear being "deconditioned". Results of posttreatment assessment using both self-report and behavioral indices of improvement indicated that only the latter measure showed significant differences between the four experimental conditions. Subjects receiving the external inhibition (loud) treatment showed significant increases in approach behavior on the posttreatment BAT, and these increases were significantly greater than those exhibited by subjects in the remaining three conditions. Further, subjects provided with confidence-building coping suggestions displayed significantly greater increases in approach behavior than subjects in the graduated exposure control group. This latter group, in turn, exhibited greater reductions in phobic avoidance than subjects receiving the external inhibition (soft) treatment, who showed no significant behavioral changes from pre- to post-treatment assessment. While all four experimental groups exhibited significant reductions in self-reported anxiety on both the Fear Survey Schedule and a Subjective Units of Discomfort scale (Wolpe, 1969), no significant differences were obtained between any of the experimental conditions. Although statistical analyses of a one-month follow-up were precluded by the failure of some subjects to return for testing, the results generally indicated that all four groups continued to improve or remained the same, with the group receiving external inhibition (loud) showing greater positive changes than the other three conditions.

Present Study

The literature reviewed above provides firm empirical evidence of the efficacy of procedures based on external inhibition in the modification of classically conditioned anxiety responses. Case studies of the clinical application of external inhibition (Singh, 1976; Wolpe & Lazarus, 1966), while encouraging, lack the experimental rigor necessary for general application of the procedure in the treatment of clinically relevant anxiety disorders. Although derived from divergent theoretical bases, the group outcome studies described above (Kleinman, 1979; Spiro, 1981; Wilkins & Domitor, 1973; Yulis *et al.*, 1975) provide much more convincing evidence of the value of external inhibition treatments of anxiety due to their use of controlled experimental procedures. Working within a cognitive framework, both Wilkins and Domitor (1973) and

Yulis et al. (1975) demonstrated that presentation of an extraneous stimulus during imagination of fear-relevant scenes could produce significant reductions in the behavioral and self-report components of the anxiety response. Kleinman (1979) successfully challenged the cognitivist's assumption that controlled attention shifts were the essential element of their procedures by demonstrating that the presentation of extraneous stimuli could, in itself, produce reductions in anxiety without instructing subjects to attend to the external stimulus. In so doing, Kleinman provided the first direct support for the use of Pavlov's (1927) laboratory-based principle of external inhibition in the treatment of an anxiety-related clinical problem. Spiro's (1981) investigation of external inhibition provides additional evidence of the clinical efficacy of this treatment approach. Although she failed to obtain the differential reductions in self-reported anxiety reported by Kleinman (1979), the external inhibition (loud) procedure did produce significantly greater increases in approach behavior than the use of cognitive coping statements, graduated exposure, or a milder intensity external stimulus.

While supporting the clinical application of Pavlov's principle of external inhibition, these studies are nevertheless lacking in several important respects when viewed in terms of the multidimensional conception of anxiety presented earlier. As noted previously, anxiety is a multidimensional construct characterized by a complex interaction between the verbal-cognitive, motoric, and physiologic response systems. Without exception, however, the studies conducted thus far on therapeutic applications of external inhibition have made use of only the self-report and/or behavioral channels for purposes of both subject selection and treatment evaluation. With regard to subject selection procedures, numerous objections have been raised concerning analogue fear research that attempts to generalize to a clinically phobic population on the basis of a treatment developed with only mildly fearful subjects (Bernstein, 1973; Bernstein & Paul, 1971). In view of the wide individual differences in terms of the specific topography of the anxiety response, and the resultant lack of covariation between response measures, it is impossible to determine on a _post hoc_ basis the percentage of subjects in these previous studies who were only "mildly fearful" or "truly phobic" in the sense of showing clinically relevant increases in anxiety across all three response modalities. The failure of research on external inhbition to assess and control for physiological responding, and to select subjects on the basis of a coincidence of activity in all three channels, is not only inconsistent with the multidimensional nature of the anxiety construct, but, more importantly, precludes valid generalization of treatment effects to phobic clients in the clinical setting.

In terms of treatment evaluation, investigations of external inhibition conducted to date have similarly failed to incorporate physiological activity as an outcome measure, and have relied exclusively on changes in self-reported anxiety or behavioral avoidance as a means of demonstrating therapeutic effectiveness. While this research has provided important empirical evidence as to the potential of external inhibition to modify phobic behavior, the absence of physiological measures among posttreatment improvement indices leaves unaddressed the ability of such a procedure to effect significant changes in autonomic responding. The capacity of this form of treatment to effectively modify the physiological component of the anxiety response would seem to be an especially important issue since external inhibition is theoretically

Table 1

Overview of Method

Group	Pretreatment Assessment	Treatment	Posttreatment Assessment
External Inhibition	SPQ BAT SUD HR SC	External Inhibition with Sound	SPQ BAT SUD HR SC
Graduated Exposure (Control)	SPA BAT SUD HR SC	Graduated Exposure to the Phobic Stimulus	SPQ BAT SUD HR SC
Test-Retest (Control)	SPQ BAT SUD HR SC	Control	SPQ BAT SUD HR SC

based on a classical autonomic conditioning paradigm. Moreover, the concept of response desynchrony reviewed earlier indicates that different treatment techniques may produce differential effects on the various components of the anxiety response. As effective treatment should ultimately be capable of modifying each of these components, adequate evaluation of treatment effects must include assessment of changes occurring across all three response modalities.

The present study represents an extension of previous research on therapeutic applications of external inhibition and examined the effects of such a procedure on the verbal-cognitive, motoric, and physiological components of the anxiety response. To accomplish this, subjects were selected and treatment effects evaluated in terms of changes elicited in each of the three response modalities by a specific fear stimulus.

The dependent variable under investigation in the current study consisted of the specific treatment given to each of three groups of phobic subjects: external inhibition, graduated exposure to the fearful stimulus, or a test-retest control procedure. The external inhibition procedure utilized as the external inhibitor a white noise stimulus presented at the intensity found to be maximally effective in Spiro's (1981) study for reducing phobic behavior. The graduated exposure condition closely followed the procedures outlined by Kleinman (1979) and Spiro (1981), and was included to: (1) control for the factor of expectancy of therapeutic gain which has been described as being an important variable in treatment outcome (e.g., Borkovec, 1972, 1973; Mahoney, 1978; Wilkins, 1971; 1973); (2) provide feedback of progression up the hierarchy which has been hypothesized to play a role in treatment effectiveness (e.g., Wilkins, 1971); and (3) control for the possibility of extinction of the anxiety response as a result of the presence of the feared stimulus (c.f. Cooke, 1968; VanEgeren, 1971). In order to more completely control for, and evaluate the contribution of, expectancy and extinction effects, the third exprimental condition merely received repeated exposures to the feared stimulus without an intervening treatment procedure.

Dependent measures were selected to sample from each of the three channels of the anxiety response. Within the physiological domain, heart rate and electrodermal responses to a specific phobic stimulus were recorded to provide a measure of autonomic reactivity. There appears to be ample evidence supporting the use of each of these physiological measures. With regard to heart rate, Hare (1973) and Klorman et al. (1975) both reported that highly fearful subjects responded to phobic stimuli with a pattern of cardiac acceleration that was indicative of a defensive reaction. A defensive response is distinguished from an orienting response which occurs in the presence of novel stimuli, involves cardiac deceleration, and habituates more rapidly than a defensive response (Graham & Clifton, 1966; Sokolov, 1963). Similarly, Gunn, Woolf, Block, and Person (1972) found that subjects typically exhibit cardiac acceleration in response to the presentation of fearful stimuli. The electrodermal response has long been one of the most popular indicators of autonomic arousal (Duffy, 1972) and has frequently been employed as a measure of anxiety and fear. Hare (1973) and Klorman et al. (1975), for example, reported that fearful subjects gave electrodermal responses of greater amplitude and duration when exposed to stimuli that were specific to their fears than nonfearful subjects shown the same stimuli.

The behavioral or overt motor component of the anxiety response was assessed through use of a variation of the behavioral avoidance test (BAT). The first systematic use of a BAT for assessing anxiety was reported by Lang and Lazovik (1963) and involved requesting snake-phobic subjects to approach, touch, and handle a live snake prior to and following treatment. Subjects' minimum distance from the snake (in feet) or degree of interaction with it (e.g., touch, hold) were then used as indices of the anxiety experienced in relation to the feared object. Lang and Lazovik's basic procedure has served as the model for most BAT's used in analogue fear research and has been employed to measure the degree of avoidance to any number of small animals, such as rats, spiders, and cockroaches, as well as avoidance of water, heights, and closed-in spaces (Bernstein & Paul, 1971; Borkovec et al., 1977; Lick & Edward, 1976). While the standard BAT procedure involves active movement by the subject in relation to the feared stimulus, the variation of this approach used in the present study involved a passive avoidance test that allowed the subject to remain in a stationary position (c.f. Levis, 1969; Miller & Levis, 1971). The advantage of such a procedure is that it provides an objective and quantifiable measure of behavioral avoidance, while at the same time permitting the continuous monitoring of physiological responding. Borkovec and Craighead (1971) have demonstrated that avoidance responses on this type of passive avoidance test are comparable, including reliability, to avoidance responses on the traditional walk-up avoidance task. Craighead (1973) also found a significant negative correlation between heart rate and proximity of the phobic object (i.e., the closer the phobic stimulus, the higher the heart rate) on a passive BAT where subjects remained stationary and the phobic object (i.e., a snake) was brought progressively closer in a series of graded steps.

Assessment of the verbal-cognitive channel was accomplished by the use of two self-report measures. Analogous to the behavioral measures obtained during actual confrontation with the phobic stimulus, specific fear ratings are routinely obtained just prior to, during, and/or immediately following test exposures, and are designed to measure the cognitive anxiety component in direct response to the stimulus (Borkovec et al., 1977). Wolpe (1969) utilized such a subjective anxiety scale to develop anxiety hierarchies with patients receiving systematic desensitization. Patients were instructed to imagine the worst anxiety "ever experienced" and to assign to that feeling a numerical value of 100. Conversely, the state of being "absolutely calm" was assigned a value of zero. Each unit was thus a "subjective unit of discomfort", and the patient was asked to rate each hierarchy item according to the amount of anxiety he or she would experience if actually confronted with the situation. This resulted in a "SUD" score for each item in the patient's hierarchy. Wolpe's SUD scale (SUDS) is similar to the Fear Thermometer (FT) developed by Walk (1956) which utilizes a scale with endpoints of 1 (completely calm) and 10 (absolute terror). Although there is no research available which would recommend the use of one or the other type of rating system, a 10-point scale was employed in the present study to assess the degree of subjective anxiety experienced during the BAT task. This smaller scale appears to be a much more manageable method of reporting subjective feelings of anxiety, and therefore likely provides a more reliable measure of fear than the 100-point scale used by Wolpe (1969). Immediate test-retest correlations (r=.94 to .98, Borkovec & Craighead, 1971) and reliability over several weeks (r=.75, Lang & Lazovik, 1963; r=.94, Trexler & Karst, 1972) have generally been quite high for these rating scales in studies of both snake phobia and speech anxiety.

While a wide variety of specific fears or phobias have been targeted for investigation in analogue fear research (e.g., fear of snakes, fear of insects), subjects in the present study were selected on the basis of the commonly reported fear of spiders, or "spider phobia". Klorman et al. (1974) have presented psychometric data on an internally consistent, 31-item, true or false self-report questionnaire which is designed to measure the verbal-cognitive or subjective component of spider phobia (see Appendix A for a copy of the questionnaire). In a study evaluating the validity of the Spider Questionnaire (SPQ), Hastings (1971) found that subjects obtaining high scores on the SPQ reported significantly greater distress when exposed to fear-relevant material than subjects whose scores indicated a low fear of spider stimuli. The two groups did not differ, however, in their subjective ratings of neutral fear-irrelevant stimuli. Due to the high incidence of "spider phobics" in the general population, the SPQ has been recommended for use in analogue fear research (Klorman et al., 1974).

The method used in the present investigation is outlined in schematic form in Table 1.

From the preceding review of the literature, it was possible to derive the following specific hypotheses which were tested:

I. Subjects who receive the external inhibition treatment would permit a significantly greater approach by the spider on the posttreatment than on the pretreatment assessment, and this improvement in approach behavior would be significantly greater than that exhibited by subjects in either the Graduated Exposure or Test-Retest control groups. A repeated measures analysis of variance was conducted on the two sets of mean BAT scores (pretreatment and posttreatment) for each of the three experimental groups in order to evaluate changes in approach behavior on the two BAT assessments.

II. Subjects receiving the external inhibition treatment would exhibit a significant reduction in self-reported fear of the spider from the pre-treatment to the posttreatment assessment, and this reduction would be significantly greater than that shown by subjects in either the Graduated Exposure or Test-Retest control groups. A repeated measures analysis of variance was conducted on the pretreatment and posttreatment mean SUDS ratings of the three experimental groups to evaluate changes in self-reported anxiety.

III. Subjects in the External Inhibition treatment group would show a significant reduction in heart rate during the posttreatment BAT as compared to that exhibited during the pretreatment assessment. This reduction in heart rate for subjects in the External Inhibition group would be significantly greater than that exhibited by subjects in either the Graduated Exposure or Test-Retest control groups. A repeated measures analysis of variance was performed on the pretreatment and posttreatment mean heart rate levels of the three experimental groups in order to evaluate changes in heart rate across the two assessment periods.

IV. Subjects in the External Inhibition treatment group would exhibit a significant reduction in skin conductance during the posttreatment BAT as compared to those shown during the pretreatment assessment. This reduction in skin conductance for subjects in the External Inhibition would be significantly greater than that exhibited by subjects in either the Graduated Exposure or Test-Retest control groups. A repeated measures analysis of variance was performed on the pretreatment and post-treatment skin conductance levels of the three experimental groups in order to evaluate changes in skin conductance across the two assessment periods.

V. Subjects who receive the external inhibition treatment would show a significant reduction in scores obtained in the posttreatment administration of the Spider Questionnaire as compared to scores obtained on the initial administration of the questionnaire. This reduction in scores by the External Inhibition group would be significantly greater than that shown by subjects in either the Graduated Exposure or Test-Retest control groups. A repeated measures analysis of variance was conducted on the two sets of mean Spider Questionnaire scores for each of the three experimental groups in order to evaluate changes in self-reported fear on the questionnaire measure.

Method

Subjects

Twenty-four (24) female subjects were chosen from undergraduate psychology courses at Virginia Commonwealth University. Subjects having a fear of spiders were initially selected on the basis of their total scores on the Spider Questionnaire (SPQ; Klorman et al., 1974) as follows: the SPQ was administered to 316 females at VCU over a two semester period during the 1982-83 academic year. Those subjects scoring in the upper 25% of the distribution of all scores on the SPQ were defined as potential high-fear subjects and randomly assigned to one of three experimental groups: (1) an External Inhibition treatment group, (2) a Graduated Exposure control group, or (3) a Test-Retest control group. These subjects were then invited to participate in a study "investigating physiological and subjective responses to visual stimuli".

A total of 53 subjects were recruited in this fashion. Further screening of these potential high-fear subjects was conducted during the pretreatment assessment phase of the study, and resulted in the disqualification of 12 subjects who failed to meet the criterion performance on the behavioral avoidance test and one subject who did not exhibit the requisite increase in physiological activity. Of the remaining 40 subjects, six were dropped due to equipment and recording difficulties, and three subjects withdrew voluntarily prior to their completion of the experiment. Six other subjects who participated during the first semester of the study were subsequently dropped when their SPQ scores were found to be below the criterion level in the combined, two-semester distribution of SPQ scores. Another subject was also dropped due to her extremely high and deviant score on the SPQ. As a result, a total of 24 subjects were included, with eight subjects being assigned to each of the three experimental groups.

The mean SPQ score for all subjects given the SPQ was 9.4 with a standard deviation of 6.19. This distribution was comparable to that of the normative data for the SPQ reported by Klorman et al. (1974), which yielded a mean of 8.82 and a standard deviation of 6.13. The range of SPQ scores for the External Inhibition group was 15 to 24 with a mean of 18.37. Scores for the Graduated Exposure group ranged from 14 to 25 with a mean of 18.75. The Test-Retest group scores ranged from 15 to 23 with a mean of 18.37.

Experimenter

The experimenter was a 28-year-old male of average height and weight who conducted himself in a pleasant, business-like manner and presented himself as a psychology graduate student doing research.

Apparatus

The experiment was conducted in the Psychophysiological Laboratory located in two adjoining, temperature controlled rooms on the second floor of the Psychological Services Center at 806 West Franklin Street.

The external stimulus was presented via a SONY Cassette recorder (TC-142) attached to a set of Pioneer (SE-405) Stereophone Headphones.

Physiological measures were recorded on a five-channel Grass Model 7-D polygraph as follows:

Heart rate was recorded via a Grass Model 7PGC preamplifier interfaced with a Grass Model 7DA driver amplifier. Beat-by-heart rate was obtained through a Grass plug-in Tachograph 7P4 and recorded on a separate channel of the polygraph. Two silver plate EKG electrodes were attached in the Standard III position on the left arm and left leg and secured with perforated rubber straps. To insure proper conductance, each electrode site was thoroughly cleaned with alcohol and an electrolyte of Grass EC-2 conductive paste was rubbed into the skin as well as onto the surface of the electrodes.

Electrodermal responses were recorded through a Grass Model 7P1 low-level DC-coupled preamplifier interfaced with a Grass Model 7DA driver amplifier. A pair of Beckman silver/silver chloride cup electrodes $2cm^2$ in area were attached to the volar surface of the left palm and referenced to a site on the ventral side of the third phalange of the left index finger. Each electrode was interfaced with an electrolyte of 50% normal saline solution in paste form. The electrodes were applied to an acetone-cleaned skin surface and held securely in place by adhesive tape.

Dependent Measures

Behavioral Avoidance Test (BAT). Each subject was seated in a chair at the end of an elevated track extending from directly beneath the subject's chest to a distance of 10-feet. A live tarantula (Eurypelma californica) enclosed in a ventilated, plexiglass case was concealed at the far end of the track and mounted on a motorized platform controlled by the experimenter from the adjacent room. At the start of the BAT, the spider was moved to the 10-foot mark by the experimenter and remained stationary at that point for a period of 30-seconds. The spider was then advanced toward the subject at the rate of approximately 1-inch/second until the subject began to feel the "least bit anxious or uncomfortable". At that point, the subject was instructed that she could press a small button on the arm of the chair that would immediately stop the spider. After a period of 30-seconds, the experimenter once again began advancing the spider toward the subject. The BAT was concluded when the subject stopped the spider a second time, with the experimenter recording the distance of the spider from the subject to the nearest inch. BAT scores ranged from 24 to 120 on the pretreatment and from 0 to 120 on the posttreatment measures.

Subjective Units of Discomfort Scale (SUDS). Subjects were instructed to rate aloud, on a scale from 1 to 10, the subjective units of discomfort (SUDS) evoked by the spider at three different times during each BAT administration: when the spider was first brought to the 10-foot mark and each time the subject stopped the spider. The former ratings were obtained so as to provide a measure of subjective anxiety with the phobic stimulus at a constant distance across all three experimental groups. The SUDS score obtained on the second stop of the spider by the subject constituted the degree of anxiety evoked by the phobic stimulus at the point of closest approach. The endpoints of the SUDS scale represented, respectively, "completely calm" (1) and "the most anxiety ever felt" (10). SUDS scores were obtained during both the pretreatment and posttreatment phases of the experimental session. The experimenter was not present in the experimental room during either of these phases in order to reduce possible demand characteristics associated with the experimenter's presence. The subject's SUDS ratings were recorded by the experimenter in the adjacent room.

Physiological Measures. Heart rate and skin conductance measures were continuously recorded throughout the experimental session. In addition, movement of the spider during the BAT (i.e., starts and stops) were recorded on a separate channel of the polygraph record in order to evaluate the physiological responses associated with the maximum and minimum distances of the phobic stimulus from the subject.

Spider Questionnaire. The SPQ (Klorman et al., 1974) was used as a screening device for the initial selection of potential spider fearful subjects and was readministered during the posttreatment assessment phase of the study.

Procedure

Subjects were tested individually and randomly scheduled for the experimental sessions. In order to insure accurate physiological recordings, subjects were asked to take no non-prescribed drugs on the day they were scheduled to participate in the experiment. In addition, coffee, other caffeinated drinks, or stimulants of any kind were prohibited for two hours, and cigarettes for one hour, prior to the experiment. Subjects having corrected vision were also asked to wear their glasses or contact lens to the experimental session. To minimize the effects of temperature fluctuations on the physiological measures, temperature was maintained at a constant 72 degrees F. in the experimental room.

Prior to the start of the experiment, each subject was asked to complete a preliminary questionnaire (Appendix B) and to sign a consent form explaining the nature of the study, the physiological measures involved, and the subject's freedom to withdraw from the experiment at any time (Appendix C). If a subject answered in the affirmative to any question on the preliminary questionnaire, she was excluded from participation in the study and was debriefed and released.

The experimental session was divided into three separate phases: (1) pretreatment screening and assessment, (2) treatment, and (3) posttreatment assessment. Each of the three experimental groups received the identical procedure in the pretreatment and posttreatment assessment phases. The three phases of the experimental session are described in detail below.

