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CONTRAST EFFECTS IN FEAR

by

DEBORAH SAMSOM

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Abstract

The purpose of this research was to determine if fear is subject to the contrast effect that pervades psychophysical and other psychological phenomena. A contrast is said to occur when the judgement of a target stimulus is inversely related to the stimulus that preceded it; hence, it was expected that the response to a fearful stimulus should be inversely related to the response made to the preceding fear stimulus.

The occurrence and nature of contrast effects were investigated in two laboratory studies of fearful people. In the first experiment, sixty-five university students were exposed on separate occasions to two fearful stimuli (spiders and snakes). The first exposure session was manipulated so that experimental groups differed in the amount of fear evoked by the stimulus (high fear, moderate fear, and low fear). Exposure to the second animal was designed to produce a moderate level of fear in all subjects. During exposure to the animals, measures of subjective fear and heart rate were taken. Results suggested that a contrast effect had occurred. Compared to a control group of subjects who experienced moderate fear on two occasions, subjects who had a high fear response to the initial stimulus showed a decrease in fear to the second stimulus. Subjects who had a low fear response to the initial stimulus showed an increase in fear to the second stimulus. This increase in fear was evident in subjective and physiological indices. None of the effects was evident when participants were reassessed one week later, suggesting that the fear contrast effect is transient.

Four theories were evaluated with regard to their ability to

account for the above findings. None of the theories could sufficiently explain the results, suggesting that a combination of at least two is necessary.

The purpose of the second experiment was to replicate the above findings, and to investigate three additional aspects. These included: a) the participant's awareness of contrast effects, b) the role of perceived similarity of the context and target stimuli, and c) the interaction between mood states and prior context. A 2 by 3 factorial design was utilized with prior context (high fear, low fear) as the first factor, and mood induction (happy, sad and no mood induction) as the second factor. Subjective fear and heart rate were recorded during exposures to the feared stimuli. In addition, perceived similarity of the target and context was examined using three questionnaires, each assessing a different dimension of similarity. Awareness of contrasts was assessed with a post-experimental questionnaire. In the absence of mood induction, contrast effects occurred as they had in the first experiment. In the conditions involving mood induction, an interaction was evident. A happy mood blocked a low-to-moderate fear contrast, and a sad mood blocked a high-to-moderate fear contrast. Contrary to expectations, none of the similarity questionnaires was related to the magnitude of the contrast effect. Finally, subjects did not appear to be aware of their own experience of a fear contrast.

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Introduction

Systematic Desensitization and Contrast Effects

Although the effectiveness of exposure techniques for fear reduction has been demonstrated (Marshall, Gauthier & Gordon, 1979), the theoretical underpinnings of this procedure remain uncertain. Several explanations have been put forward, including reciprocal inhibition (Wolpe, 1958) and habituation (Rachman, 1978; Wilson & Davison, 1971).

The reciprocal inhibition interpretation as described by Wolpe (1958) holds that a graded hierarchy and an incompatible response (e.g., relaxation) are essential for the successful desensitization of fear. Several investigators have examined the role of relaxation in systematic desensitization. Some studies (e.g., Davison, 1968; Kass & Gilner, 1974) suggest that structured relaxation is an essential ingredient, but others do not support this conclusion (Miller & Nawas, 1970; Nawas, Welsch & Fishman, 1970). Schubot (1966) found that relaxation was necessary only for subjects who were extremely phobic. For moderately fearful subjects, the same degree of improvement occurred whether or not relaxation was paired with anxiety. It could be argued that people who experience intense fear reactions are more likely to seek treatment for their difficulty, and would therefore be more like the extreme phobics than the moderate phobics in the Schubot study. This would suggest the importance of utilizing relaxation in a clinical setting.

The necessity of presenting hierarchy items in a graded, gradual fashion has also been debated. Using the standard desensitization format, items are ranked according to the amount of fear each elicits, and the least fear-arousing ones are presented first. While this procedure is clearly effective, there has also been empirical confirmation of the efficacy of flooding or implosion treatments. These techniques are based on the non-graduated introduction of high-intensity phobic material in the absence of any relaxation training (e.g., Hogan & Kirchner, 1968; Boulougouris, Marks & Marset, 1971). Similarly, Richardson and Suinn (1973) reported improvements in test anxiety when their subjects were exposed to only the three highest hierarchy scenes.