Pretreatment screening and assessment. Upon completion of the preliminary questionnaire and consent form, the first BAT was administered as a means of further screening potential high-fear subjects and providing baseline data from which to evaluate treatment effects. In order to obtain a more accurate pretreatment assessment, subjects were not told they were selected on the basis of their fear of spiders so as to reduce instructional effects on the pretreatment measures (Gilmore, 1981). Each subject was seated comfortably in a padded lounge chair at the end of the BAT track and given instructions explaining the nature of the phobic stimulus and the BAT procedure. (Specific instructions to subjects are in Appendix D). After the instructions had been read and the electrodes attached, subjects sat quietly with their eyes open for a 6-minute adaptation period prior to the start of the first BAT. The adaptation period was to allow sufficient time for the subject to become acclimated to the experimental setting and the electrodes, and to "settle down" physiologically, before beginning the experimental session.

In order to select only those subjects who were highly fearful of spiders, any subject who was able to bring the spider to a distance of less than 24-inches on the second trial of the BAT or who failed to exhibit an increase in heart rate of at least 10% (from the last averaged beat-by-beat heart rate obtained during the adaptation period to the highest beat-by-beat heart rate elicited during exposure to the spider) was eliminated from the study as exhibiting too little anxiety.

Treatment Groups

Immediately following the end of the first BAT, the experimenter re-entered the experimental room and replaced the spider in its concealed location at the far end of the BAT track. Subjects meeting the criteria specified above then received the treatment appropriate to the experimental group to which they had been randomly assigned. The procedures and instructions for each group were as follows:

External Inhibition. The subject remained seated in the chair and was told the following:

> Previous research has shown that learned responses, such as your discomfort in the presence of spiders, can be changed by presenting a different type of stimulus while the spider is present. That is what we will be doing next. The spider will once again be brought to the end of the track and stopped, and will then begin moving closer to you after a period of about 30-seconds. As before, if you begin to feel the least bit anxious or uncomfortable you may press the button on the arm of the chair and the spider will stop moving. This time, however, after the spider has stopped, I will present a series of noises which you will hear through these headphones, on for a few seconds and off for a few seconds. When the noises have stopped, I will once again begin moving the forward. If you are still too anxious to have the spider moved closer, you should simply press the button as soon as the spider begins moving and the noises will be repeated. If you do not press the button immediately, the spider will continue to move forward and we will repeat the process, stopping the spider whenever you feel the least bit anxious and presenting the series of noises. For this part of the experiment, it will not be necessary for you to rate your anxiety level, but remember to sit as still as possible and look directly at the spider for the entire time it is on the track. Do you have any questions?

The headphones were then placed on the subject and adjusted for comfort. The experimenter went to the adjacent room and, after a 2-minute adaptation period, moved the spider to the 10-foot mark. After a period of 30-seconds, the experimenter began moving the spider forward, bringing it progressively closer to the subject at a rate of approximately 1-inch/second. When the subject pressed the button and stopped the spider, the experimenter presented the external noise stimulus for a total of 30-seconds. The external stimulus consisted of white noise delivered at an intensity of approximately 95 db A by a SONY tape recorder through the stereophonic headphones. One administration of the sound as an externally inhibiting stimulus was defined as a 30-second presentation with the white noise alternately on and off for two-second periods. The white noise stimulus was prerecorded and the tape operated by the experimenter in the adjacent room. The strength of the stimulus was controlled by the tape recorder at 95 db A.

After presentation of the external stimulus, the experimenter once again began advancing the spider toward the subject. Each time the subject pressed the button and stopped the spider, the external stimulus was presented in the manner described above. This phase of the experiment was terminated after the subject had received 15 presentations of the external stimulus or had permitted the spider to reach the endpoint of the BAT track, whichever occurred first.

Graduated Exposure. Subjects remained seated in the chair and were given the following instructions:

> Previous research has shown that learned responses, such as your discomfort in the presence of spiders, can be changed by exposing you to the spider while you are relaxed and comfortable. That is what we will be doing next. So make yourself as comfortable as you can in the chair, your body will be relaxed, and your fear will be deconditioned. The spider will once again be brought to the end of the track and stopped, and will then begin moving closer to you after a period of about 30-seconds. As before, if you begin to feel the least bit anxious or uncomfortable you may press the button on the arm of the chair and the spider will stop moving. This time, however, after the spider has been stopped, I would like you to relax yourself once again, but remember not to move around because of the sensitive nature of the recording equipment. After taking about 30-seconds to relax yourself, I will once again begin moving the spider forward. If you are still too anxious to have the

> spider moved closer, you should simply press the button as soon as the spider begins moving and relax yourself once again. If you do not press the button immediately, the spider will continue to move forward and we will repeat the process, stopping the spider whenever you feel the least bit anxious and allowing you to relax yourself again. This time you will be wearing this set of headphones to keep out any outside noises that may affect the physiological recordings and interfere with your ability to relax completely. For this part of the experiment, it will not be necessary for you to rate your anxiety level, but remember to sit as still as possible and look directly at the spider for the entire time it is on the track. Do you have any questions?

The headphones were then placed on the subject as a control for extraneous noise and adjusted for comfort. The experimenter went to the adjacent room and, after a 2-minute adaptation period, moved the spider to the 10-foot mark. The BAT procedure, as described above, was repeated for a total of 15 trials, with trials being defined as each time the subject stopped the movement of the spider, or until the subject had permitted the spider to reach the endpoint of the track.

Test-Retest Control. Subjects remained seated in the chair and were told the following:

> I would now like to obtain recordings of your physiological activity without the spider present. This time you will be wearing this set of headphones to keep out any outside noises that may affect the physiological recordings. Just sit quietly and keep your eyes open as you normally would for the next few minutes. Please remember to keep as still as possible due to the sensitive nature of the recording equipment. Do you have any questions?

The headphones were then placed on the subject as a control for extraneous noise and adjusted for comfort. The experimenter then went to the adjacent room and subjects sat quietly for a period of 10-minutes. This period of time was comparable to the time required to administer the External Inhibition and Graduated Exposure procedures.

Posttreatment Assessment

Immediately following the end of the treatment phase of the session, the experimenter re-entered the experimental room and replaced the spider in its concealed location at the far end of the BAT track. In the post-treatment assessment phase, two BAT's were administered in order to assess changes in approach behavior and to evaluate changes in self-reported anxiety and physiological activity at the closest distance obtained on the pretreatment assessment (Borkovec et al., 1977). The first BAT, with a procedure identical to that of the pretreatment BAT, was administered to determine changes in approach behavior. Subjects were given the following specific instructions:

> I would once again like to determine your responses to the spider using the procedure we employed at the beginning of the experiment. In a few minutes, I will move the spider to the end of the track where it will be stopped. After the spider has stopped, I would like you to rate aloud the degree of discomfort or anxiety you feel as you look at the spider at that distance. Use the same scale from 1 to 10 to rate your anxiety as before, with 1 representing no anxiety or completely calm and 10 representing the most anxiety you have ever felt. Remember you may use any number from 1 to 10 that best describes the discomfort or anxiety you experience while looking at the spider. After a period of about 30-seconds, the spider will again begin to move slowly down the track and will continue to move toward you. As before, if you should begin to feel the least bit anxious or uncomfortable, you may press the button on the arm of the chair and the spider will stop moving. After you press the button and the spider stops, I would like for you to again rate aloud the degree of discomfort or anxiety you experience using the scale from 1 to 10. Again, since the purpose of this is to see just how close you can comfortably come to the spider, I will start moving it forward again after a period of about 30-seconds. If you again begin to feel the least bit anxious or uncomfortable, you may press the button and the spider will be stopped completely. After the spider stops moving for the second time, I would like for you to once again rate aloud the degree of discomfort or anxiety you experience using the 10-point scale. Let the spider come as close as possible, but if you begin to feel the slightest bit anxious or uncomfortable, please do not try to force yourself to continue.

> Please remember to keep as still as possible due to the sensitive nature of the recording equipment, and use only a movement of your right hand should you find it necessary to press the button. Keep your left arm and left leg perfectly still at all times. Look directly at the spider for the entire time it is on the track and rate your level of discomfort or anxiety each time the spider stops moving using the scale from 1 to 10. Do you have any questions?

The experiment then went to the adjacent room and, after a 3-minute adaptation period, began the posttreatment BAT. The BAT was concluded when the subjcet stopped the spider for the second time, with this distance being recorded as the posttreatment BAT approach score.

At the end of the first posttreatment BAT, the experimenter re-entered the experimental room and replaced the spider in its concealed location at the far end of the BAT track. The second posttreatment BAT was then administered in order to assess changes in self-reported anxiety and physiological activity at the closest distance obtained on the pretreatment assessment. Each subject received the following instructions:

> I would like to determine your responses to the spider for a final time using a slightly different procedure. As before, I will first move the spider to the end of the track where it will be stopped. After the spider has stopped, I would like you to again rate aloud the degree of discomfort or anxiety you feel as you look at the spider at that distance, using the same 10-point scale. After about 30-seconds, the spider will again begin to move slowly down the track, but this time I do not want you to press the button to stop the spider. Instead, I will stop moving the spider at a particular point on the track and, after it stops, I would like you to rate aloud the degree of discomfort or anxiety you experience using the scale from 1 to 10. While I do not want you to press the button to stop the spider, it will come no closer to you than it has on previous trials. Remember to keep as still as possible, keep your eyes on the spider, and rate your level of discomfort or anxiety each time the spider stops using the 10-point scale. Do you have any questions?

The experimenter then went to the adjacent room and, after a 3-minute adaptation period, began the second posttreatment BAT by moving the spider to the 10-foot mark. After a period of 30-seconds, the experimenter moved the spider to the point on the BAT track where it had been stopped by the subject on the second trial of the pretreatment BAT.

Following completion of the second BAT, the experimenter re-entered the experimental room, replaced the spider in its concealed location, and removed the electrodes. Subjects were then given a copy of the Spider Questionnaire to complete outside the experimental room.

At the conclusion of the experimental session, each subject was thoroughly debriefed and asked to raise any questions concerning the experimental procedure. Subjects were asked to refrain from discussing the experiment with other students in order to avoid biasing other possible subjects. An inquiry was also made at this time regarding any residual side effects experienced as a result of the experimental procedures. Although no such side effects were expected, any subject reporting significant discomfort was offered follow-up attention by the experimenter at the Psychological Services Center. Only one subject reported significant distress following the experimental session and was offered follow-up attention; however, prior to the follow-up session, she indicated by telephone that her distress had subsided and that further attention was not needed.

Results

Subject Selection Variables

Three separate selection criteria were utilized to help insure that only those subjects who were highly fearful of spiders were selected for participation in the study. The selection criteria included: (1) a total score on the Spider Questionnaire (SPQ) that was within the upper 25% on the distribution of all scores on the SPQ; (2) allowing the spider to come no closer than 24-inches on the pre-treatment behavioral avoidance test (BAT); and (3) an increase in heart rate of at least 10% during the pretreatment BAT (from the last averaged beat-by-beat heart rate elicited during the adaptation period to the highest beat-by-beat heart rate elicited during the pretreatment BAT). A summary of the scores obtained by the three experimental groups on each of the selection variables is presented in Table 2.

As all subjects were randomly assigned to the three experimental groups, it had been assumed that the groups would not be significantly different on any of the selection measures used. In order to test this assumption, three separate analyses of variance were conducted on the pretreatment SPQ, BAT, and heart rate scores. These analyses, presented in Table 3, revealed no significant differences between the experimental groups on any of the three selection measures.

For purposes of clarity, the results for each of the five dependent variables will be presented separately. Discussion of the specific dependent measures will be followed by an examination of the

Table 2

Selection Variables
Group Means and Standard Deviations

Group		Measures: SPQ	BAT [a]	HR [b]
External Inhibition	$\overline{X}$	18.37	46.50	28.25
	S.D.	2.69	15.43	11.40
Graduated Exposure	$\overline{X}$	18.75	45.25	27.50
	S.D.	2.99	13.46	14.50
Test-Retest	$\overline{X}$	18.37	53.00	26.00
	S.D.	2.64	24.04	7.02

[a]BAT scores are expressed in inches

[b]Heart rate is expressed as a change score, obtained by subtracting the last averaged beat-by-beat heart rate during the adaptation period from the highest averaged beat-by-beat heart rate elicited during the pretreatment BAT.

Table 3

Analyses of Variance for Subject Selection Variables

SPQ

Source	df	SS	MS	F
Group	2	.75	.37	.04
Error	21	185.25	8.82	
Total	23	186.00		

*p .05
**p .01

BAT

Source	df	SS	MS	F
Group	2	277.00	138.50	.36
Error	21	7975.50	379.79	
Total	23	8252.50		

*p .05
**p .01

Heart Rate

Source	df	SS	MS	F
Group	2	21.00	10.50	.07
Error	21	3115.50	148.36	
Total	23	3136.50		

*p $<$ .05
**p $<$ .01

intercorrelations between dependent variables and of the treatment trials administered during the treatment phase of the experiment. A summary of the group means and standard deviations for each of the five dependent variables is provided in Appendix E.

Behavioral Avoidance Test

All subjects were administered a passive behavioral avoidance test (BAT) as part of both the pretreatment and posttreatment assessments. The closest approach of the spider permitted by the subject on each occasion was recorded to the nearest inch and constituted the pretreatment and posttreatment BAT scores.

A repeated measures analysis of variance was conducted on the two sets of BAT scores (pretreatment BAT and posttreatment BAT #1) using a 2 x 3 ANOVA on the Period (pre, post) x Group (External Inhibition, Graduated Exposure, Test-Retest) factors. As shown in Table 4, the ANOVA yielded a significant main effect for the Period factor (F [1,21]= 35.13, $p < .01$), indicating that all three experimental groups exhibited a significant improvement in approach behavior over the two assessment periods, and permitted the spider to come significantly closer on the posttreatment BAT than on the pretreatment BAT. The nonsignificant Group main effect and Group x Period interaction effect revealed that this increase in approach behavior from the pretreatment to the posttreatment assessment was not significantly different for the three experimental groups. The mean performances for each group on the behavioral measure are presented graphically in Figure 1.

Table 4

Analysis of Variance for Behavioral Avoidance Test

Source	df	SS	MS	F
Between	23	18814.25		
Group	2	2243.62	1121.81	1.42
Error	21	16570.63	789.08	
Within	24	7053.00		
Period	1	3996.75	3996.75	35.03**
Group x Period	2	660.12	330.06	2.89
Error	21	2396.13	114.10	
Total	47	25867.25		

*$p < .05$
**$p < .01$

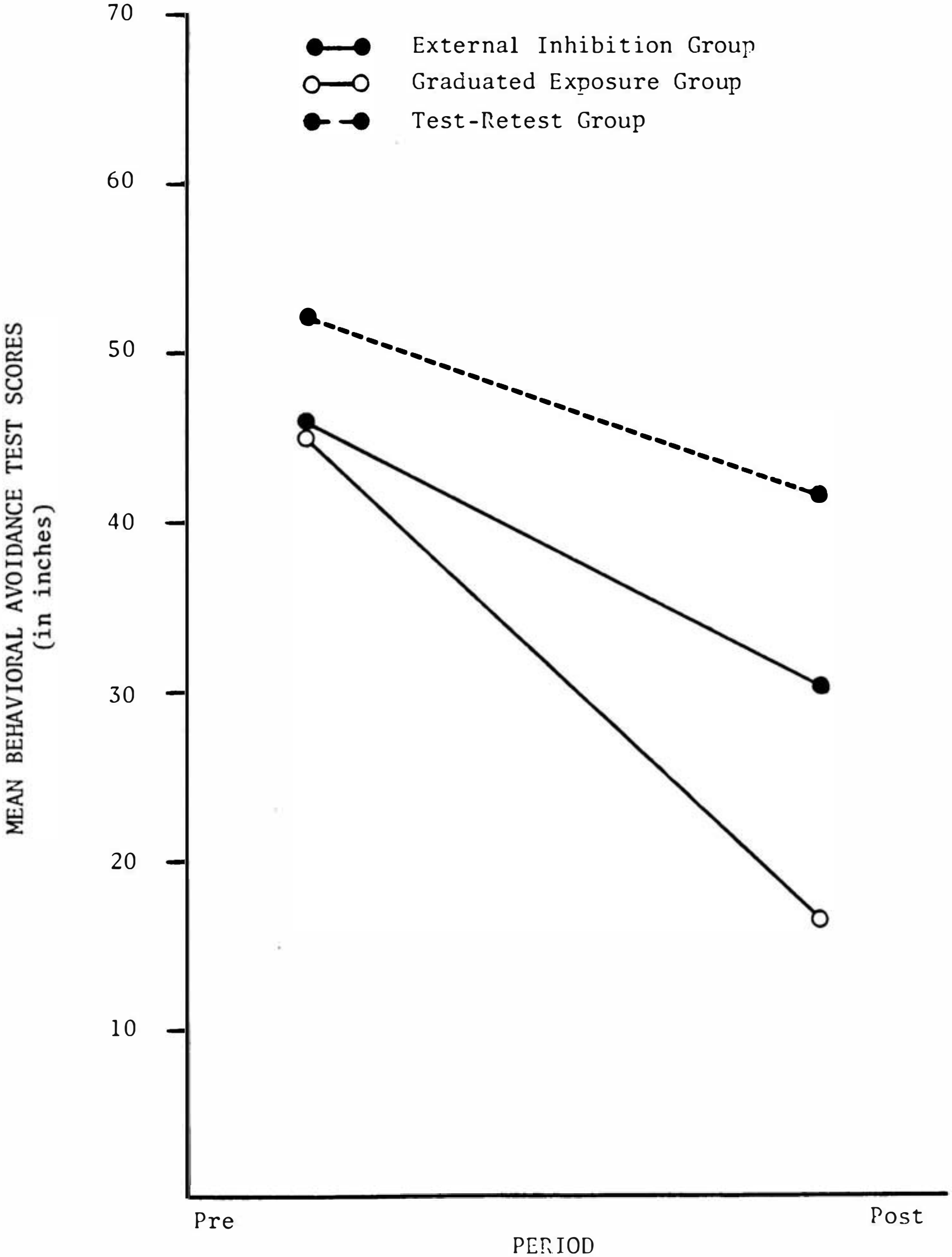

Figure 1. Pretreatment and posttreatment behavioral avoidance test scores for external inhibition, graduated exposure, and test-retest groups.

Subjective Units of Distress

Each subject rated aloud to the experimenter her subjective rating of the amount of distress evoked by the spider on three separate occasions during each BAT administration: when the spider was first brought to the end of the BAT track and each of the two times the subject stopped the spider. The former ratings were obtained so as to provide a measure of subjective distress with the spider at a constant distance across all three experimental groups. The SUDS score obtained on the second stop of the spider by the subject constituted the degree of anxiety evoked by the phobic stimulus at the point of closest approach. The rating scale that was used ranged from 1 to 10, with 1 representing no distress and 10 representing maximal distress.

Three separate analyses were performed on the SUDS data to evaluate: (1) changes in SUDS ratings elicited at the constant 10-foot distance; (2) changes in SUDS ratings obtained at the point of closest pretreatment approach; and (3) changes in SUDS ratings elicited at the point of closest approach on both the pretreatment and posttreatment assessments.

In order to evaluate changes in self-reported anxiety with the spider at a constant distance, a repeated measures analysis of variance was performed on the SUDS ratings elicited at the 10-foot point during the pretreatment BAT and posttreatment BAT #1 using a 2 x 3 ANOVA on the Period x Group factors. The ANOVA revealed a significant main effect for the Period factor ($F [1,21] = 51.47$, $p < .01$), but failed to show either a significant main effect for the Group factor or a significant Group x Period interaction effect. This indicated that all three experimental groups displayed a significant reduction in the mean subjective distress ratings evoked by the spider at the constant 10-foot distance on the posttreatment BAT, with no one group showing a significantly greater reduction than the other two. The results of the repeated measures ANOVA are presented in Table 5, and the group mean distress ratings are shown graphically in Figure 2.

Changes in the SUDS ratings reported at the point of closest pretreatment approach was examined by conducting a repeated measures analysis of variance on the two sets of SUDS scores (pretreatment BAT and posttreatment BAT #2) using a 2 x 3 ANOVA on the Period x Group factors. As can be seen in Table 6, the ANOVA once again yielded a significant main effect for the Period factor (F [1,21] = 40.04, $p <$ .01), which indicated that the spider evoked significantly lower mean subjective distress ratings on the posttreatment BAT when presented at the point of closest pretreatment approach. In addition, the failure to obtain a significant main effect for the Group factor and the nonsignificant Group x Period interaction effect indicated that this reduction in the mean SUDS ratings was similar for each of the three experimental groups. The group mean subjective distress ratings for the pretreatment and posttreatment assessments are graphically represented in Figure 3.

Changes in the SUDS ratings elicited at the point of closest approach on both the pretreatment and posttreatment assessments were also examined. A repeated measures analysis of variance was performed on the SUDS ratings obtained during the pretreatment BAT and the posttreatment BAT #1 using a 2 x 3 ANOVA on the Period x Group factors. The ANOVA, presented in Table 7, again revealed a significant main effect for the Period factor (F [1,21] = 15,70, $p <$ .01), with neither

Table 5

Analysis of Variance for Subjective Units of Distress
(10-Foot Distance)

Source	df	SS	MS	F
Between	23	107.98		
Group	2	17.17	8.58	1.98
Error	21	90.81	4.32	
Within	24	18.50		
Period	1	13.02	13.02	51.47**
Group x Period	2	.17	.08	.33
Error	21	5.31	.25	
Total	48	126.48		

*$p < .05$
**$p < .01$

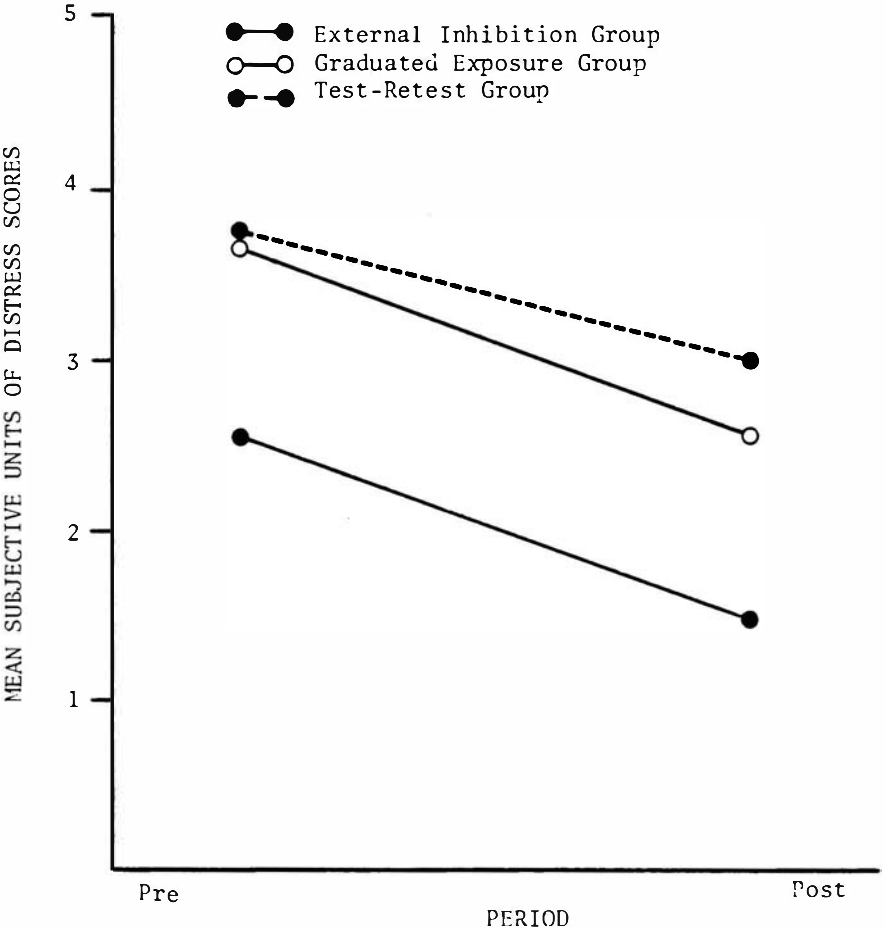

Figure 2. Pretreatment and posttreatment subjective units of distress scores for external inhibition, graduated exposure, and test-retest groups with the spider at the 10-foot distance.

Table 6

Analysis of Variance for Subjective Units of Distress
(Closest Pretreatment Approach)

Source	df	SS	MS	F
Between	23	108.48		
Group	2	4.54	2.27	.46
Error	21	103.94	4.95	
Within	24	208.50		
Period	1	130.02	130.02	40.04**
Group x Period	2	10.29	5.15	1.58
Error	21	68.19		
Total	47	316.98		

*$p < .05$
**$p < .01$

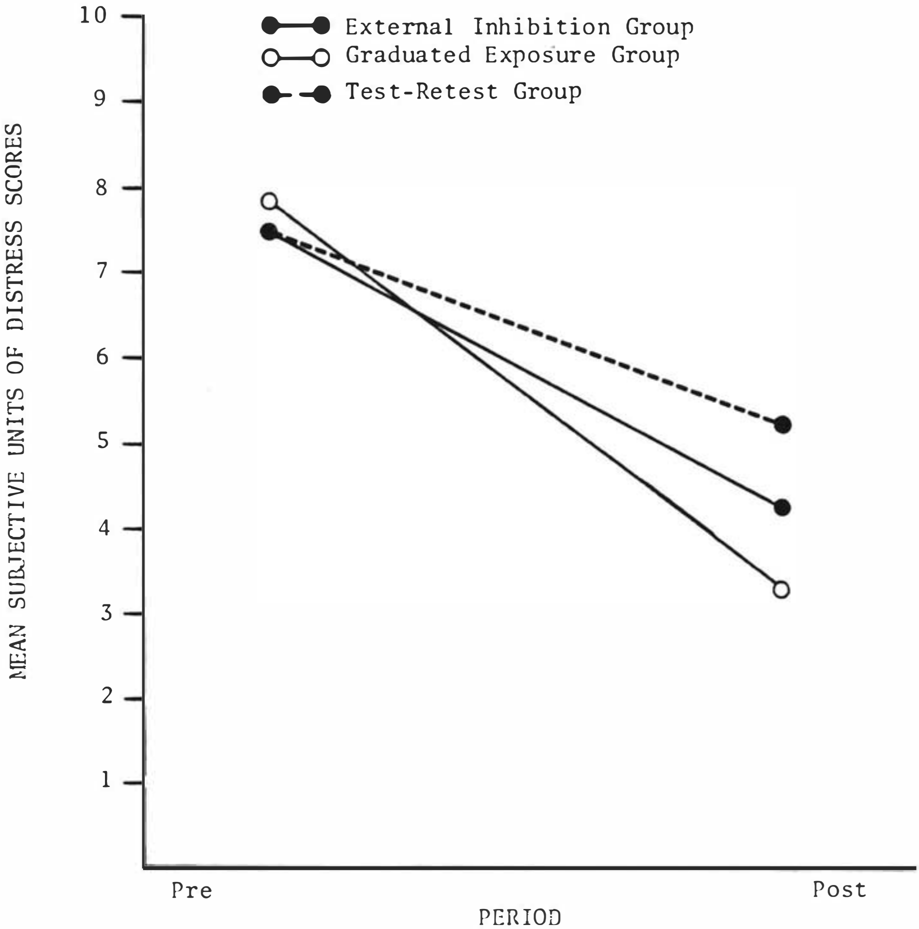

Figure 3. Pretreatment and posttreatment subjective units of distress scores for external inhibition, graduated exposure, and test-retest groups with the spider at the point of closest pretreatment approach.

Table 7

Analysis of Variance for Subjective Units of Distress
(Point of Closest Approach)

Source	df	SS	MS	F
Between	23	117.67		
Group	2	2.17	1.08	.20
Error	21	115.50	5.50	
Within	24	75.00		
Period	1	30.08	30.08	15.70**
Group x Period	2	4.67	2.33	1.22
Error	21	40.25	1.92	
Total	47	192.67		

*$p < .05$
**$p < .01$

the Group main effect nor the Group x Period interaction effect being significant. This indicated that, with the spider at its point of closest approach, all three groups reported significantly lower mean subjective distress ratings on the posttreatment assessment than on the pretreatment BAT, and that these reductions in mean SUDS scores were similar for each of the experimental groups. Figure 4 graphically depicts the pretreatment and posttreatment group mean subjective distress ratings.

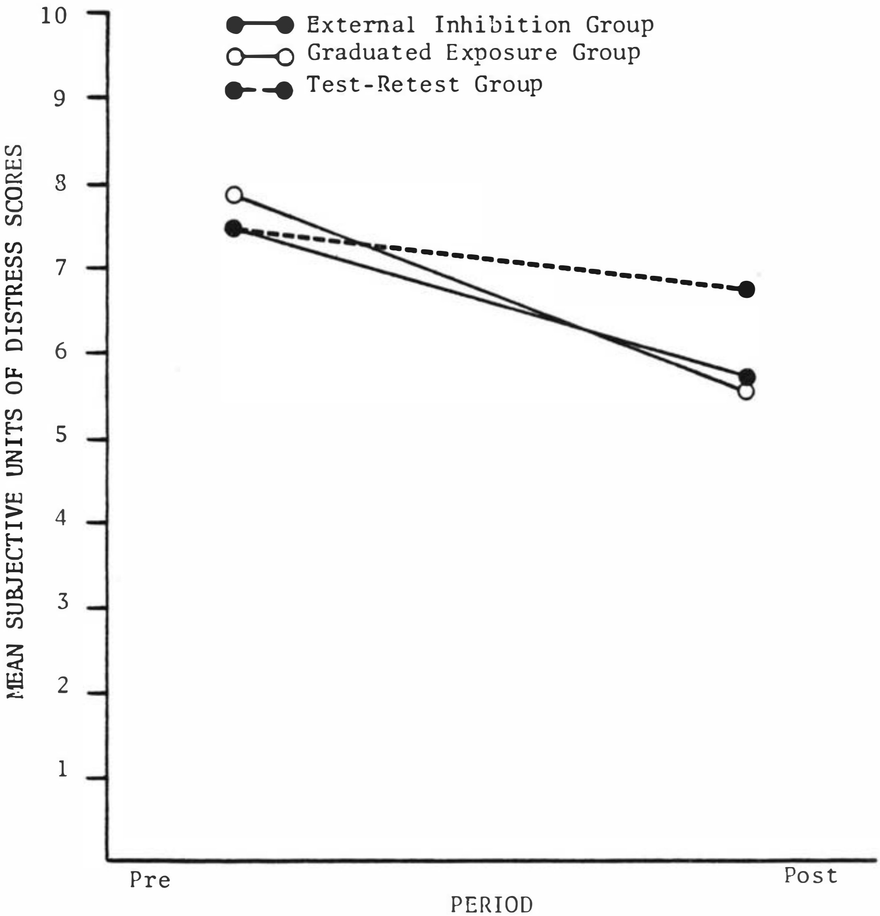

Figure 4. Pretreatment and posttreatment subjective units of distress scores for external inhibition, graduated exposure, and test-retest groups with the spider at the point of closest approach.

Heart Rate

Heart rate in beats per minute was sampled from the cardiotachograph every 5 seconds for the final 30 seconds of each BAT adaptation period. These scores served as the "basal" or initial level of heart rate activity for each respective BAT. The physiological recordings were also sampled every 5 seconds for each 30-second period the spider was presented in a stationary position (i.e., when it was stopped at the 10-foot point, when the spider was stopped for a second time by the subject, and when the spider was presented at the point of closest pretreatment approach on the posttreatment BAT #2). These scores represented the subject's "stress" level of heart rate activity for each respective BAT. In order to control for individual variation in baseline amplitude, a difference, or change, score was computed by subtracting the mean "basal" level of heart rate from the mean "stress" level of heart rate for each of the three analyses performed on the pretreatment and posttreatment heart rate data. Change scores were also computed from the peak heart rates elicited during the adaptation and exposure periods on the pretreatment and posttreatment BAT's. Since the analyses performed on the peak heart rate data yielded essentially the same results as those obtained for the mean heart rate scores, only the latter results are included.

The three analyses conducted on the mean heart rate change scores were the same as those performed on the subjective distress ratings, and were used to evaluate: (1) changes in heart rate activity elicited at the constant 10-foot distance; (2) changes in heart rate responding at the point of closest pretreatment approach; and (3) changes in heart rate activity elicited at the point of closest approach on both the pretreatment and posttreatment assessments.

In order to evaluate changes in heart rate responding at the constant 10-foot distance, a repeated measures analysis of variance was performed on the two sets of heart rate change scores calculated from the pretreatment BAT and posttreatment BAT #1 heart rate levels. Using a 2 x 3 ANOVA on the Period x Group factors, the analysis revealed a significant main effect for the Period factor ($F [1,21] = 21.23$, $p < .01$), but failed to show either a significant main effect for the Group factor or a significant Group x Period interaction effect (Table 8). This indicated that each of the experimental groups exhibited a significant reduction in the heart rate activity elicited by the spider at the constant 10-foot distance from the pretreatment to the posttreatment assessment, and that this reduction was similar across all three groups. The mean heart rate change scores for each group are shown graphically in Figure 5.

A repeated measures analysis of variance was also conducted on the heart rate change scores calculated from the pretreatment BAT and posttreatment BAT #2 using a 2 x 3 ANOVA on the Period x Group factor to evaluate changes in heart rate activity at the point of closest pretreatment approach. No significant main effects or interaction effects were obtained from this analysis, as can be seen in Table 9.

Heart rate responding at the point of closest approach on both the pretreatment and posttreatment (BAT #1) assessments was evaluated by using a 2 x 3 repeated measures analysis of variance conducted on the Period x Group factors. As shown in Table 10, the ANOVA yielded a significant main effect for the Period factor ($F [1,21] = 17,69$, p .01). This indicated that the heart rate activity elicited by the

Table 8

Analysis of Variance for Heart Rate
(10-Foot Distance)

Source	df	SS	MS	F
Between	23	2097.90		
Group	2	260.63	130.32	1.49
Error	21	1837.26	87.49	
Within	24	1568.15		
Period	1	770.48	770.48	21.23**
Group x Period	2	35.53	17.76	
Error	21	762.14	36.29	
Total	47	3666.05		

*$p < .05$
**$p < .01$

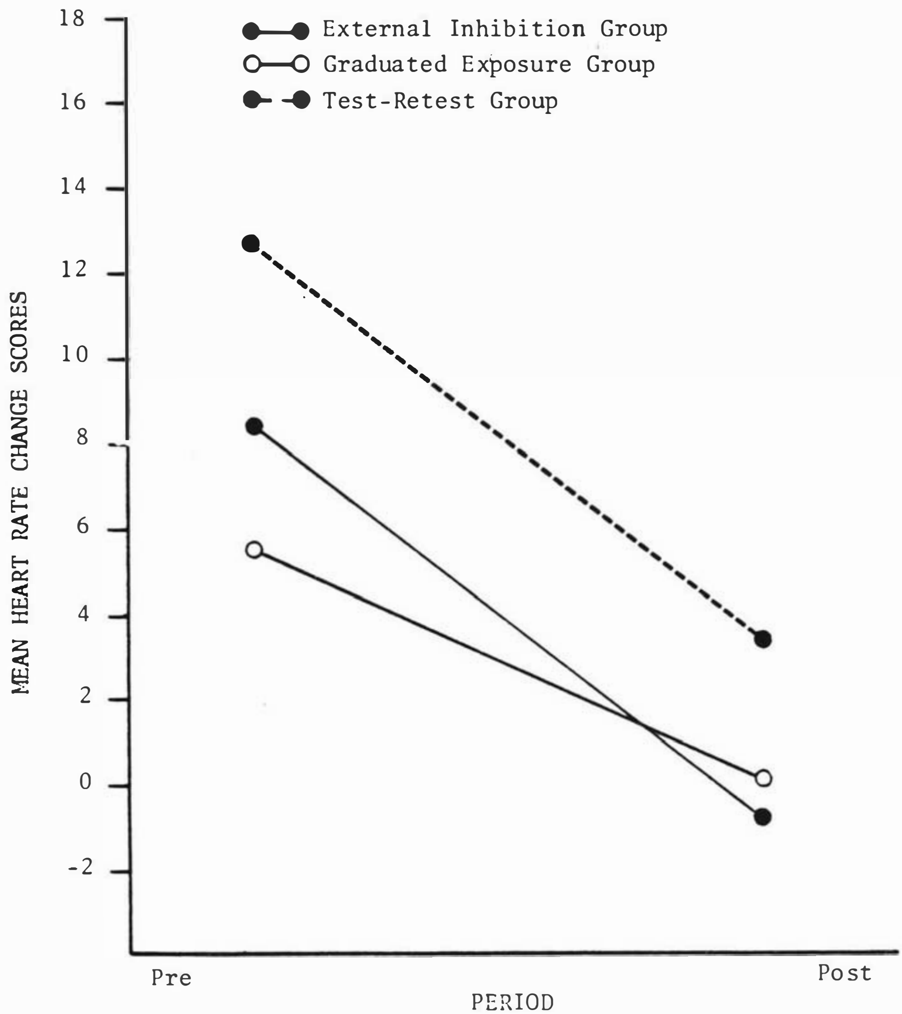

Figure 5. Pretreatment and posttreatment heart rate change scores for external inhibition, graduated exposure, and test-retest groups with the spider at the 10-foot distance.

Table 9

Analysis of Variance for Heart Rate
(Closest Pretreatment Approach)

Source	df	SS	MS	F
Between	23	2171.48		
Group	2	138.43	69.21	.71
Error	21	2033.05	96.81	
Within	24	1438.80		
Period	1	135.58	135.58	2.21**
Group x Period	2	15.82	7.91	.13
Error	21	1287.40	61.30	
Total	47	3610.28		

*$p < .05$
**$p < .01$

Table 10

Analysis of Variance for Heart Rate
(Point of Closest Approach)

Source	df	SS	MS	F
Between	23	2214.82		
Group	2	62.98	31.49	.31
Error	21	2151.85	102.47	
Within	24	1528.93		
Period	1	696.09	696.09	17.69**
Group x Period	2	6.50	3.25	.08
Error	21	826.34	39.35	
Total	47	3743.75		

*p < .05
**p < .01

spider at its point of closest approach was significantly less for all three groups on the posttreatment than on the pretreatment BAT. In addition, the failure to obtain either a significant main effect for the Group factor or a significant Group x Period interaction effect indicated that each of the experimental groups exhibited similar reductions in heart rate responding over the two assessment periods. Figure 6 graphically represents the group mean heart rate change scores for the pretreatment and posttreatment assessments.

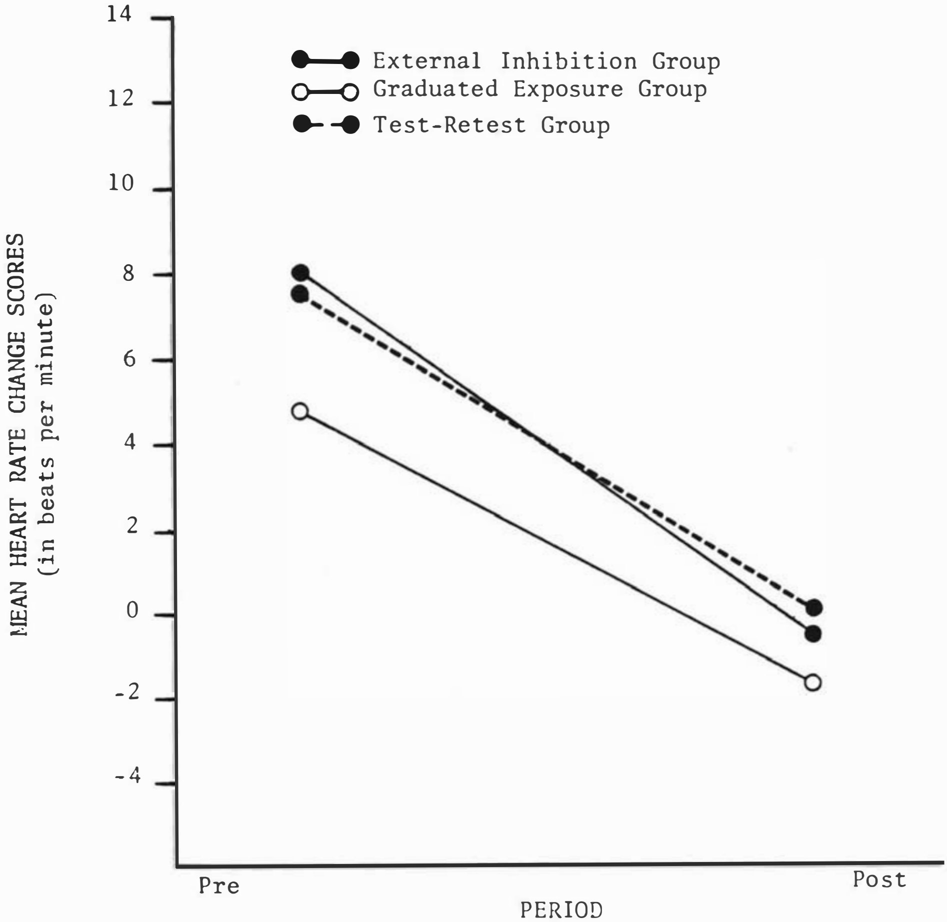

Figure 6. Pretreatment and posttreatment heart rate change scores for external inhibition, graduated exposure, and test-retest groups with the spider at the point of closest approach.

Skin Conductance

Skin resistance levels were sampled from the physiological record every 5 seconds for the final 30 seconds of each BAT adaptation period. These scores served as the subject's "basal" or initial skin resistance level for each respective BAT. The recordings were also sampled every 5 seconds for each 30-second period that the spider was presented in a stationary position (i.e., when it was first brought to the end of the BAT track, when the spider was stopped for a second time by the subject, and when the spider was presented at the point of closest pretreatment approach on the posttreatment BAT #2). These scores represented the subject's "stress" level of skin resistance activity for each respective BAT. A reciprocal transformation of skin resistance values was performed creating skin conductance scores as suggested by Venables and Martin (1968). These scores were then used to derive a change score by subtracting the mean "basal" level of skin conductance from the mean "stress" level of skin conductance for each of the three analyses performed on the skin conductance data. As with the heart rate data, change scores were also computed from the peak skin conductance values elicited during the adaptation and exposure periods on the pretreatment and posttreatment assessments. As before, these analyses yielded essentially the same findings as those obtained for the mean skin conductance scores and are therefore not included in the results.

The three analyses conducted on the mean skin conductance change scores were identical to those performed on the SUDS and heart rate data. As with these previous measures, the three analyses were used to evaluate: (1) changes in skin conductance activity elicited at the constant 10-foot distance; (2) changes in skin conductance elicited at the point of closest pretreatment approach; and (3) changes in skin conductance activity at the point of closest approach on both the pre-treatment and posttreatment BATs.

To evaluate changes in skin conductance activity with the spider at a constant 10-foot distance, a repeated measures analysis of variance was performed on the skin conductance change scores calculated from the pretreatment BAT and posttreatment BAT #1 mean skin conductance levels. Using a 2 x 3 ANOVA on the Period x Group factors, the analysis revealed a significant main effect for the Period factor (F [1,21] = 48.46, $p < .01$), but failed to show either a significant main effect for the Group factor or a significant Group x Period interaction effect (Table 11). This indicated that all three experimental groups exhibited significant and similar reductions in the skin conductance activity elicited by the spider at the constant 10-foot distance from the pretreatment to the posttreatment assessment. The mean skin conductance change scores for each group are displayed graphically in Figure 7.

A repeated measures analysis of variance was also conducted on the skin conductance change scores computed from the pretreatment BAT and posttreatment BAT #2 in order to evaluate changes in skin conductance activity elicited at the point of closest pretreatment approach. The 2 x 3 ANOVA conducted on the Period x Group factors once again yielded a significant main effect for the Period factor (F [1,21] = 26.64, $p < .01$), as shown in Table 12. This effect indicated that significantly lower levels of skin conductance activity were elicited on the posttreatment assessment as compared to the pretreatment

Table 11

Analysis of Variance for Skin Conductance
(10-Foot Distance)

Source	df	SS	MS	F
Between	23	42.61		
Group	2	1.97	.99	.51
Error	21	40.64	1.94	
Within	24	52.40		
Period	1	35.14	35.14	48.46**
Group x Period	2	2.03	1.02	1.40
Error	21	15.23	.73	
Total	47	95.01		

*$p < .05$
**$p < .01$

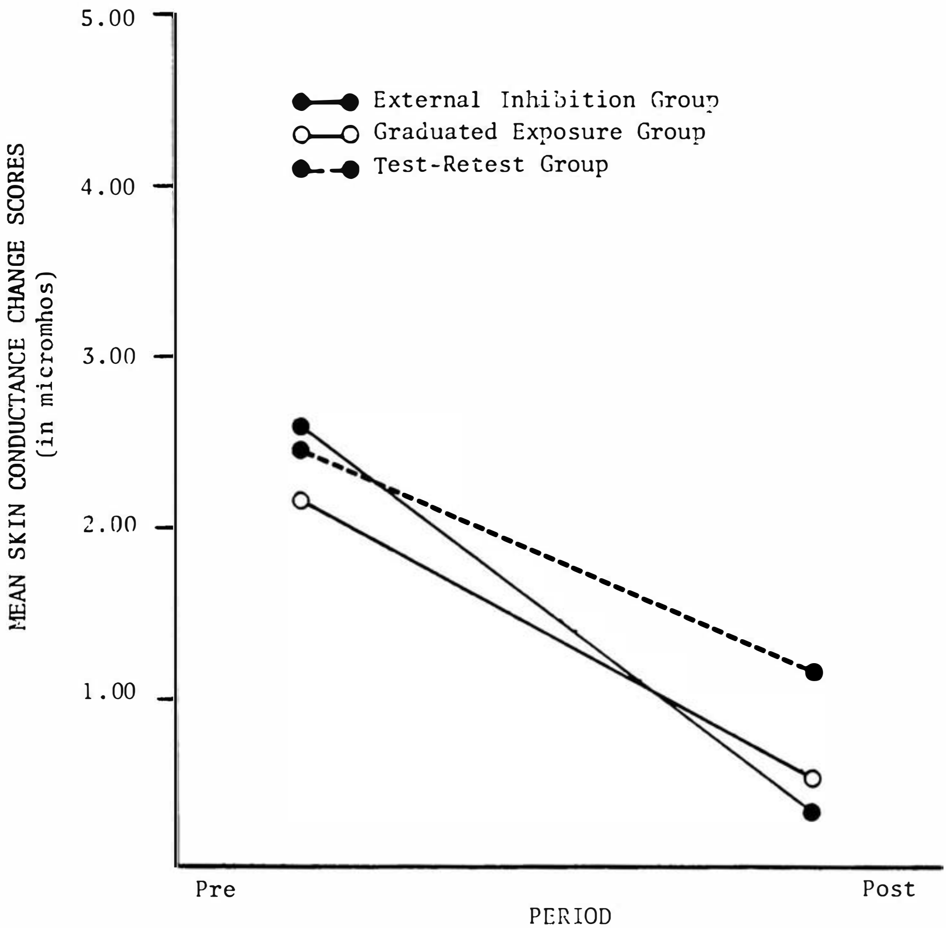

Figure 7. Pretreatment and posttreatment skin conductance change scores for external inhibition, graduated exposure, and test-retest groups with the spider at the 10-foot distance.

Table 12

Analysis of Variance for Skin Conductance
(Closest Pretreatment Approach)

Source	df	SS	MS	F
Between	23	27.46		
Group	2	3.68	1.84	1.63
Error	21	23.78	1.13	
Within	24	57.44		
Period	1	30.94	30.94	26.64**
Group x Period	2	2.10	1.05	.90
Error	21	24.40	1.16	
Total	47	84.90		

$^{*}p < .05$
$^{**}p < .01$

assessment when the spider was presented at the point of closest pretreatment approach. In addition, the nonsignificant Group main effect and Group x Period interaction effect indicated that these reductions in skin conductance activity were similar for all three experimental groups. Figure 8 graphically depicts the mean skin conductance change scores for each group.

Skin conductance activity elicited at the point of closest approach on the pretreatment and posttreatment (BAT #1) assessments was evaluated by using a 2 x 3 repeated measures analysis of variance conducted on the Period x Group factors. As shown in Table 13, the ANOVA revealed a significant main effect for the Period factor ($F [1,21) = 38.73$, $p < .01$), as well as a significant Group x Period interaction effect ($F [1,21] = 3.64$, $p < .05$). While the significant main effect for the Period factor implied that the magnitude of all group mean skin conductance scores was reduced from the pretreatment to the posttreatment assessment, the significant Group x Period interaction effect indicated that the three groups changed differentially across the two assessment periods. A Duncan's Multiple Range Test performed on the significant Group x Period interaction effect revealed that the External Inhibition and Graduated Exposure groups both showed a significant, and similar, reduction in the skin conductance activity elicited by the spider at its point of closest approach on the posttreatment BAT as compared to the activity elicited on the pretreatment assessment. The Test-Retest group, however, displayed no significant reductions in skin conductance activity across the two assessment periods. Table 14 presents the results of the Duncan's Multiple Range Test and Figure 9 graphically represents the Group x Period interaction.

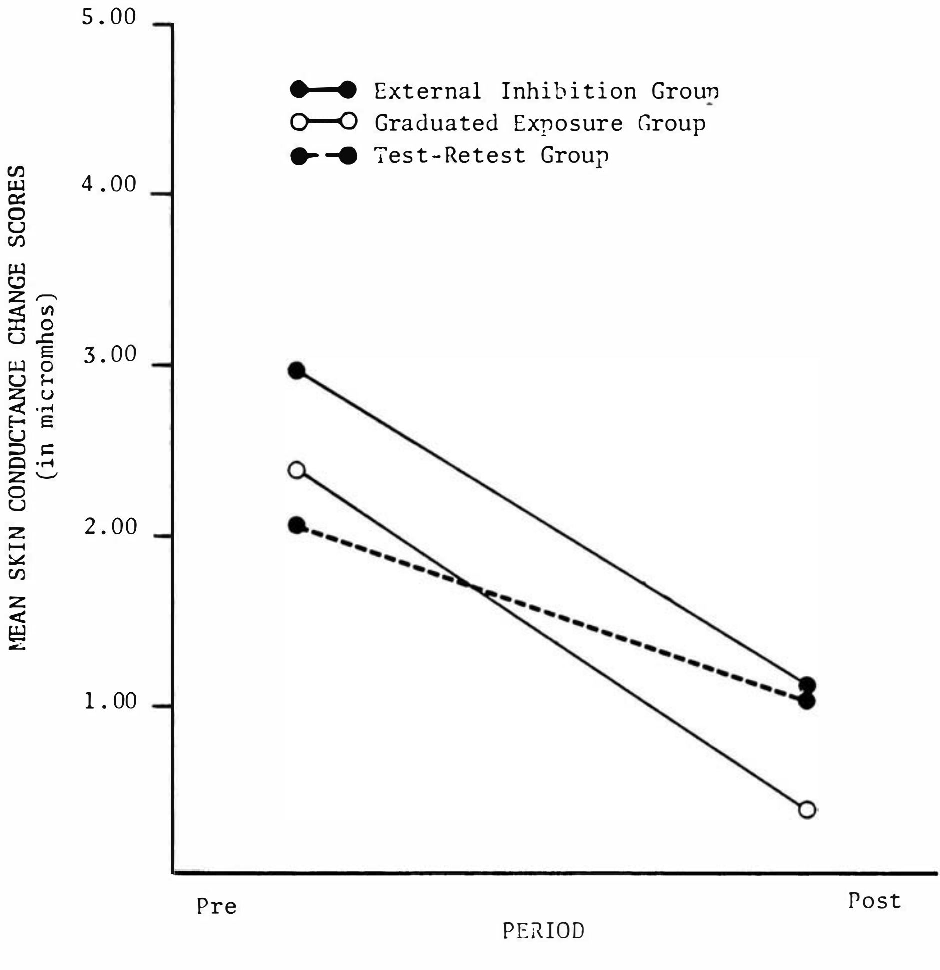

Figure 8. Pretreatment and posttreatment skin conductance change scores for the external inhibition, graduated exposure, and test-retest groups with the spider at the point of closest pretreatment approach.

Table 13

Analysis of Variance for Skin Conductance
(Point of Closest Approach)

Source	df	SS	MS	F
Between	23	39.92		
Group	2	.89	.45	.24
Error	21	39.03	1.86	
Within	24	35.70		
Period	1	20.63	20.63	38.73**
Group x Period	2	3.88	1.94	3.64*
Error	21	11.19	.33	
Total	47	75.63		

*$p < .05$
**$p < .01$

Table 14

Duncan's Multiple Range Test for Skin Conductance
(Point of Closest Approach)
Group x Period

Grouping	Mean	N	Group x Period
A	2.97	8	Ext Inh x Pre
A,B	2.37	8	Grad Exp x Pre
B,C	2.09	8	Test-Retest x Pre
C,D	1.53	8	Test-Retest x Post
D	1.02	8	Ext Inh x Post
D	.95		Grad Exp x Post

Note. Means with the same grouping letter are not significantly different, alpha level = .05.

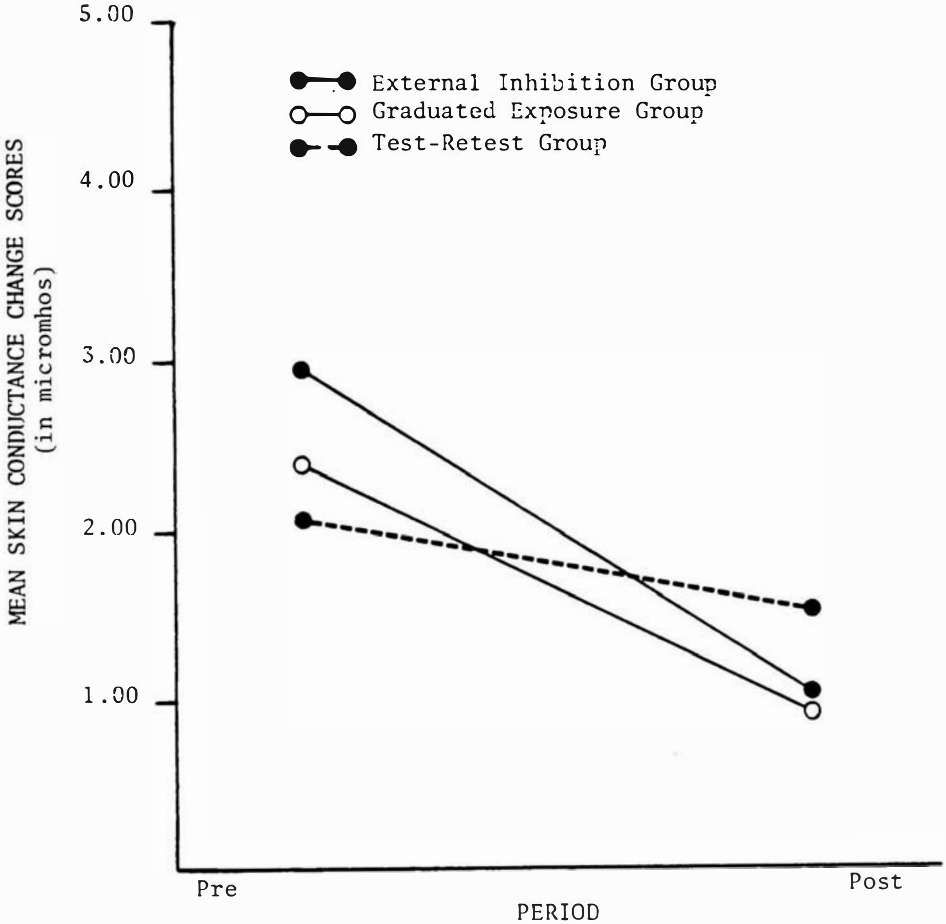

Figure 9. Pretreatment and posttreatment skin conductance change scores for external inhibition, graduated exposure, and test-retest groups with the spider at the point of closest approach.

Spider Questionnaire

Each subject was administered the Spider Questionnaire (SPQ) on two separate occasions. The first administration prior to participation in the experiment served as the basis for initial subject selection. The second administration of the SPQ occurred during the posttreatment assessment phase of the study and followed completion of the final behavioral avoidance task.

A repeated measures analysis of variance was conducted on the two sets of SPQ scores using a 2 x 3 ANOVA on the Group x Period factors. No significant main effects or interaction effects were obtained on the SPQ as can be seen in Table 15.

Table 15

Analysis of Variance for Spider Questionnaire

Source	df	SS	MS	F
Between	23	336.00		
Group	2	2.62	1.31	.08
Error	21	333.38	15.87	
Within	24	177.00		
Period	1	27.00	27.00	3.81
Group x Period	2	1.12	.56	.08
Error	21	148.88	7.09	
Total	47	513.00		

*$p < .05$
**$p < .01$

Concordance of Dependent Variables

In order to examine the degree of concordance between the five dependent variables, Pearson Product-Moment Correlation coefficients were computed for each of the three experimental groups for both the pretreatment and posttreatment measures. Specific response measures used in determining concordance rates for both the pretreatment and posttreatment assessments included: (1) point of closest approach on the BAT; (2) SUDS ratings elicited by the spider at the point of closest approach; (3) total scores obtained on the SPQ for either the initial (for the pretreatment correlations) or second (for the post-treatment correlations) administration of the questionnaire; (4) heart rate change scores computed at the point of closest approach; and (5) skin conductance change scores computed at the point of closest approach.

The greatest concordance between dependent variables (with concordance being defined as correlations that are significant at the .05 level) was obtained for subjects in the External Inhibition group. This group yielded two significant correlations out of a possible 10 on the pretreatment measures, and one significant correlation on the posttreatment variables. Tables 16 and 17 illustrate the correlations obtained. While an identical number of significant correlations was obtained with Test-Retest subjects on the posttreatment dependent measures, this group yielded only one such correlation on the pre-treatment variables as shown in Tables 18 and 19.

No significant correlations between dependent variables were obtained for the Graduated Exposure group on either the pretreatment or posttreatment measures. The correlation matrices for the Graduated Exposure group are provided in Tables 20 and 21.

Table 16

Pearson Product Moment Correlations for External Inhibition Subjects on the Pretreatment Measures
N=8

	BAT	SPQ	SUDS	HR	SC
BAT	1.00				
SPQ	-.22	1.00			
SUDS	-.74*	.45	1.00		
HR	.03	.16	.49	1.00	
SC	.003	-.19	.42	-.80*	1.00

*$p < .05$

Table 17

Pearson Product Moment Correlations for External Inhibition Subjects in the Posttreatment Measures
N=8

	BAT	SPQ	SUDS	HR	SC
BAT	1.00				
SPQ	-.38	1.00			
SUDS	-.13	.22	1.00		
HR	.04	-.56	-.002	1.00	
SC	-.21	-.64	.08	.72*	1.00

*$p < .05$

Table 18

Pearson Product Moment Correlations for Test-Retest Subjects on the Pretreatment Measures
N=8

	BAT	SPQ	SUDS	HR	SC
BAT	1.00				
SPQ	-.40	1.00			
SUDS	-.22	.74*	1.00		
HR	.21	-.52	-.35	1.00	
SC	-.59	-.003	-.03	-.34	1.00

*$p < .05$

Table 19

Pearson Product-Moment Correlations for Test-Retest Subjects on the Posttreatment Measures
N=8

	BAT	SPQ	SUDS	HR	SC
BAT	1.00				
SPQ	.07	1.00			
SUDS	.12	.46	1.00		
HR	.22	.18	-.002	1.00	
SC	-.72*	.14	.19	-.36	1.00

*$p < .05$

Table 20

Pearson Product Moment Correlations for Graduated Exposure Subjects on the Pretreatment Measures
N=8

	BAT	SPQ	SUDS	HR	SC
BAT	1.00				
SPQ	.17	1.00			
SUDS	.08	.46	1.00		
HR	.12	-.16	.61	1.00	
SC	-.40	.15	.21	-.30	1.00

*$p < .05$

Table 21

Pearson Product Moment Correlations for Graduated Exposure Subjects on the Posttreatment Measures
N=8

	BAT	SPQ	SUDS	HR	SC
BAT	1.00				
SPQ	.43	1.00			
SUDS	.41	.55	1.00		
HR	.38	.32	.39	1.00	
SC	.24	.13	.50	.66	1.00

*$p < .05$

Treatment Trials

During the treatment phase of the experiment, subjects in the External Inhibition group were exposed to the spider and presented with the external stimulus noise each time they pressed the button to stop the advance of the spider. Graduated Exposure subjects were administered the same procedure without the presentation of the external stimulus. In both cases, this phase of the experiment continued until 15 trials had been completed (15 administrations of the external stimulus in the case of External Inhibitions subjects and 15 stops of the spider for Graduated Exposure subjects), or until the subject had allowed the spider to reach the endpoint of the track. This latter criterion resulted in some subjects receiving less than the maximum of 15 trials during the treatment phase.

An examination of the data for both groups revealed that only one subject in the External Inhibition group received less than 15 sound administrations, while a total of seven subjects in the Graduated Exposure group were able to bring the spider to the endpoint of the track prior to reaching the 15 trial criterion. A Chi Square Test was performed on the number of subjects in both groups who received the maximum of 15 trials during the treatment phase of the study to determine if this number was significantly different for the two experimental groups. As can be seen in Table 22, the number of subjects receiving a total of 15 trials was significantly greater for the External Inhibition group than for the Graduated Exposure group ($x^2 = 9.00$, df = 1, $p < .01$).

In order to determine if the total number of trials administered to the two groups during the treatment phase of the study also

Table 22

Chi Square Test of Significant Differences of the Number of Subjects Receiving the Maximum Number of Treatment Trials

	Group: External Inhibition	Group: Graduated Exposure	
Number of Subjects Receiving 15 Treatment Trials	7	1	8
Number of Subjects Receiving less than 15 Treatment Trials	1	7	8
Total	8	8	16

differed significantly, a t-test was performed on the mean trials received by the External Inhibition and Graduated Exposure subjects. This analysis was also highly significant ($t = 5.53$, $df = 14$, $p < .01$), indicating that External Inhibition subjects received a significantly greater number of trials during the treatment phase than subjects in the Graduated Exposure group.

Discussion

The present study represented an extension of previous research on the therapeutic applications of the external inhibition phenomenon, and sought to examine the effects of such a procedure on the verbal-cognitive, motoric, and physiological components of the anxiety response. To accomplish this, subjects were selected and treatment effects evaluated on the basis of changes elicited in each of the three response modalities by a specific fear stimulus. An attempt was made to demonstrate that use of an external inhibition procedure would produce significant reductions in anxiety across all three response channels, and that these reductions in anxiety would be significantly greater than those evidenced by subjects receiving procedures designed to control for expectancy effects and repeated exposure to the phobic stimulus. This section will be organized according to the five proposed hypotheses, followed by a discussion of the implications of the present investigation for the external inhibition phenomenon and analogue fear research.

Hypothesis I

Subjects who receive the external inhibition treatment would permit a significantly greater approach by the spider on the posttreatment than on the pretreatment assessment, and this improvement in approach behavior would be significantly greater than that exhibited by subjects in either the Graduated Exposure or Test-Retest control groups.

The results of the BAT data provided support for the first part of this hypothesis, in that subjects who received the external inhibition treatment displayed a significant improvement in approach behavior from the pretreatment to the posttreatment assessment. The results did not confirm, however, the assertion that these subjects would show significantly more improvement on the behavioral measure than subjects in the two untreated control groups. Indeed, the findings revealed that all three experimental groups exhibited similar, significant increases in approach behavior to the spider over the two assessment periods. The failure to obtain significant differential group effects for subjects receiving the external inhibition treatment is inconsistent with the findings previously reported by Kleinman (1979) and Spiro (1981). Both of these investigators found that subjects treated with an external inhibition procedure showed significantly greater improvement in approach behavior than subjects who received a control procedure similar to that administered to Graduated Exposure subjects in the current study. The present results are also contradictory to the findings of Wilkins and Domitor (1973) who demonstrated the relative efficacy of their external inhibition-like procedure in modifying phobic avoidance behavior.

The BAT was utilized in the current investigation as a means of further screening subjects who had reported a high fear of spiders on the Spider Questionnaire, as well as evaluating the effects of the treatment intervention on avoidance behavior. While similar in this regard, the particular BAT procedure that was used differed in several important respects from the BATs employed in previous studies on external inhibition, differences which may have contributed, at least in part, to the discrepancies in the behavioral data. The most apparent difference lies in the use of a passive, rather than an active, avoidance procedure in which the phobic stimulus was moved progressively closer to the subject by mechanical means in order to permit the accurate recording of physiological activity. This procedure represents a rather dramatic deviation from the more traditional walk-up avoidance tasks used by both Kleinman (1979) and Spiro (1981). Apart from the requirement that the subject remain stationary for purposes of physiological recording, the use of a passive avoidance procedure was predicated on previous research indicating that passive and active BATs yield comparable measures of avoidance behavior (Borkovec & Craighead, 1971). While it is impossible to determine how the current subjects' performance may have differed with the use of a walk-up BAT task, comparisons can be made between the behavioral data obtained through the passive BAT and that reported in previous studies on external inhibition. In the present work, the passive avoidance test yielded mean pretreatment approach scores which ranged from 45.25 to 53 inches for the three experimental groups. These numbers appear comparable to the pretreatment BAT scores reported by Kleinman (1979) which averaged just over 60 inches for each of his three experimental conditions, and to Spiro's (1981) reported range of 36 to 60 inches for her four treatment groups. As will be discussed below, a subject's performance on any BAT task can be influenced by a large number of variables that are completely unrelated to anxiety, a fact that makes comparisons of behavioral measures across different studies somewhat tenuous at best. It would appear, however, that, at least in terms of these previous investigations, the avoidance behavior exhibited on the passive BAT procedure was roughly equivalent to that displayed when the more traditional walk-up avoidance task is used. Moreover, these comparisons indicate that subjects in all three investigations were similar in terms of their willingness to initially approach the different phobic stimuli utilized in these studies.

A more important distinction than the passive versus active dimension pertains to the extent of approach behavior that was possible on the passive BAT as compared to that in prior research on external inhibitors. In the current experiment, the physical constraints of the BAT apparatus and the requirement that subjects remain as still as possible for physiological recording purposes meant that the phobic stimulus could be brought no closer to the subject than the end of the BAT track, a point at which the spider was still several inches from actual contact with the subject. In contrast, the BAT procedures used by Kleinman (1979) and Spiro (1981) included additional steps which allowed subjects to potentially come into closer physical proximity with, and actually touch, the phobic stimulus. As the contact-noncontact dimension has been demonstrated to be the index of avoidance that is most resistent to test-retest change (Levis, 1969), the absence of any opportunity for subjects to come closer to or actually touch the spider likely represents a rather serious methodological flaw. While the precise effects of this procedural variation can only be speculative, it seems reasonable to suggest that subjects may have perceived relatively little threat in the situation since they were aware that the spider could be brought no closer than the endpoint of the BAT track and that no physical contact would be required. Indeed, a great many subjects sought to confirm this verbally prior to the initial BAT assessment. Under these conditions, the avoidance behavior exhibited during the pretreatment assessment may have been largely a function of the novelty and relative uncertainty of the situation, while the post-treatment performances were influenced in the direction of greater approach by the perceived lack of any real threat in the situation. This effect was likely heightened even further by the obviously secure nature of the spider in its container, as well as by the fact that the spider typically exhibited little or no movement during the assessment procedure. This is in contrast to the usually active behavior exhibited by Kleinman's (1979) cockroaches and Spiro's (1981) snake (Spiro, 1983). While movement of the phobic stimulus is often regarded as an undesirable artifact (e.g., Kleinman, 1979) and has led some researchers to use dead specimens as phobic objects (Marcia et al., 1969), the absence of realistic, albeit unpredictable, behavior in the feared stimulus increases dramatically the artificiality of the analogue assessment situation (Bernstein, 1973; Feisk & Rosenthal, 1973). In the present study, for example, many subjects expressed their belief during an informal interview following the experiment that the spider was "not real" or was "dead," and a large number attributed their post-treatment increases in approach behavior to this belief.

Of particular relevance to the present findings, Bernstein (1973) has noted that the BAT procedures used in analogue fear research are extremely susceptible to a wide variety of situational and contextual features in the experimental setting. By situational and contextual features he is referring to any nonspecific, extra-treatment variables which may, in themselves, influence a subject's behavior in the direction of either increased or decreased anxiety within the analogue assessment situation. For example, a large number of studies have repeatedly demonstrated that the often implicit demand characteristics associated with BAT procedures can significantly affect subjects' behavioral performance. This includes both the implicit demand that one should exhibit fearful behavior when exposed to a phobic stimulus or feared situation, and show a reduction in the behavioral manifestations of anxiety following a presumably effective treatment intervention (Efran, Ascher, Webb, & Moore, 1977; Oliveau, Agras, Leitenberg, Moore, & Wright, 1969; Orne, 1962). More generally, Lick and Edward (1969) have pointed out that a subject's behavior in a "safe and controlled" laboratory environment may be based on precisely those factors, e.g., recognition that the subject can avoid going closer to the phobic stimulus, or the impression conveyed by the experimenter and the general context that everything is under control and that nothing dangerous or unpredictable is going to happen. While such factors may severely limit the external validity of behavioral measures and thereby preclude the generalization of any observed effects, the confounding influence of these nonspecific variables also pose a very serious threat to the internal validity of behavioral assessment procedures used in analogue fear research (Bernstein, 1973; Borkovec et al., 1977).

In the present work, several procedural and instructional variations were adapted in an attempt to minimize the potentially contaminating effects of situational and contextual factors on subjects' avoidance behavior. First, since previous research has demonstrated that a subject's anxiety in the analogue situation is often based on the perceived expectation that such behavior be displayed (e.g., Bernstein, 1973; Gilmore, 1981), subjects remained uninformed throughout the experiment that they had been selected on the basis of their self-reported fear of spiders on the Spider Questionnaire. Thus, rather than presenting the situation as one in which their fear of spiders would be assessed and treated, subjects were simply informed that the purpose of the study was to investigate their responses to "certain kinds of objects and ways of modifying these responses." In this manner, it was expected that whatever behavior was exhibited during the session would be more a function of the subject's actual anxiety level than of any implicit demand for displaying fearful behavior (c.f. Bernstein, 1973). Secondly, the demands placed upon subjects to exhibit fearless behavior on the pretreatment, as well as the posttreatment, BAT were judged to be slightly greater than in previous studies on external inhibition. Although similar to both Kleinman (1979) and Spiro (1981) in that subjects were told to stop the advance of the spider when they began to "feel the slightest bit anxious or uncomfortable," they were also instructed to "let the spider come as close as possible" to the endpoint of the BAT track. While not as stringent as some investigators have recommended (e.g., Bernstein, 1973; Borkovec et al., 1977), these instructions were thought to represent a reasonable compromise between a very high and a very low level of demand that would exclude mildly fearful subjects, while at the same time permit the inclusion of a sufficient number of subjects to fill each of the experimental groups. Third, the posttreatment instructions given to all three groups were identical and included no explicit suggestions for improved performance for subjects who had received an intervening treatment procedure (i.e., the External Inhibition and Graduated Exposure groups). In this manner, it was believed that any demands for increased approach behavior on the posttreatment assessment would be equivalent for each of the experimental conditions.

Recognizing the impossibility of eliminating all sources of bias in analogue assessments, Bernstein (1973) has recommended that the effects of nonspecific variables on behavioral performance be assessed by including an additional control group in the experimental design. Subjects in this condition would receive the usual pretreatment behavioral assessment, then no treatment, and then a second assessment that contains as much demand for fearlessness as the tests that follow active treatment. The magnitude of change exhibited by this group can then be used to estimate the degree to which improvement in the treated groups is attributable to situational and contextual factors in the experimental setting. While included primarily as a means of assessing and controlling for expectancy and extinction effects, the Test-Retest group in the present study is comparable to the control condition described by Bernstein (1973), and thus permits a fairly accurate evaluation of the effects of nonspecific experimental variables on the behavioral measure. The improved approach behavior exhibited by these subjects on the posttreatment assessment was both dramatic and significant, and was similar to the reductions displayed by the External Inhibition and Graduated Exposure groups. The degree of improvement shown by the Test-Retest group would indicate, therefore, that factors other than those predicted to produce reduced avoidance (i.e., the external inhibition procedure) were likely responsible in large part for the improvement shown by all three groups on the posttreatment behavioral measure. Although impossible to specify with any degree of certainty, these factors likely included the aforementioned stimulus characteristics of the spider and the procedural components of the BAT, both of which likely combined to create a highly artificial and relatively benign analogue situation. Additional factors may have included subjects' increased familiarity with the situation as the session progressed and possible implicit demands for increased approach behavior on the posttreatment assessment. Regardless of the specific factors responsible, these findings strongly imply that the behavior exhibited by subjects in the External Inhibition treatment group was less reflective of the effects of this particular procedure than of nonspecific extra-treatment variables within the experimental setting. Moreover, as will be discussed in more detail in a later section, the significant and rapid improvement in approach behavior that was attained through simple repeated exposure to the spider also casts serious doubt on the actual fearfulness of the analogue population used in the present study.

Hypothesis II

Subjects receiving the external inhibition treatment would exhibit a significant reduction in self-reported fear of the spider from the pretreatment to the posttreatment assessment, and this reduction would be significantly greater than that shown by subjects in either the Graduated Exposure or Test-Retest control groups.

The analysis of the SUDS data provided partial support for Hypothesis II, in that subjects who received the external inhibition treatment reported significantly lower mean subjective distress ratings following treatment than during the pretreatment assessment. This decline in distress ratings was evidenced at all three points assessed on the BAT, i.e., with the spider at the constant 10-foot distance, at the point of closest pretreatment approach, and at the point of closest approach on the posttreatment assessment. As with the behavioral data, however, the results did not support the prediction that the reduction in distress ratings by the External Inhibition group would be significantly greater than that exhibited by the two control conditions. All three experimental groups showed similar significant reductions in the SUDS ratings elicited by the spider at each of the three assessment points on the posttreatment BAT. While contradictory to previous reports indicating the relative efficacy of external inhibition procedures in modifying self-reported anxiety (Kleinman, 1979; Wilkins & Domitar, 1973), these findings are consistent with Spiro's (1981) failure to achieve differential group effects on a SUDS rating scale.

In this latter study, Spiro (1981) attributed the finding of similar reductions in self-reported anxiety across her four treatment groups to a "potent placebo effect," which was conceptualized as consisting of "all the nonspecific therapeutic effects which lead to increased client acceptance of the treatment based on the client's belief in treatment efficacy" (p. 63). This interpretation was invoked on the basis that all of the experimental conditions had received some type of credible "treatment" procedure, each of which included a rationale for anxiety reduction that was apparently accepted as valid by a majority of the participants (c.f. Borkovec & Nau, 1972). In the current study, a comparison of changes in the distress ratings reported by subjects in the External Inhibition and Graduated Exposure groups would lead to a similar conclusion regarding the operation of placebo effects, since both conditions received a treatment-oriented rationale for their respective procedures. Such an explanation is contraindicated, however, by the finding that subjects in the Test-Retest condition exhibited similar significant reductions in the SUDS ratings evoked by the spider during the posttreatment BAT assessment. These reductions occurred even though this group received no intervening procedure that might have induced a "placebo effect" capable of producing such marked changes in self-reported anxiety.

These findings, as with those obtained on the behavioral measure, provide evidence of significant and relatively rapid reductions in anxiety following simple exposure to the phobic stimulus, and indicate that these reductions were not limited only to avoidance behavior, but included self-reported anxiety to the spider as well. The rapid attenuation of anxiety in the self-report channel offers additional support for the notion that a combination of nonspecific situational factors and subject characteristics may have been the predominant influence on subjects' responses to the spider within the present analogue assessment situation.

Hypothesis III

Subjects in the External Inhibition treatment group would show a significant reduction in heart rate during the posttreatment BAT as compared to that exhibited during the pretreatment assessment. This reduction in heart rate for subjects in the External Inhibition group would be significantly greater than that exhibited by subjects in either the Graduated Exposure or Test-Retest control groups.

Although somewhat less consistent, the results of the heart rate data generally supported the first part of Hypothesis III pertaining to the effects of the external inhibition procedure on heart rate responding. External Inhibition subjects exhibited a significant decline in heart rate activity from the pretreatment to the posttreatment assessment for those responses elicited at the constant 10-foot distance and at the point of closest approach. This group showed no significant reductions, however, in the heart rate activity elicited on the post-treatment assessment when the spider was presented at the point of closest pretreatment approach. The identical, and similarly significant, pattern was obtained for the Graduated Exposure and Test-Retest control groups, offering no support for the prediction that External Inhibition subjects would display significantly greater reductions in heart rate activity than the untreated control conditions.

At first glance, these findings would appear to provide clear, negative implications regarding the relative efficacy of the external inhibition procedure in modifying physiological responding. In view of the discussion thus far, however, it seems reasonable to suggest that heart rate responding may have been influenced by many of the same non-specific extra-treatment variables that apparently affected the behavioral and self-report measures of anxiety. While it is generally conceded that voluntary distortion of bodily responses is not as readily apparent in the physiological response mode as in the self-report and behavioral channels (Kallman, 1975; Kallman & Feurstein, 1977), physiological measures may, under some conditions, be highly susceptible to influence by a variety of experimental factors other than anxiety, particularly among mildly fearful analogue populations (Gilmore, 1981; Lazarus & Opton, 1966; Paul & Bernstein, 1973; Schachter, 1966). In a study reported by Odom and Nelson (1977), for example, snake fearful subjects who received high-demand instructions for increased heart rate exhibited significantly greater heart rate responses during a BAT procedure than subjects given low-demand instructions. Other studies, by contrast, have failed to demonstrate such an effect when the subject was unaware of the particular response system being assessed or when the high demand instructions were specific to increased approach behavior alone (Bergman & Johnson, 1972; Miller & Bernstein, 1972; Smith, Diener, & Beaman, 1974). This suggests that when heart rate is designated, implicitly or explicitly, as a response mode of interest, heart rate responding may be as susceptible to the same confounding effects of situational and instructional factors as responses within the behavioral and self-report channels. In the current study, subjects were made fully aware prior to their participation in the experiment that recordings of physiological activity would be involved, and were provided with rather specific information regarding the interest in and nature of the particular systems being monitored (i.e., heart rate and sweat gland activity). Under these conditions, it is possible that heart rate activity could have been influenced in the direction of decreased responsivity by subtle and implicit demands for anxiety reduction on the posttreatment assessment.

A second factor which likely contributed to the present findings for the heart rate measure is the process of simple habituation, which refers to a decrease in a physiological response with repeated stimulus presentations. As Kallman and Feurstein (1977) have pointed out, any organism will orient both behaviorally and physiologically to the initial presentation of a novel stimulus or situation. The orienting response, however, usually habituates rather quickly upon repeated stimulus exposure, while the responses evoked by relevant, anxiety-producing stimuli typically habituate at a much slower rate (Mangelsdorf & Zuckerman, 1975). For this reason, it is important to assess physiological reactivity over several trials or sessions in order to insure that an organism's response does not merely reflect the novelty of the situation or stimulus (Kallman, 1975). Applying this notion to analogue fear research, Borkovec et al. (1974) have indicated that use of an analogue fear situation is inappropriate if pre- and posttest exposure to the phobic stimulus results "in such rapid habituation of physiological arousal that the effect of therapeutic procedures is unassessable" (p. 504). Such an habituation effect occurred in the present study, with the significant reductions in heart rate responding by the Test-Retest group precluding any meaningful comparisons with regard to the potential therapeutic effects of the external inhibition treatment procedure. In addition, the rapid habituation of heart rate activity with repeated stimulus exposure implies that the physiological responsivity exhibited by all three groups during the initial pretreatment assessment may have been due primarily to the novelty and uncertainty associated with the specific situation and stimulus. This is consistent with the suggestion made earlier regarding the factors that likely contributed to the high degree of behavioral avoidance displayed during the pretreatment BAT. In this regard, Borkovec et al. (1977) have observed that a lack of perceived stimulus and response clarity is a defining property of anxiety assessment situations, even with seemingly straightforward procedures such as the BAT. As noted by these authors: "the exact nature of the threat in stress situations will often be vague and ambiguous, and the responses necessary for an appropriate and efficient transaction with the stressors are correspondingly unclear. This ambiguity not only intensifies the threat, but it is also likely to produce a diffuse and fluctuating pattern of physiological responding because of the perceived wide range of possible threat components and useful coping responses" (p. 413). In the present case, there was probably a very high degree of ambiguity, and therefore threat, associated with the initial BAT assessment since subjects had neither seen the spider nor had the opportunity to successfully operate the BAT apparatus. On the posttreatment assessment, however, subjects had not only interacted with both the spider and BAT apparatus with no untoward consequences, but were also explicitly told that the procedures would be identical. Under these circumstances, the ambiguity and associated threat were removed, resulting in less diffuse physiological activity and a corresponding decrease in heart rate responding.

These considerations may also account for the failure of all three groups to show any significant declines in heart rate activity on the posttreatment assessment when the spider was presented at the point of closest pretreatment approach. On this final BAT task, subjects were told that a "slightly different procedure" would be used and that they would no longer have any control over the movement of the spider. Although they were informed that the spider would be brought no closer than it had on previous trials, the announcement of a new procedure and the perceived loss of control likely reintroduced a high degree of ambiguity and threat into the situation that was sufficient to elevate heart rate responding to the level attained during the initial, pre-treatment exposure.

Hypothesis IV

Subjects in the External Inhibition treatment group would exhibit a significant reduction in skin conductance during the posttreatment BAT as compared to that shown during the pretreatment assessment. This reduction in skin conductance for subjects in the External Inhibition group would be significantly greater than that exhibited by subjects in either the Graduated Exposure or Test-Retest control groups.

The results of the skin conductance data partially supported Hypothesis IV. Subjects who received the external inhibition treatment displayed significant reductions in skin conductance activity at all three assessment points on the posttreatment BAT, i.e., the constant 10-foot distance, the point of closest approach, and the point of closest approach on the pretreatment BAT. The findings once again failed to support the prediction that External Inhibition subjects would show more improvement on the skin conductance measure than the two control conditions. With only a single exception, all three experimental groups displayed similar significant reductions in skin conductance activity from the pretreatment to the posttreatment assessment. The one exception was the nonsignificant decline in skin conductance activity exhibited by Test-Retest subjects at the point of closest approach on the posttreatment BAT.

These findings are fairly consistent with the results of the heart rate data, and provide further evidence of relatively rapid habituation of physiological reactivity over repeated exposures to the phobic stimulus. As noted previously, this rapid habituation of autonomic responding implies that the initially high levels of physiological responsivity were primarily a function of the novelty and ambiguity associated with the specific situation and stimulus. Moreover, the habituation of physiological reactivity with repeated stimulus exposure prevents the comparisons that are necessary for an adequate evaluation of treatment effects (c.f. Borkovec _et al_., 1974).

The most apparent discrepancy between the skin conductance and heart rate data lies in the failure of the Test-Retest group to exhibit any significant change from the skin conductance activity displayed at the point of closest approach on the pretreatment assessment to that elicited at the point of closest approach on the BAT. This finding must be interpreted cautiously in light of the evidence presented thus far indicating a dramatic decline in overall anxiety for all three groups over the two assessment periods. It does represent, however, the single instance where relevant comparisons can be made as to the possible relative effects of the external inhibition procedure on physiological activity. In this case, subjects in the External Inhibition group showed significantly greater reduction in skin conductance activity from the pretreatment to the posttreatment assessment than subjects who simply received repeated exposure to the phobic stimulus. Subjects in the Graduated Exposure condition, however, also displayed significant reductions in skin conductance activity over the two assessment periods and, in this respect, did not differ significantly from the External Inhibition treatment group. Thus, while indicating that external inhibition was more effective than repeated stimulus exposure in reducing the skin conductance activity elicited by the spider at its point of closest approach, these findings do not rule out the possibility that these reductions were simply the result of placebo or expectancy effects (Cooke, 1968; Mahoney, 1978; Wilkins, 1971, 1973).

Considered together, the results of the physiological data point to a rather rapid habituation in the anxiety response from the pretreatment to the posttreatment assessment for each of the three experimental groups. As with the behavioral and self-report measures, these findings strongly suggest that a combination of situational features and subject characteristics may have been the primary determining factors of the responses elicited to the spider in all three response modalities.

Hypothesis V

Subjects who receive the external inhibition treatment would show a significant reduction in scores obtained on the posttreatment administration of the Spider Questionnaire as compared to scores obtained on the initial administration of the questionnaire. This reduction in scores by the External Inhibition group would be significantly greater than that shown by subjects in either the Graduated Exposure or Test-Retest control groups.

The results of the SPQ data failed to provide any support for Hypothesis V. None of the three experimental groups, including the External Inhibition group, showed significant reductions in their total scores on the SPQ from the initial administration of the questionnaire prior to their participation in the study to the second administration following completion of the experiment.

In selecting the SPQ as a measure of self-reported fear of spiders, it was expected that this instrument would provide a more thorough and precise assessment of the verbal-cognitive component of spider-related anxiety than use of a single, intensity-based fear rating (e.g., Fear Survey Schedule; Wolpe & Lang, 1964). In terms of screening potential high-fear subjects, the SPQ proved to be relatively satisfactory since only 12 of the 53 subjects (23%) who were invited to participate on the basis of their SPQ scores failed to exhibit the requisite degree of behavioral avoidance. This percentage is considerably better than, for example, that reported by Spiro (1981) who had nearly 50 percent of her subjects be disqualified on a BAT task after indicating "much" or "very much" fear of snakes on a modified version of the Fear Survey Schedule. Thus, in terms of discriminating fearful from nonfearful subjects, the SPQ would seem to be a fairly valid instrument (c.f. Hastings, 1971). Its use appears to have been somewhat more problematic, however, for assessing changes in self-reported anxiety over repeated administrations of the questionnaire. Despite the fact that all three groups displayed clear evidence of anxiety reduction in each of the response channels during the experimental session, the SPQ failed to reflect these reductions on the posttreatment administration of the questionnaire.

The most probable explanation for this discrepancy lies in the specific construction of the questionnaire itself. Designed to assess a rather generalized fear of spider stimuli, the questionnaire is very high in content validity (Lemke & Wiersma, 1976) in that test items sample the respondent's fear in relation to a large number of spider-related situations (e.g., "If I came upon a spider while cleaning the attic I would probably run," "I dislike looking at pictures of spiders in a magazine"). The total number of such items endorsed likely provides a reasonably good index of how generalized a person's fear of spiders is, and thereby indirectly suggests the severity or intensity of the fear. Considering the highly specific nature of many of these items, however, they may have had very little relevance to the contrived and similarly specific analogue fear situation in the present experiment. In this regard, Lick and Sushinsky (1975) have observed that subjects' self-reported anxiety on rating scales and questionnaire measures is most predictive of their actual behavior when the self-report questions accurately describe the real situations in which the behavior is to be assessed. In the current case, subjects' scores on the SPQ reflected self-reported anxiety toward certain types of spiders in specific kinds of situations, neither of which was likely represented adequately in the analogue situation where this anxiety was assessed. Moreover, as suggested earlier, it is highly likely that subjects responding within the analogue situation was determined primarily by specific situational and contextual features of the experimental setting itself. Under these conditions, it is not at all surprising that SPQ scores were found to be unrelated to the responses exhibited during the analogue assessment, and similarly failed to detect the changes in these responses over the two assessment periods. Indeed, the only significant correlation obtained for the questionnaire measure was with the SUDS ratings elicited by the Test-Retest group on the pretreatment assessment. The SPQ showed no significant correlations with the behavioral or physiological measures on either the pretreatment or posttreatment BAT assessment.

In view of these considerations, it seems most likely that the nonsignificant findings for the SPQ are attributable to a combination of the highly specific nature of the test items themselves, and the restriction of any reductions in anxiety to the particular analogue situation employed in the present experiment.

Implications-External Inhibition

The results of the present study failed to provide any evidence of the relative efficacy of external inhibition in modifying phobic behavior. These findings are contrary to previous clinical case studies and group outcome studies which have offered suggestive support for the use of such a procedure in the treatment of anxiety-related disorders.

It was predicted, on the basis of this previous research, that use of an external inhibition treatment procedure would result in significantly greater reductions in anxiety across all three response channels than procedures which controlled for repeated exposure to the phobic stimulus and expectancy and placebo effects. In all cases, however, the external inhibition procedure was found to be either ineffective or no more effective than the two control procedures in modifying the various components of the anxiety response.

Interestingly, the external inhibition and graduated exposure procedures did yield rather disparate results within the treatment phase of the experimental session. During this phase, subjects in the External Inhibition group were presented with the external stimulus noise each time they stopped the advance of the spider, while Graduated Exposure subjects received the identical procedure but were instead instructed to "relax" themselves each time they pressed the button to stop the spider. In both cases, this phase of the experiment was continued until 15 trials had been completed (15 administrations of the external stimulus in the case of External Inhibition subjects and 15 stops of the spider for Graduated Exposure subjects), or until the subject had allowed the spider to reach the endpoint of the BAT track. The two groups were found to be significantly different in terms of the number of subjects in each group who permitted the spider to reach the endpoint of the track prior to completing the 15 treatment trials. Seven out of the eight subjects in the Graduated Exposure group were able to bring the spider to the end of the BAT track before all 15 trials had been completed, as opposed to only one subject in the External Inhibition group. These differences in performance resulted in the External

Inhibition subjects receiving significantly more treatment trials ($\overline{X}$ = 14.88) than subjects in the Graduated Exposure condition ($\overline{X}$ = 7.25). Thus, even though they received only half as many treatment trials with a supposedly inert procedure, nearly every subject in the Graduated Exposure group permitted the spider to move to the point of closest possible approach during the treatment phase of the experiment. This contrasts to the one External Inhibition subject who completed the treatment phase prematurely, but who still required a total of 14 treatment trials before allowing the spider to reach the endpoint of the BAT track. The seemingly greater effectiveness of the graduated exposure procedure in reducing avoidance behavior within the treatment session was unexpected and is somewhat difficult to explain. Despite their use of comparable groups and the same 15 trial criterion, neither Kleinman (1979) nor Spiro (1981) found such differential effects during the treatment phase of their studies and administered all 15 treatment trials to subjects in each experimental group. In these previous investigations, however, the BAT procedure used during treatment involved moving the phobic stimulus in discrete 1-foot intervals and included additional steps that allowed for potential subject contact with the feared object. The BAT format used during the treatment phase of the present study involved neither discrete behavioral steps nor the opportunity for the subject to actually come into physical contact with the spider. The absence of predetermined stopping points for the spider, together with the lack of any possibility for physical contact may have substantially increased the likelihood that all subjects would reach the termination point on the BAT prior to completing all 15 treatment trials. These factors do not account, however, for the finding of large group differences between the External Inhibition and Graduated Exposure conditions in terms of the number of subjects who completed the treatment phase of the experiment prematurely.

Although the reasons underlying these differences are unclear, it may be that the white noise stimulus presented to subjects in the External Inhibition group produced an actual increase in their overall level of arousal during exposure to the phobic stimulus. This increased arousal, in turn, could have interfered with the habituation of the anxiety response and maintained their avoidance behavior during the relatively brief treatment session (c.f. Goethe, 1980; Kallman & Isaacs, 1977; Sckneirla, 1959). While Spiro (1981) also employed white noise as the external inhibiting stimulus, such an effect would not have been as apparent in her study since all subjects were less likely to reach the termination point on the behavioral task used during treatment. This suggestion can only remain speculative since no attempt was made to analyze the levels of physiological arousal exhibited throughout the treatment period. It does imply, however, that white noise may not be the stimulus of choice within the external inhibition paradigm. Whatever the reason, it is clear that these differential treatment effects were short-lived, as both groups displayed similar significant reductions in anxiety in all three response modalities on the posttreatment assessment measures.

While the findings of the current investigation would seem to seriously question the clinical efficacy of external inhibition in the treatment of anxiety, the results are subject to two important considerations which cast doubt on the internal validity of the study itself. First, the Test-Retest control condition was included to provide a comparison group against which to evaluate treatment effects and the possible contribution of placebo and expectancy factors. It had been assumed, albeit implicitly, that the brief, repeated exposure to the phobic stimulus would produce very little, if any, change in the anxiety exhibited by these subjects, leaving the comparison of interest between the External Inhibition and Graduated Exposure groups. Clearly, the consistently significant results obtained for the Test-Retest condition did not fulfill this expectation and, instead, indicated that the multiple responses used to define anxiety were extremely easy to modify through only brief exposure to the spider, with the addition of an intervening treatment being of relatively little consequence. The finding that repeated avoidance tests can produce change in the positive direction has some precedence in the literature (Rachman, 1966; Lang & Lazovil, 1963), and, in many instances, prolonged, extensive exposure to the phobic object can itself be therapeutic (Cooke, 1966; Bandura, Grusec, & Menlove, 1967; Garfield, Darwin, Singer, & McBruitz, 1967; Marks, 1978; Ritter, 1968). In the present case, however, the exposure received by subjects in the Test-Retest group was neither prolonged nor extensive, and was therefore of doubtful efficacy in terms of producing an actual therapeutic effect. In fact, the relatively brief exposure given these subjects during the initial assessment has, in some instances, been found to be associated with an increase, rather than a decrease, in fear behavior (Miller & Levis, 1971; Stone & Borkovec, 1975). It seems more likely, therefore, that a combination of situational, instructional, and procedural variables may have been the primary influence in producing the rather large reduction in anxiety exhibited by the Test-Retest condition, and was likely the overriding determinant in the reductions shown by the other two experimental groups as well. While impossible to specify with any degree of certainty, these nonspecific variables may have included: (1) a novelty effect on the pretreatment assessment, (2) subtle and implicit demands for a reduction in anxiety on the posttreatment BAT, (3) contextual cues relating the safety and benign nature of the situation, and (4) the physical characteristics of the spider and test apparatus. Whatever their exact source, it is apparent that these uncontrolled and unpredicted effects exerted a large impact on the response systems being assessed and, in so doing, virtually precluded the valid evaluation of the potential therapeutic effects of the external inhibition procedure.

The second, related consideration regarding the results obtained in the current study pertain to the analogue subjects which comprised the three experimental groups. As noted previously, a principal objection that is frequently raised regarding analogue fear research is the use of subjects drawn from an undergraduate population who may not be truly phobic, in the sense that they exhibit clinically relevant increases in anxiety in all three response modalities as a result of the presentation of the presumed phobic stimulus (e.g., Bernstein, 1973; Bernstein & Paul, 1971). Recognizing the limitations associated with using an analogue population, an attempt was made in the present work to select only highly fearful subjects on the basis of their responsivity to the spider in the verbal-cognitive, motoric, and physiological response channels. While this method of subject selection represented a much more stringent procedure than is usually employed in analogue research, there is evidence which suggests that the present sample was not "truly phobic" and, instead, was probably only mildly fearful at best. In his extensive review of the behavioral assessment of anxiety, Bernstein (1973) cites evidence indicating that truly phobic subjects likely comprise less than five percent of an undergraduate population if rigorous selection criteria are used. Lang (1968) has similarly reported that when subjects are carefully screened through questionnaires, avoidance tests, and interviews, only about one or two percent of an undergraduate population will qualify as phobics. The more usual case in which much less stringent selection procedures are used typically results in defining a considerably larger percentage of subjects as "phobic." Robinson and Suinn (1969), for example, classified nearly 70 percent of their screened subjects as phobic on the basis of a questionnaire measure alone. Even the addition of an avoidance test to a verbal report measure may still lead to the selection of as much as 18 to 22 percent of the originally contacted population (Bernstein, 1973). In the current investigation, only eight percent of the subjects who were initially administered the questionnaire measure were accepted as being sufficiently fearful in terms of their responding in each of the three response channels. By comparison, this percentage would seem to be fairly respectable and conservative, and implies the selection of a relatively large number of "truly phobic" subjects. The examination of correlations among the pretreatment measures, however, provides evidence to the contrary, and indicates that the objective of selecting subjects who were characterized by a coincidence of activity in all three response modalities was not realized. Specifically, the External Inhibition group showed only two significant correlations out of a possible 10, while one out of 10 was obtained for the Test-Retest subjects. The Graduated Exposure condition yielded no significant correlations among the pretreatment measures. Although consistent with previous research reporting a lack of concordance between the various response systems in anxiety (e.g., Borkovec et al., 1974; Martin, 1961), the dearth of significant correlations indicates that subjects in the present investigation were not characterized by an especially high level of emotional arousal during their initial exposure to the phobic stimulus. As Hodgson and Rachman (1974) have noted, "concordance between response systems is likely to be high during strong emotional arousal, (while) discordance will be more evident when emotional responses are relatively mild" (p. 319). Thus, it seems quite likely that, despite attempts to use a more rigorous selection procedure, the subjects comprising the three experimental groups were only mildly fearful and were not, as had been hoped, representative of phobic clients in the clinical setting.

The apparently mild fear characterizing these subjects may also account, in large part, for the seemingly potent effects of nonspecific experimental factors in reducing the anxiety response. As Borkovec _et al_. (1973) have pointed out, extra-treatment variables such as those mentioned above have a much "greater effect on low fearful subjects than on high fearful subjects _within_ the analogue phobic population" (p. 495). Since the current subjects were probably only mildly fearful, they were especially susceptible to the confounding effects of these nonspecific extra-treatment variables, and were consequently able to exhibit significant reductions in anxiety across repeated testings even with no explicit attempt being made to modify their responding.

Considered together, these findings suggest that the present experiment was of doubtful validity, both in terms of assessing the presence of, and changes in, the anxiety response, and adequately evaluating potential treatment effects. The selection procedures that were used failed to screen out a large number of mildly fearful subjects, and the inclusion of these subjects served to greatly intensify the confounding effects of nonspecific extra-treatment variables on the responses being measured. These effects, in turn, precluded any meaningful comparisons between the experimental groups in terms of differential treatment effects. The use of mildly fearful subjects in a mildly fearful analogue setting would indicate that the obtained results do not represent an adequate or valid test of the hypotheses under investigation concerning the relative efficacy of the external inhibition treatment. The effectiveness, or ineffectiveness of this procedure in the treatment of anxiety-related disorders remains, therefore, an empirical question subject to future experimental investigation.

Implications-Analogue Fear Research

Analogue fear research of the type represented in the current investigation has been severely criticized from a number of quarters, primarily on the basis that these studies often bear little resemblence to the clinical situation in terms of the population, problems, and procedures employed (Cooper, Furst, & Bridger, 1969; Marks, 1978). This lack of similarity is viewed as a serious deficiency since it may severely limit the extent to which findings obtained in the analogue situation can be generalized to the clinical setting. Marks (1978), for example, has noted that the fears of clinically phobic clients are usually much more intense and extensive than those evidenced by analogue subjects, and are very often associated with other complex problems which preclude successful interventions directed toward a single fear alone. Clinical populations have also been shown to be characterized by a significantly greater number of life stressors and neurotic symptoms, as well as a more urgent need for help with their problems (Lieberman & Gardner, 1976). Analogue subjects, on the other hand, usually exhibit a better overall personal and social adjustment, factors which have been demonstrated to be associated with improvement from many different clinical treatments (Garfield, 1978).

Despite the inherent limitations, analogue studies have become established practice in behavior therapy research because they afford the opportunity to investigate circumscribed therapeutic procedures or problems under well-controlled conditions with a usually large population of potential subjects. In short, analogue research enables the investigator to circumvent many of the practical, as well as ethical, problems associated with conducting controlled group studies in the clinical setting (Kazdin, 1978). Questions pertaining to both the internal and external validity of these studies have, however, led to numerous recommendations in recent years for improving the quality of this research approach (Bates, 1970; Bernstein & Paul, 1971; Levis, 1970). Borkovec et al. (1974), for example, have presented several suggestions for selecting an appropriate and clinically relevant target behavior for analogue fear research. First, they suggest that the specific target behavior selected for investigation should occur at a reasonably high frequency within the clinical population so as to increase the face validity of the behavior as a clinically relevant problem. Second, the target behavior used should represent a source of concern and distress to the individual subject, and should be demonstrated to interfere in some fashion with the individual's daily functioning. In this manner, the target behavior and analogue sample will both be more representative of the problems and clients found within the clinical setting. A third, related suggestion is that the target behavior should not be influenced by simple demand, suggestion, and expectancy effects, a criterion that can be satisfied most easily by selecting only highly fearful subjects who are less susceptible to the influence of these effects (Borkovec, 1973). Fourth, substantial increases in physiological activity should occur in anticipation of, and in response to, the presentation of the phobic stimulus or feared situation. This suggestion is in agreement with Bernstein and Paul (1971) who state that analogue subjects must display significant "increases in physiological arousal . . . as a result of the presumed eliciting stimulus object" (p. 228). Finally, simple pre- and posttest exposure to the phobic stimulus or feared situation should not result in such rapid habituation of physiological activity that it is impossible to accurately assess the effects of the treatment procedures used.

While these recommendations are noteworthy, the researcher conducting an analogue study is often in the position of trying to balance the concern with designing a clinically relevant study (i.e., selecting an appropriate target behavior and reasonably fearful subjects) on the one hand, with the requirement of finding a sufficient number of subjects to actually run the experiment on the other (Bernstein, 1973). Such was the case in the present investigation, where an attempt was made to both choose a target behavior (spider phobia) whose use had some precedence in the clinical literature, and employ multichannel response measures as a means of selecting fearful subjects and evaluating treatment effects. Fear of spiders has been utilized as the target behavior in a large number of analogue studies (e.g., Cotler, 1970; Marcia _et al._, 1969; Taylor, 1977) and its widespread use is attributable, at least in part, to the fact that it involves a highly discriminable stimulus whose presentation can be easily and carefully controlled under laboratory conditions. This particular target problem would seem to be of questionable clinical relevance, however, in terms of either occurring with a high frequency within the clinical population or representing a significant source of interference to the individual's daily functioning. This is especially true when the variety of spider used within the analogue situation (e.g., tarantula) represents a markedly divergent species whose stimulus value may have little relevance to the subjects' fear in the naturalistic setting. This implies that future analogue studies should give careful consideration to selecting more appropriate and clinically relevant target problems, and representing these problems under stimulus conditions in the laboratory setting that more closely simulate those occurring in the natural environment. In this regard, studies by Borkovec and his colleagues (Borkovec _et al_., 1974; Borkovec, Wall, & Stone, 1974) have indicated that the anxiety associated with social interaction and with public speaking are potentially useful treatment targets for analogue fear research. Those problems are frequent and often severe enough to be clinically relevant, and have also been demonstrated to be much less susceptible to the confounding effects of artifacts during the experimental session. In addition, these target behaviors are usually accompanied by substantial increases in physiological arousal that are relatively resistant to habituation effects. While the assessment of these particular targets is likely to be much more complex than the measurement of anxiety in relation to small animals, the potential benefits in terms of increased clinical relevance and less ambiguous data would seem to warrant their consideration (Borkovec et al., 1977).

The response criteria used to select subjects in the current study were chosen so as to represent each of the three response channels in anxiety. Measures from all three modalities were included to address the criticism that analogue fear subjects are most often screened on the basis of only one or two response measures, leaving their responsivity in the remaining channels unassessed and uncontrolled. As noted earlier, this is a particularly important issue, both in view of the multidimensional nature of the anxiety construct and in terms of generalizing treatment effects to a clinically phobic population. The SPQ was selected as the initial screening device because it was expected that this instrument would provide a more complete assessment of the verbal-cognitive component of spider anxiety than a single intensity-based fear rating. While likely attaining this goal, the highly specific nature of many of the test items, along with the dichotomous response categories (i.e., true or false), suggest that this questionnaire may be tapping into relatively mild fears of spiders in very specific situations. Increased discrimination between highly fearful and mildly fearful subjects might therefore be attained by combining such a generalized questionnaire measure with careful interviews and a fear intensity rating (e.g., Fear Survey Schedule) for selecting analogue subjects (e.g., Prigatano & Johnson, 1974). With regard to the behavioral measure, the passive BAT procedure would appear to be a viable technique for assessing behavioral avoidance while simultaneously recording physiological activity. In the present case, however, the behavioral criterion used for selecting subjects (a distance of not less than two feet on the initial BAT), although comparable to that utilized in previous analogue studies (e.g., Kleinman, 1979, Spiro, 1981), was rather liberal and probably allowed for the selection of a large number of nonphobic subjects. While a principal reason for selecting this criterion was to insure that a sufficient number of subjects would qualify for the experiment, future research should consider setting more rigorous behavioral qualifications, both in terms of the minimal allowable distance and the demands that are placed on subjects for increased approach behavior (c.f. Bernstein, 1974). Further, additional steps should be included in the BAT procedure so as to allow the subject to potentially come into physical contact with the phobic object. Although these procedural components will likely result in the exclusion of a large percentage of subjects who report a high degree of verbal anxiety, it will insure that those who are selected will be more representative of the clinical population and less susceptible to artifactual influences. Finally, the physiological selection criterion used represented the most conspicuous divergence from, and improvement upon, previous analogue research. As pointed out earlier, very few studies have included physiological response measures as part of their subject selection procedures, despite the fact that this system is considered by most to be of functional importance in the establishment and maintenance of the anxiety response. The lack of precedence for using physiological measures in this manner led to the rather arbitrary selection of a criterion response - a 10 percent increase in heart rate during the initial exposure to the spider. This particular criterion was chosen because it represented at least a moderate increase in heart rate responding from the baseline level of activity, and was also easy to calculate in session from the polygraph record when determining whether a subject qualified physiologically. Unfortunately, subsequent inspection of the individual records revealed that the increases in heart rate were usually associated with the initial, abrupt movement of the spider to the end of the BAT track, and that these increases were frequently followed by an often rapid decline in heart rate responding. It seems likely, therefore, that the increases in physiological activity which served as a basis for subject selection were due, in large part, to the "shock" value associated with the sudden appearance of the spider on the BAT track. This implies that there were likely a large number of subjects included for whom physiological activity and internal cues were not functionally important in their fear behavior. While the degree of physiological arousal that is "clinically relevant" remains an empirical question, future analogue studies should consider using averaged levels of physiological activity during the baseline and exposure periods to better insure that any observed increases are a function of the subject's actual anxiety in relation to the particular stimulus used. Although more difficult to calculate in session from standard polygraph recordings, the use of on-line computers for analyzing physiological activity would make the task relatively simple.

In summary, the results of the present investigation failed to provide support for the relative efficacy of external inhibition in modifying the verbal-cognitive, motoric, and physiological components of the anxiety response. Although producing significant reductions in anxiety across all three response modalities, the external inhibition procedure was found to be no more effective in this regard than procedures controlling for expectancy effects and repeated exposure to the phobic stimulus. While disappointing, these findings are likely attributable to a combination of situational factors and subject characteristics that led to a rapid decline in anxiety for all three experimental groups, and thereby precluded the valid evaluation of treatment effects. In this respect, the current study has more substantial implications for the conduct of analogue fear research than for the potential effectiveness of external inhibition. This procedure remains a promising alternative treatment for anxiety disorders whose relative effectiveness is still open to empirical investigation. By constructing well-designed studies that are responsive to both the multidimensional nature of the anxiety construct and the inherent limitations and pitfalls of analogue research, investigators will be better able to evaluate the potential effectiveness of the external inhibition phenomenon in treating the pervasive clinical problem of anxiety.

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Appendix A

Spider Questionnaire

Spider Questionnaire

Name: ______________________ Sex: Male _____ Female ______

Directions: Please answer True (T) or False (F) to the following questions by circling the appropriate letter for each item. Simply answer each question as it usually applies to you.

T F 1. I avoid going to parks or on camping trips because there may be spiders about.

T F 2. I would feel some anxiety holding a toy spider in my hand.

T F 3. If a picture of a spider crawling on a person appears on the screen during a motion picture, I turn my head away.

T F 4. I dislike looking at pictures of spiders in a magazine.

T F 5. If there is a spider on the ceiling over my bed, I cannot go to sleep unless someone kills it for me.

T F 6. I enjoy watching spiders build webs.

T F 7. I am terrified by the thought of touching a harmless spider.

T F 8. If someone says that there are spiders anywhere about, I become alert and on edge.

T F 9. I would not go down to the basement to get something if I thought there might be spiders down there.

T F 10. I would feel uncomfortable if a spider crawled out of my shoe as I took it out of the closet to put it on.

T F 11. When I see a spider, I feel tense and restless.

T F 12. I enjoy reading articles about spiders.

T F 13. I feel sick when I see a spider.

T F 14. Spiders are sometimes useful.

T F 15. I shudder when I think of spiders.

T F 16. I don't mind being near a harmless spider if there is someone there in whom I have confidence.

T F 17. Some spiders are very attractive to look at.

T F 18. I don't believe anyone could hold a spider without some fear.

T F 19. The way spiders move is repulsive.

T F 20. It wouldn't bother me to touch a dead spider with a long stick.

T F 21. If I came upon a spider while cleaning the attic I would probably run.

T F 22. I'm more afraid of spiders than any other animal.

T F 23. I would not want to travel to Mexico or Central America because of the greater prevalance of tarantulas.

T F 24. I am cautious when buying fruit because bananas may attract spiders.

T F 25. I have no fear of non-poisonous spiders.

T F 26. I wouldn't take a course in biology if I thought I might have to handle live spiders.

T F 27. Spider webs are very artistic.

T F 28. I think that I'm no more afraid of spiders than the average person.

T F 29. I would prefer not to finish a story if something about spiders was introduced into the plot.

T F 30. Even if I was late for a very important appointment, the thought of spiders would stop me from taking a shortcut through an underpass.

T F 31. Not only am I afraid of spiders but millipedes and caterpillars make me feel anxious.

Appendix B

Preliminary Questionnaire

Preliminary Questionnaire

1. Have you ever been treated by a psychologist or psychiatrist?

2. Have you ever fainted or had distressing symptoms when frightened?

3. Do you have a history of heart disease?

Appendix C

Consent Form

Consent Form

The purpose of this study is to investigate the types of responses that people have to certain kinds of objects and ways of modifying these responses through the use of different intervention techniques. The procedures involved in this investigation will include having you be exposed to a harmless spider; however, at all times the spider will come no closer to you than the distance which you indicate you are willing for it to come. In the course of this study you may also be presented with some loud noise which sounds like static on an FM radio. This noise is not harmful or discomforting in any way and you will always know about it ahead of time. All of the procedures being studied are experimental in nature.

During the experimental session, you will be asked to report your reactions to the harmless spider and allow the experimenter, Jerry Gilmore, to record certain physiological functions. Specifically, measures of your heart rate and sweat gland activity will be taken. Neither of these measures involve any pain or sensation whatsoever.

It is believed that your participation in this study involves no risk to you, although you may, depending upon your reaction to harmless spiders, experience some mild stress or discomfort. As a result of this study, we hope to determine the effectiveness of these new techniques in modifying certain kinds of responses.

The study will require about one hour of your time. If you agree to participate, you may withdraw from the study at any time. When we have completed your phase of the experiment you will be informed about the details of the study. If you have any questions, feel free to ask them now or save them until we are finished.

Please read the following paragraph carefully and sign your name below if you are in agreement:

I voluntarily consent to be a subject in the study being conducted by Jerry Gilmore under the direction of Dr. William Kallman. Mr. Gilmore has described the study to me and has given me the opportunity to ask questions. I understand that I may withdraw from the experiment at any time and my data will be deleted from the results at my request. I authorize Mr. Gilmore to record my heart rate and sweat gland activity during the experiment. I understand that all data collected will be held in the strictest confidence and any published results of the study will insure my anonymity.

______________________________ Witness

______________________________ Subject

______________________________ Date

Appendix D

Pretreatment Instructions

Pretreatment Instructions

The purpose of this study is to investigate the physiological and psychological reactions that people have to certain kinds of stimuli. Although you cannot see it right now, at the other end of this track is a live tarantula spider enclosed in a plastic case. If you are unfamiliar with them, they are a rather large, furry member of the spider family that originate from tropical climates. Although they are purported to be dangerous, this one is not poisonous and cannot escape from the plastic case. However, the spider's case is mounted on a small motorized platform that can be moved automatically back and forth on this track. In order to determine your reactions to this type of spider, it will be slowly moved down this track at various times during the experiment. Each time it is moved, however, you will know in advance when it is coming and you will determine exactly how close it comes or how far away it remains.

Throughout the study I will be recording your heart rate and sweat gland activity. The equipment here is perfectly safe and you will experience no sensation whatever from any of the equipment. After I hook you up to the physiological recording equipment, I would like you to sit quietly and to keep as still as possible due to the sensitive nature of the recording equipment. If you have no questions at this point, I will hook you up to the recording equipment and then give you further instructions. (The heart rate and skin conductance electrodes will then be attached).

For the first part of the experiment, I would like to determine some of your responses to the spider. As I mentioned before, concealed at the other end of the track is a live tarantula enclosed in a plastic case and mounted on a motorized platform that I will control from the other room. In a few minutes, I will move the spider to the end of the track (10-foot mark) where it will be stopped. After the spider has stopped, I would like you to rate aloud the degree of discomfort or anxiety you feel as you look at the spider at that distance. Use a scale from 1 to 10 to rate your anxiety, with 1 representing no anxiety or completely calm and 10 representing the most anxiety you have ever felt. Remember you may use any number from 1 to 10 that best describes the discomfort or anxiety you experience while looking at the spider. After a period of about 30-seconds, the spider will again begin to move slowly down the track and will continue to move toward you. If, for any reason, you should begin to feel the least bit anxious or uncomfortable, you may press the button on the right arm of the chair and the spider will immediately stop moving. After you press the button and the spider stops moving, I would like for you to again rate aloud the degree of discomfort or anxiety you experience using the same scale from 1 to 10. Since the purpose of this is to see just how close you can comfortably come to the spider, I will start moving it forward again after a period of about 30-seconds. But, as before, if you begin to feel the least bit anxious or uncomfortable, you may press the button and the spider will be stopped completely. After the spider stops moving for the second time, I would like you to once again rate aloud the degree of discomfort or anxiety you experience using the 10-point scale. Let the spider come as close as possible, but if you begin to feel the slightest bit anxious or uncomfortable, please do not try to force yourself to continue.

Please remember to keep as still as possible due to the sensitive nature of the recording equipment, and use only a movement of your right hand should you find it necessary to press the button. Keep your left arm and left leg perfectly still at all times. Keep your eyes open and look directly at the spider for the entire time it is on the track. Remember to rate your level of discomfort or anxiety each time the spider stops moving using the scale from 1 to 10. If you have no further questions, we will begin. Please sit quietly keeping your eyes open as you normally would for the next few minutes so that the physiological equipment can be calibrated properly.

Appendix E

Group Means and Standard Deviations

Dependent Measures	External Inhibition Pre		External Inhibition Post		Graduated Exposure Pre		Graduated Exposure Post		Test-Retest Pre		Test-Retest Post	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
[a]BAT	46.5	15.43	30.12	12.41	45.25	13.46	17.12	20.73	53.00	24.04	42.75	35.43
[b]SUDS-10	2.62	1.22	1.5	.70	3.75	1.56	2.12	1.49	3.87	1.76	3.0	1.5
SUDS-CPA	7.5	1.8	4.37	2.0	7.87	1.96	3.37	2.06	7.5	.87	5.25	2.33
SUDS-PCA	7.5	1.8	5.75	1.39	7.87	1.96	5.62	2.39	7.5	.87	6.75	1.98
[c]HR-10	8.42	7.29	-.71	5.67	5.62	10.02	.04	4.45	12.87	8.7	3.54	6.62
HR-CPA	8.04	7.5	6.21	3.74	4.83	12.8	1.19	4.05	7.89	7.04	3.29	10.72
HR-PCA	8.04	7.5	-.41	6.38	4.83	12.8	-1.83	5.3	7.89	7.04	.17	5.81
[d]SC-10	2.63	.61	.36	.26	2.12	1.96	.54	.81	2.46	1.32	1.17	.57
SC-CPA	2.97	1.27	1.13	.78	2.37	1.23	.41	.62	2.09	1.04	1.07	1.66
SC-PCA	2.97	1.27	1.02	.63	2.37	1.23	.95	.95	2.09	1.04	1.53	.88
[e]SPQ	18.37	2.69	16.5	3.2	18.75	2.99	17.25	4.26	18.37	2.64	17.25	2.95

[a]BAT scores are expressed in inches, with a possible range of 24 to 120 on the pretreatment measure and 0 to 120 on the posttreatment BAT.

[b]Possible SUDS scores ranged from 1 to 10 for each subject. Ratings were obtained at the 10-ft. point (SUDS-10), the point of closest pretreatment approach (CPA), and the point of closest approach on both the pretreatment approach (CPA), and the point of closest approach on both the pretreatment and posttreatment BAT's (PCA).

[c]Heart rate is expressed as a change score and was computed at the same three assessment points as the SUDS data.

[d]Skin conductance is expressed as a change score and was computed at the same three assessment points as the SUDS and HR data.

[e]Possible SPQ scores ranged from 0 to 31 for each subject.

Appendix E

Group Means and Standard Deviations

Appendix F

Publication Draft

Use of an External Inhibition Procedure in the Treatment of Spider Phobic Subjects

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Running Head: EXTERNAL INHIBITION

Abstract

The relative effectiveness of the external inhibition treatment in modifying the multiple components of the anxiety response was examined by a comparison with procedures controlling for expectancy effects and repeated exposure to the phobic stimulus. Subjects were 24 female undergraduate students who were selected from a pool of 316 females according to the following criteria: (1) a total score on the SPQ that was within the upper 25% of the distribution of scores on the SPQ, (2) a distance score of at least 24 inches on a passive behavioral avoidance test (BAT), and (3) an increase in heart rate of at least 10% during the initial exposure to the spider. Eight subjects meeting these criteria were randomly assigned to one of three experimental groups: An External Inhibition group, a Graduated Exposure control group, or a Test-Retest Control group. Dependent measures consisting of pre- and posttreatment BAT scores, subjective distress ratings (SUDS) elicited by the spider, heart rate responding, skin conductance activity, and SPQ scores failed to provide any evidence of the relative efficacy of external inhibition in modifying phobic behavior. In all cases, the external inhibition treatment was found to be either ineffective or no more effective than the two control procedures in modifying the multiple components of the anxiety response. These findings are discussed in terms of various situational, procedural, and subject factors that may have contributed to the rapid habituation of anxiety among all three experimental groups, and thereby precluded the valid evaluation of potential treatment effects. The implications of these results for the external inhibition phenomenon and for analogue fear research are discussed.

Although having received relatively little attention to date, treatment techniques based on the phenomenon of external inhibition (Pavlov, 1927) appear to hold a great deal of promise as a means of effectively modifying maladaptive anxiety in humans. As a therapeutic approach for anxiety or phobic disorders, techniques based on external inhibition are derived from the classical conditioning model of anxiety (Mowrer, 1947; Wolpe, 1958). This model essentially argues that maladaptive anxiety is the result of the pairing of an anxiety response with some objectively neutral or harmless stimulus, such that this stimulus itself comes to elicit increased levels of anxiety. In the external inhibition paradigm, a second external stimulus (e.g., a tone or light) is presented in the presence of the conditioned fear stimulus as a means of attenuating the conditioned fear response. A number of experimental and clinical case studies (Kleinman, 1979; Singh, 1976; Spiro, 1981; Wilkins & Domitor, 1973; Wolpe & Lazarus, 1966) have successfully demonstrated that use of such a procedure can significantly reduce the conditioned anxiety response evoked by a variety of specific phobic stimuli.

While supporting the clinical application of the principle of external inhibition, these studies are nevertheless lacking in several important respects when viewed in terms of the multidimensional nature of the anxiety construct. As Lang (1968) has noted, anxiety is commonly regarded as a multidimensional construct characterized by a complex interaction between the verbal-cognitive, physiological, and motoric response systems. Without exception, however, the studies conducted thus far on therapeutic applications of external inhibition have made use of only the self-report and/or behavioral channels for purposes of both subject selection and treatment evaluation. With regard to subject selection procedures, numerous objections have been raised concerning analogue fear research that attempts to generalize to a clinically phobic population on the basis of a treatment developed with only mildly fearful subjects (Bernstein, 1973; Bernstein & Paul, 1971). In view of the wide individual differences in terms of the specific topography of the anxiety response, and the resultant lack of covariation between response measures, it is impossible to determine on a *post hoc* basis the percentage of subjects in these previous studies who were only "mildly fearful" or "truly phobic" in the sense of showing clinically relevant increases in anxiety across all three response modalities. The failure of research on external inhibition to assess and control for physiological responding, and to select subjects on the basis of a coincidence of activity in all three channels, is not only inconsistent with the multidimensional nature of the anxiety construct, but, more importantly, precludes valid generalization of treatment effects to phobic clients in the clinical setting.

In terms of treatment evaluation, investigations of external inhibition conducted to date have similarly failed to incorporate physiological activity as an outcome measure, and have relied exclusively on changes in self-reported anxiety or behavioral avoidance as a means of demonstrating therapeutic effectiveness. While this research has provided important empirical evidence as to the potential of external inhibition to modify phobic behavior, the absence of physiological measures among posttreatment improvement indices leaves unaddressed the ability of such a procedure to effect significant changes in autonomic responding. The capacity of this form of treatment to effectively modify the physiological component of the anxiety response would seem to be an especially important issue since external inhibition is theoretically based on a classical autonomic conditioning paradigm. Moreover, the concept of response desynchrony (Rachman & Hodgson, 1974) indicates that different treatment techniques may produce differential effects on the various components of the anxiety response. As effective treatment should ultimately be capable of modifying each of these components, adequate evaluation of treatment effects must include assessment of changes occurring across all three response modalities.

The present study represents an extension of previous research on therapeutic applications of external inhibition and sought to examine the effects of such a procedure on the verbal-cognitive, physiological, and motoric components of the anxiety response. To accomplish this, subjects were selected and treatment effects evaluated in terms of changes elicited in each of the three response modalities by a specific fear stimulus. The following specific hypotheses were tested: (1) Subjects who receive the external inhibition treatment would permit a significantly greater approach by the phobic stimulus (i.e., a spider) on the posttest than on the pretest assessment, and this improvement in approach behavior would be significantly greater than that exhibited by subjects in either the graduated exposure or test-retest control groups; (2) Subjects receiving the external inhibition treatment would exhibit a significant reduction in self-reported fear of the spider from the pretest to the posttest assessment, and this reduction would be significantly greater than that shown by subjects in either the graduated exposure or test-retest control groups; (3) Subjects in the external inhibition treatment group would show a significant reduction in heart rate level during the posttest BAT as compared to that exhibited during the pretest assessment. This reduction in heart rate for subjects in the external inhibition group would be significantly greater than that exhibited by subjects in either the graduated exposure or test-retest control groups; (4) Subjects in the external inhibition treatment group would exhibit a significant reduction in skin conductance levels during the posttest BAT as compared to those shown during the pretest assessment. This reduction in skin conductance for subjects in the external inhibition group would be significantly greater than that exhibited by subjects in either the graduated exposure or test-retest control groups; (5) Subjects who receive the external inhibition treatment would show a significant reduction in scores obtained on the posttest administration of the Spider Questionnaire as compared to scores obtained on the initial administration of the questionnaire. This reduction in scores by the external inhibition group would be significantly greater than that shown by subjects in either the graduated exposure or test-retest control groups.

Method

Subjects

Twenty-four (24) female subjects were chosen from undergraduate psychology courses at Virginia Commonwealth University. Subjects having a fear of spiders were initially selected on the basis of their total scores on the Spider Questionnaire (SPQ; Klorman et al., 1974) as follows: the SPQ was administered to 316 females at VCU over a two semester period during the 1982-83 academic year. Those subjects scoring in the upper 25% of the distribution of all scores on the SPQ were defined as potential high-fear subjects and randomly assigned to one of three experimental groups: (1) an External Inhibition treatment group, (2) a Graduated Exposure control group, or (3) a

Test-Retest control group. These subjects were then invited to participate in a study "investigating physiological and subjective responses to visual stimuli." A total of 53 subjects were recruited in this fashion. Further screening of these potential high-fear subjects was conducted during the pretreatment assessment phase of the study, and resulted in the selection of 24 subjects, with eight subjects being assigned to each of the three experimental groups.

Apparatus

The external stimulus was presented via a SONY Cassette recorder (TC-142) attached to a set of Pioneer (SE-405) Stereophone Headphones.

Physiological measures were recorded on a five-channel Grass Model 7-D polygraph as follows:

Heart rate was recorded via a Grass Model 7PGC preamplifier interfaced with a Grass Model 7DA driver amplifier. Beat-by-heart rate was obtained through a Grass plug-in Tachograph 7P4 and recorded on a separate channel of the polygraph. Two silver plate EKG electrodes were attached on the left arm and left leg and secured with perforated rubber straps. To insure proper conductance, each electrode site was thoroughly cleaned with alcohol and an electrolyte of Grass EC-2 conductive paste was rubbed into the skin as well as onto the surface of the electrodes.

Electrodermal responses were recorded through a Grass Model

7P1 low-level DC-coupled preamplifier interfaced with a Grass Model 7DA driver amplifier. A pair of Beckman silver/silver chloride cup electrodes $2cm^2$ in area were attached to the volar surface of the left palm and referenced to a site on the ventral side of the third phalange of the left index finger. Each electrode was interfaced with an electrolyte of 50% normal saline solution in paste form. The electrodes were applied to an acetone-cleaned skin surface and held securly in place by adhesive tape.

Dependent Measures

Behavioral Avoidance Test (BAT). Each subject was seated in a chair at the end of an elevated track extending from directly beneath the subject's chest to a distance of 10-feet. A live tarantula (Eurypelma californica) enclosed in a ventilated, plexiglass case was concealed at the far end of the track and mounted on a motorized platform controlled by the experimenter from the adjacent room. At the start of the BAT, the spider was moved to the 10-foot mark by the experimenter and remained stationary at that point for a period of 30-seconds. The spider was then advanced toward the subject at the rate of approximately 1-inch/second until the subject began to feel the "least bit anxious or uncomfortable." At that point, the subject was instructed that she could press a small button on the arm of the chair that would immediately stop the spider. After a period of 30-seconds, the experimenter once again began advancing the spider toward the subject. The BAT was concluded when the subject stopped the spider a second time, with the experimenter recording the distance of the spider from the subject to the nearest inch.

Subjective Units of Discomfort Scale (SUDS). Subjects were instructed to rate aloud, on a scale from 1 to 10, the subjective units of discomfort (SUDS) evoked by the spider at three different times during each BAT administration: when the spider was first brought to the 10-foot mark and each time the subject stopped the spider. The endpoints of the SUDS scale represented, respectively, "completely calm" (1) and "the most anxiety ever felt" (10).

Physiological Measures. Heart rate and skin conductance measures were continuously recorded throughout the experimental sessions. In addition, movement of the spider during the BAT (i.e., starts and stops) were recorded on a separate channel of the polygraph record in order to evaluate the physiological responses associated with the maximum and minimum distances of the phobic stimulus from the subject.

Spider Questionnaire. The SPQ (Klorman et al., 1974) was used as a screening device for the initial selection of potential spider fearful subjects and was readministered during the posttreatment assessment phase of the study.

Procedure

Subjects were tested individually and randomly scheduled for the experimental sessions. Prior to the start of the experiment, each subject was asked to sign a consent form explaining the nature of the study, the physiological measures involved, and the subject's freedom to withdraw from the experimental at any time.

The experimental session was divided into three separate phases: (1) pretreatment screening and assessment, (2) treatment, and (3) posttreatment assessment. Each of the three experimental groups received the identical procedure in the pretreatment and posttreatment assessment phases. The three phases of the experimental session are described in detail below.

Pretreatment screening and assessment. Upon completion of the preliminary questionnaire and consent form, the first BAT was administered as a means of further screening potential high-fear subjects and providing baseline data from which to evaluate treatment effects. Each subject was seated comfortably in a padded lounge chair at the end of the BAT track and given instructions explaining the nature of the phobic stimulus and the BAT procedure (specific instructions to subjects are available on request). After the instructions had been read and the electrodes attached, subjects sat quietly with their eyes open for a 6-minute adaptation period prior to the start of the first BAT.

In order to select only those subjects who were highly fearful of spiders, any subject who was able to bring the spider to a distance of less than 24-inches on the second trial of the BAT *or* who failed to exhibit an increase in heart rate of at least 10%

(from the last averaged beat-by-beat heart rate obtained during the adaptation period to the highest beat-by-beat heart rate elicited during exposure to the spider) was eliminated from the study as exhibiting too little anxiety.

Treatment Groups

Immediately following the end of the first BAT, the experimenter re-entered the experimental room and replaced the spider in its concealed location at the far end of the BAT track. Subjects meeting the criteria specified above then received the treatment appropriate to the experimental group to which they had been assigned.

External Inhibition. The subject remained seated in the chair and was read instructions explaining the External Inhibition treatment procedure. The headphones were then placed on the subject and adjusted for comfort. The experimenter went to the adjacent room and, after a 2-minute adaptation period, moved the spider to the 10-foot mark. After a period of 30-seconds, the experimenter began moving the spider forward, bringing it progressively closer to the subject at a rate of approximately 1-inch/second. When the subject pressed the button and stopped the spider, the experimenter presented the external noise stimulus for a total of 30-seconds. The external stimulus consisted of white noise delivered at an intensity of approximately 95 db A by a SONY tape recorder through the stereophonic headphones. One administration of the sound as an externally inhibiting stimulus was defined as a 30-second presentation with the white noise alternately on and off for two-second periods. The white noise stimulus was prerecorded and the tape operated by the experimenter in the adjacent room. The strength of the stimulus was controlled by the tape recorder at 95 db A.

After presentation of the external stimulus, the experimenter once again began advancing the spider toward the subject. Each time the subject pressed the button and stopped the spider, the external stimulus was presented in the manner described above. This phase of the experiment was terminated after the subject had received 15 presentations of the external stimulus or had permitted the spider to reach the endpoint of the BAT track, whichever occurred first.

Graduated Exposure. Subjects remained seated in the chair and were given instructions explaining the Graduated Exposure procedure. The headphones were then placed on the subject as a control for extraneous noise and adjusted for comfort. The experimenter went to the adjacent room and, after a 2-minute adaptation period, moved the spider to the 10-foot mark. The BAT procedure, as described above, was repeated for a total of 15 trials, with trials being defined as each time the subject stops the movement of the spider, or until the subject had permitted the spider to reach the endpoint of the track.

Test-Retest Control. Subjects remained seated in the chair and were read instructions explaining the Test-Retest Control procedure. The headphones were then placed on the subject as a control for extraneous noise and adjusted for comfort. The experimenter then went to the adjacent room and subjects sat quietly for a period of 10-minutes. This period of time was comparable to the time required to administer the External Inhibition and Graduated Exposure procedures.

Posttreatment Assessment

Immediately following the end of the treatment phase of the session, the experimenter re-entered the experimental room and replaced the spider in its concealed location at the far end of the BAT track. In the posttreatment assessment phase, two BAT's were administered in order to assess changes in approach behavior and to evaluate changes in self-reported anxiety and physiological activity at the closest distance obtained on the pretreatment assessment (Borkovec et al., 1977). The first BAT, with a procedure identical to that of the pretreatment BAT, was administered to determine changes in approach behavior.

At the end of the first posttreatment BAT, the experimenter re-entered the experimental room and replaced the spider in its concealed location at the far end of the BAT track. The second posttreatment BAT was then administered in order to assess changes in self-reported anxiety and physiological activity at the closest distance obtained on the pretreatment assessment. The experimenter read the instructions to the subject and then, after a 3-minute adaptation period, began the second posttreatment BAT by moving the spider to the 10-foot mark. After a period of 30-seconds, the experimenter moved the spider to the point on the BAT track where it had been stopped by the subject on the second trial of the pretreatment BAT.

Following completion of the second BAT, the experimenter re-entered the experimental room, replaced the spider in its concealed location, and removed the electrodes. Subjects were then given a copy of the Spider Questionnaire to complete outside the experimental room.

Results

Behavioral Avoidance Test

A repeated measures analysis of variance was conducted on the two sets of BAT scores (pretreatment BAT and posttreatment BAT #1) using a 2 x 3 ANOVA on the Period (pre, post) x Group (External Inhibition, Graduated Exposure, Test-Retest) factors. The ANOVA yielded a significant main effect for the Period factor (F [1,21] = 35.13, $p < .01$), indicating that all three experimental groups exhibited a significant improvement in approach behavior over the two assessment periods, and permitted the spider to come significantly closer on the posttreatment BAT than on the pretreatment BAT. A nonsignificant Group main effect and Group x Period interaction effect revealed that this increase in approach behavior from the pretreatment to the posttreatment assessment was not significantly different for the three experimental groups.

Subjective Units of Distress

In order to evaluate changes in self-reported anxiety with the spider at a constant distance, a repeated measures analysis of variance was performed on the SUDS ratings elicited at the 10-foot point during the pretreatment BAT and posttreatment BAT #1 using a 2 x 3 ANOVA on the Period x Group factors. The ANOVA revealed a significant main effect for the Period factor ($F[1,21] = 51.47$, $p < .01$), but failed to show either a significant main effect for the Group factor or a significant Group x Period interaction effect. This indicated that all three experimental groups displayed a significant reduction in the mean subjective distress ratings evoked by the spider at the constant 10-foot distance on the posttreatment BAT, with no one group showing a significantly greater reduction than the other two.

Changes in the SUDS ratings reported at the point of closest pretreatment approach was examined by conducting a repeated measures analysis of variance on the two sets of SUDS scores (pretreatment BAT and posttreatment BAT #2) using a 2 x 3 ANOVA on the Period x Group factors. The ANOVA once again yielded a significant main effect for the Period factor ($F[1,21] = 40.04$, $p < .01$), which indicated that the spider evoked significantly lower mean subjective distress ratings on the posttreatment BAT when presented at the point of closest pretreatment approach. In addition, the failure to obtain a significant main effect for the Group factor and the nonsignificant Group x Period interaction effect indicated that this reduction in the mean SUDS ratings was similar for each of the three experimental groups.

Changes in the SUDS ratings elicited at the point of closest approach on both the pretreatment and posttreatment assessments were also examined. A repeated measures analysis of variance was performed on the SUDS ratings obtained during the pretreatment BAT and the posttreatment BAT #1 using a 2 x 3 ANOVA on the Period x Group factors. The ANOVA again revealed a significant main effect for the Period factor ($F[1,21] = 15.70$, $p < .01$), with neither the Group main effect nor the Group x Period interaction effect being significant. This indicated that, with the spider at its point of closest approach, all three groups reported significantly lower mean subjective distress ratings on the posttreatment assessment than on the pretreatment BAT, and that these reductions in mean SUDS scores were similar for each of the experimental groups.

Heart Rate

Heart rate in beats per minute was sampled from the cardiotachograph every 5 seconds for the final 30 seconds of each BAT adaptation period. These scores served as the "basal" or initial level of heart rate activity for each respective BAT.

The physiological recordings were also sampled every 5 seconds for each 30-second period the spider was presented in a stationary position (i.e., when it was stopped at the 10-foot point, when the spider was stopped for a second time by the subject, and when the spider was presented at the point of closest pretreatment approach on the posttreatment BAT #2). These scores represented the subject's "stress" level of heart rate activity for each respective BAT. In order to control for individual variation in baseline amplitude, a difference, or change, score was computed by subtracting the mean "basal" level of heart rate from the mean "stress" level of heart rate for each of the three analyses performed on the pretreatment and posttreatment heart rate data.

In order to evaluate changes in heart rate responding at the constant 10-foot distance, a repeated measures analysis of variance was performed on the two sets of heart rate change scores calculated from the pretreatment BAT and posttreatment BAT #1 heart rate levels. Using a 2 x 3 ANOVA on the Period x Group factors, the analysis revealed a significant main effect for the Period factor ($F[1,21] = 21.23$, $p < .01$), but failed to show either a significant main effect for the Group factor or a significant Group x Period interaction effect. This indicated that each of the experimental groups exhibited a significant reduction in the heart rate activity elicited by the spider at the constant 10-foot distance from the pretreatment to the posttreatment assessment, and that this reduction was similar across all three groups.

A repeated measures analysis of variance was also conducted on the heart rate change scores calculated from the pretreatment BAT and posttreatment BAT #2 using a 2 x 3 ANOVA on the Period x Group factor to evaluate changes in heart rate activity at the point of closest pretreatment approach. No significant main effects or interaction effects were obtained from this analysis.

Heart rate responding at the point of closest approach on both the pretreatment and posttreatment (BAT #1) assessments was evaluated by using a 2 x 3 repeated measures analysis of variance conducted on the Period x Group factors. The ANOVA yielded a significant main effect for the Period factor ($F[1,21] = 17.69$ $p < .01$). This indicated that the heart rate activity elicited by the spider at its point of closest approach was significantly less for all three groups on the posttreatment than on the pretreatment BAT. In addition, the failure to obtain either a significant main effect for the Group factor or a significant Group x Period interaction effect indicated that each of the experimental groups exhibited similar reductions in heart rate responding over the two assessment periods.

Skin Conductance

Skin resistance levels were sampled from the physiological record every 5 seconds for the final 30 seconds of each BAT adaptation period. These scores served as the subject's "basal" or initial skin resistance level for each respective BAT. The recordings were also sampled every 5 seconds for each 30-second period that the spider was presented in a stationary position (i.e., when it was first brought to the end of the BAT track, when the spider was stopped for a second time by the subject, and when the spider was presented at the point of closest pretreatment approach on the posttreatment BAT #2). These scores represented the subject's "stress" level of skin resistance activity for each respective BAT. A reciprocal transformation of skin resistance values was performed creating skin conductance scores as suggested by Venables and Martin (1968). These scores were then used to derive a change score by subtracting the mean "basal" level of skin conductance from the mean "stress" level of skin conductance for each of the three analyses performed on the skin conductance data.

To evaluate changes in skin conductance activity with the spider at a constant 10-foot distance, a repeated measures analysis of variance was performed on the skin conductance change scores calculated from the pretreatment BAT and posttreatment BAT #1 mean skin conductance levels. Using a 2 x 3 ANOVA on the Period x Group factors, the analysis revealed a significant main effect for the Period factor ($F[1,21] = 48.46$, $p < .01$), but failed to show either a significant main effect for the Group factor or a significant

Group x Period interaction effect. This indicated that all three experimental groups exhibited significant and similar reductions in the skin conductance activity elicited by the spider at the constant 10-foot distance from the pretreatment to the posttreatment assessment.

A repeated measures analysis of variance was also conducted on the skin conductance change scores computed from the pretreatment BAT and posttreatment BAT #2 in order to evaluate changes in skin conductance activity elicited at the point of closest pretreatment approach. The 2 x 3 ANOVA conducted on the Period x Group factors once again yielded a significant main effect for the Period factor ($F[1,21] = 26.64$, $p < .01$). This effect indicated that significantly lower levels of skin conductance activity were elicited on the posttreatment assessment as compared to the pretreatment assessment when the spider was presented at the point of closest pretreatment approach. In addition, the nonsignificant Group main effect and Group x Period interaction effect indicated that these reductions in skin conductance activity were similar for all three experimental groups.

Skin conductance activity elicited at the point of closest approach on the pretreatment and posttreatment (BAT #1) assessments was evaluated by using a 2 x 3 repeated measures analysis of variance conducted on the Period x Group factors. The ANOVA revealed a significant main effect for the Period factor

($F[1,21] = 38.73$, $p < .01$), as well as a significant Group x Period interaction effect ($F[1,21] = 3.64$, $p < .05$). While the significant main effect for the Period factor implied that the magnitude of all group mean skin conductance scores was reduced from the pretreatment to the posttreatment assessment, the significant Group x Period interaction effect indicated that the three groups changed differentially across the two assessment periods. A Duncan's Multiple Range Test performed on the significant Group x Period interaction effect revealed that the External Inhibition and Graduated Exposure groups both showed a significant, and similar, reduction in the skin conductance activity elicited by the spider at its point of closest approach on the posttreatment BAT as compared to the activity elicited on the pretreatment assessment. The Test-Retest group, however, displayed no significant reductions in skin conductance activity across the two assessment periods.

Spider Questionnaire

Each subject was administered the Spider Questionnaire (SPQ) on two separate occasions. The first administration prior to participation in the experiment served as the basis for initial subject selection. The second administration of the SPQ occurred during the posttreatment assessment phase of the study and followed completion of the final behavioral avoidance task.

A repeated measures analysis of variance was conducted on the two sets of SPQ scores using 2 x 3 ANOVA on the Group x Period factors. No significant main effects or interaction effects were obtained on the SPQ.

Treatment Trials

During the treatment phase of the experiment, subjects in the External Inhibition group were exposed to the spider and presented with the external stimulus noise each time they pressed the button to stop the advance of the spider. Graduated Exposure subjects were administered the same procedure without the presentation of the external stimulus. In both cases, this phase of the experiment continued until 15 trials had been completed (15 administrations of the external stimulus in the case of External Inhibition subjects and 15 stops of the spider for Graduated Exposure subjects), or until the subject had allowed the spider to reach the endpoint of the track. This latter criterion resulted in some subjects receiving less than the maximum of 15 trials during the treatment phase.

An examination of the data for both groups revealed that only one subject in the External Inhibition group received less than 15 sound administrations, while a total of seven subjects in the Graduated Exposure group were able to bring the spider to the endpoint of the track prior to reaching the 15 trial criterion. A Chi Square Test was performed on the number of subjects in both groups who received the maximum of 15 trials during the treatment phase of the study to determine if this number was significantly different for the two experimental groups. The number of subjects receiving a total of 15 trials was significantly greater for the External Inhibition group than for the Graduated Exposure group ($x^2 = 9.00$, df = 1, $p < .01$).

In order to determine if the total number of trials administered to the two groups during the treatment phase of the study also differed significantly, a t-test was performed on the mean trials received by the External Inhibition and Graduated Exposure subjects. This analysis was also highly significant ($t = 5.53$, df = 14, $p < .01$), indicating that External Inhibition subjects received a significantly greater number of trials during the treatment phase than subjects in the Graduated Exposure group.

Discussion

The present study represented an extension of previous research on the therapeutic applications of the external inhibition phenomenon, and sought to examine the effects of such a procedure on the verbal-cognitive, motoric, and physiological components of the anxiety response. To accomplish this, subjects were selected and treatment effects evaluated on the basis of changes elicited in each of the three response modalities by a specific fear stimulus. An attempt was made to demonstrate that use of an external inhibition procedure would produce significant reductions in anxiety across all three response channels, and that these reductions in anxiety would be significantly greater than those evidenced by subjects receiving procedures designed to control for expectancy effects and repeated exposure to the phobic stimulus.

The results of the present study failed to provide any evidence of the relative efficacy of external inhibition in modifying phobic behavior. These findings are contrary to previous clinical case studies and group outcome studies which have offered suggestive support for the use of such a procedure in the treatment of anxiety-related disorders. It was predicted, on the basis of this previous research, that use of an external inhibition treatment procedure would result in significantly greater reductions in anxiety across all three response channels than procedures which controlled for repeated exposure to the phobic stimulus and expectancy and placebo effects. In all cases, however, the external inhibition procedure was found to be either ineffective or no more effective than the two control procedures in modifying the various components of the anxiety response.

Interestingly, the external inhibition and graduated exposure procedures did yield rather disparate results within the treatment phase of the experimental sessions. Specifically, the two groups were found to be significantly different in terms of the number of subjects in each group who permitted the spider to reach the endpoint of the track prior to completing the 15 treatment trials. Seven out of the eight subjects in the Graduated Exposure group were able to bring the spider to the end of the BAT track before all 15 trials had been completed, as opposed to only one subject in the External Inhibition group. These differences in performance resulted in the External Inhibition subjects receiving significantly more treatment trials ($\overline{X}$ = 14.88) than subjects in the Graduated Exposure condition ($\overline{X}$ = 7.25). Thus, even though they received only half as many treatment trials with a supposedly inert procedure, nearly every subject in the Graduated Exposure group permitted the spider to move to the point of closest possible approach during the treatment phase of the experiment. This contrasts to the one External Inhibition subject who completed the treatment phase prematurely, but who still required a total of 14 treatment trials before allowing the spider to reach the endpoint of the BAT track. The seemingly greater effectiveness of the graduated exposure procedure in reducing avoidance behavior within the treatment session was unexpected and is somewhat difficult to explain.

Although the reasons underlying these differences are unclear, it may be that the white noise stimulus presented to subjects in the External Inhibition group produced an actual <u>increase</u> in their overall level of arousal during exposure to the phobic stimulus. This increased arousal, in turn, could have interfered with the habituation of the anxiety response and maintained their avoidance behavior during the relatively brief treatment session (c.f. Goethe, 1980; Kallman & Isaacs, 1977; Sckneirla, 1959). While Spiro (1981) also employed white noise as the external inhibiting stimulus, such an effect would not have been as apparent in her study since all subjects were less likely to reach the termination point on the behavioral task used during treatment. This suggestion can only remain speculative since no attempt was made to analyze the levels of physiological arousal exhibited throughout the treatment period. It does imply, however, that white noise may not be the stimulus of choice within the external inhibition paradigm. Whatever the reason, it is clear that these differential treatment effects were short-lived, as both groups displayed similar significant reductions in anxiety in all three response modalities on the posttreatment assessment measures.

While the findings of the current investigation would seem to seriously question the clinical efficacy of external inhibition in the treatment of anxiety, the results are subject to two important considerations which cast doubt on the internal validity of the study itself. First, the Test-Retest control condition was included to provide a comparison group against which to evaluate treatment effects and the possible contribution of placebo and expectancy factors. It had been assumed, albeit implicitly, that the brief, repeated exposure to the phobic stimulus would produce very little, if any, change in the anxiety exhibited by these subjects, leaving the comparison of interest between the External

Inhibition and Graduated Exposure groups. Clearly, the consistently significant results obtained for the Test-Retest condition did not fulfill this expectation and, instead, indicated that the multiple responses used to define anxiety were extremely easy to modify through only brief exposure to the spider, with the addition of an intervening treatment being of relatively little consequence. Given these findings, it seems likely that some combination of nonspecific extra-treatment variables (situational, instructional, and procedural variables) may have been the primary influence in producing the rather large reduction in anxiety exhibited by the Test-Retest condition, and was likely the overriding determinant in the reductions shown by the other two experimental groups as well. While impossible to specify with any degree of certainty, these nonspecific variables may have included: (1) a novelty effect on the pretreatment assessment, (2) subtle and implicit demands for a reduction in anxiety on the posttreatment BAT, (3) contextual cues relating the safety and benign nature of the situation, and (4) the physical characteristics of the spider and test apparatus. Whatever their exact source, it is apparent that these uncontrolled and unpredicted effects exerted a large impact on the response systems being assessed and, in so doing, virtually precluded the valid evaluation of the potential therapeutic effects of the external inhibition procedure.

The second, related consideration regarding the results obtained in the current study pertain to the analogue subjects which comprised the three experimental groups. A principal objection that is frequently raised regarding analogue fear research is the use of subjects drawn from an undergraduate population who may not be truly phobic, in the sense that they exhibit clinically relevant increases in anxiety in all three response modalities as a result of the presentation of the presumed phobic stimulus (e.g., Bernstein, 1973; Bernstein & Paul, 1971). Recognizing the limitations associated with using an analogue population, an attempt was made in the present work to select only highly fearful subjects on the basis of their responsivity to the spider in the verbal-cognitive, motoric, and physiological response channels. While this method of subject selection represented a much more stringent procedure than is usually employed in analogue research, there is evidence which suggests that the present sample was not "truly phobic" and, instead, was probably only mildly fearful at best. In his extensive review of the behavioral assessment of anxiety, Bernstein (1973) cites evidence indicating that truly phobic subjects likely comprise less than five percent of an undergraduate population if rigorous selection criteria are used. Lang (1968) has similarly reported that when subjects are carefully screened through questionnaires, avoidance tests, and interviews, only about one or two percent of an undergraduate population will qualify as phobics. In the current investigation, only eight percent of the subjects who were initially administered the questionnaire were accepted as being sufficiently fearful in terms of their responding in each of the three response channels. By comparison, this percentage would seem to be fairly respectable and conservative, and implies the selection of a relatively large number of "truly phobic" subjects. The examination of correlations among the pretreatment measures, however, provides evidence to the contrary, and indicates that the objective of selecting subjects who were characterized by a coincidence of activity in all three response modalities was not realized. Specifically, the External Inhibition group showed only two significant correlations out of a possible 10, while one out of 10 was obtained for the Test-Retest subjects. The Graduated Exposure condition yielded no significant correlations among the pretreatment measures. Although consistent with previous research reporting a lack of concordance between the various response systems in anxiety (e.g., Borkovec *et al.*, 1974; Martin, 1961), the dearth of significant correlations indicates that subjects in the present investigation were not characterized by an especially high level of emotional arousal during their initial exposure to the phobic stimulus. As Hodgson and Rachman (1974) have noted, "concordance between response systems is likely to be high during strong emotional arousal, (while) discordance will be more evident when emotional responses are relatively mild" (p. 319). Thus, it seems quite likely that, despite attempts to use a more rigorous selection procedure, the subjects comprising the three experimental groups were only mildly fearful and were not, as had been hoped, representative of phobic clients in the clinical setting.

The apparently mild fear characterizing these subjects may also account, in large part, for the seemingly potent effects of nonspecific experimental factors in reducing the anxiety response. As Borkovec et al. (1973) have pointed out, extra-treatment variables such as those mentioned above have a much "greater effect on low fearful subjects than on high fearful subjects within the analogue phobic population" (p. 495). Since the current subjects were probably only mildly fearful, they were especially susceptible to the confounding effects of these nonspecific extra-treatment variables, and were consequently able to exhibit significant reductions in anxiety across repeated testings even with no explicit attempt being made to modify their responding.

Considered together, these findings suggest that the present experiment was of doubtful validity, both in terms of assessing the presence of, and changes in, the anxiety response, and adequately evaluating potential treatment effects. The selection procedures that were used failed to screen out a large number of mildly fearful subjects, and the inclusion of these subjects served to greatly intensify the confounding effects of nonspecific extra-treatment variables on the responses being measured. These effects, in turn, precluded any meaningful comparisons between the experimental groups in terms of differential treatment effects. The use of mildly fearful subjects in a mildly fearful analogue setting would indicate that the obtained results do not represent an adequate or valid test of the hypotheses under investigation concerning the relative efficacy of the external inhibition treatment. The effectiveness, or ineffectiveness of this procedure in the treatment of anxiety-related disorders remains, therefore, an empirical question subject to future experimental investigation.

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Vita

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