Still further evidence inconsistent with Wolpe's theorizing has come from Krapfl and Nawas' (1970) report of comparable therapeutic gains in desensitization treatments employing ascending, descending, or randomly ordered hierarchies. All three methods led to significantly more approach behaviour and less subjective fear compared to a no-treatment control group. When these approaches were compared to a second control group involving exposure to fear irrelevant stimuli (Pseudodesensitization group), the ascending and descending methods (but not random ordering) were significantly more effective in reducing fear.

The evidence described above is compatible with the hypothesis that habituation, rather than reciprocal inhibition, is the effective mechanism of fear reduction.

Habituation is a simple and appealing explanation of changes in fear as a result of exposure. It is defined as decreased responding as the result of repeated stimulus presentation. The majority of research has examined habituation in nonhuman animals. Research with humans has focused primarily on physiological responses to auditory tones. One notable exception to this is a study by Lang (1970) examining the effects of repeated exposure to fearful stimuli on autonomic activity and verbal reports of fear. Subjects were snake-fearful university students who viewed twenty successive presentations of brief films of snakes. Half of the films were ranked as high in fear intensity, and the other half as low in fear intensity. The order of presentation was varied across experimental groups (i.e. high series first or low series first). Lang also examined the effects of cognitive set by giving subjects one of three instructions for viewing the film series: (1) catharsis - subjects were told to imagine they were actually participating in the events on the screen and to let themselves experience the full force of their emotions, (2) relaxation - subjects were similarly instructed to vividly experience the events but to remain relaxed (pre-film training in muscle relaxation was administered), (3) attend - subjects were told simply to attend closely to the films.

Several interesting findings emerged from this investigation. When the low fear film was presented first, no differences in fear reduction across groups was observed. However, with the high-to-low intensity order, the Relaxation group showed significantly greater reductions in fear than either the Catharsis or Attend groups. This was evident in lower average fearfulness rating of the films, less overall skin conductance response, and lower scores on a post-experimental fear questionnaire. Interestingly, the Catharsis group responded to the high-to-low order with increased GSR and higher scores on the fear questionnaire. It seems that by attempting to maximize their fear, these subjects blocked habituation to the feared stimuli.

Klorman (1974) followed-up these findings with a more detailed investigation of the effects of stimulus order on habituation. His participants were also snake-fearful undergraduate students. Snake films of three levels of fear intensity (high, moderate and low) were presented in ascending, descending, or nonsystematic (random) sequences. Physiological measures (heart rate and skin resistance) and subjective measures of fear were recorded during exposure trials. Significant group differences in patterns of habituation were evident in subjective reports of fear and heart rate. In the ascending order, most of the habituation occurred to low fear stimuli. Heart rate responses to the high and medium fear films tended to _increase_ over trials. In comparison, the nonsystematic and especially descending orders exhibited much greater habituation to high fear films. By the end of each session, they displayed similar low levels of subjective fear and heart rate to all levels of fearful stimuli.

The results of Klorman's investigation suggest that prior exposure to low fear stimuli impedes habituation to high fear stimuli. This implies that the standardized method of systematic desensitization may not in fact be the most efficient means of reducing fear. On the basis of his findings, Klorman recommends that nonascending hierarchies be used to maximize fear habituation. Lang (1970) makes a similar recommendation. This radical suggestion has been largely ignored by those using exposure techniques.

There have been no replications or extensions of Klorman's research. In fact, there is not even a satisfactory explanation to account for his findings. Klorman devotes very little of his article to theoretical issues. In discussing the results, he notes that in both the Descending and Ascending orders, most of the habituation occurred in the first film session. He speculates that this session "evoked the greatest cardiac adaptation and set the adaptation level". In using the term "adaptation level", Klorman is making reference to Helson's (1964) theory (discussed later in this paper). This theory was put forth to account for contrast effects in psychophysics. Thus, Klorman is implying that his findings reflect some sort of contrast effect. Lang (1970) uses the same explanation to account for his findings.

A contrast is said to occur when the judgement of a given "target" stimulus is inversely related to the stimulus that preceded it (Sherman, Ahlm, Berman & Lynn, 1978). This definition is descriptive in nature, and does not imply any particular underlying process. With regard to the studies by Klorman and Lang, exposure to a high degree of fear caused subjects to shift their ratings away from this extreme and hence subsequent stimuli were judged as less fearful.

Subjects who initially experienced a low amount of fear shifted their ratings away from the low end of the fear continuum, resulting in higher fear reports of subsequent stimuli. It is important to point out that both Klorman and Lang demonstrated differences in subjective and physiological measures, suggesting that the impact of contrasts is wider than just self-reported fear.

The presence of contrast effects in exposure techniques for fear reduction has not been directly investigated. However, some of the fear research conducted in our laboratory suggests that contrasts can and do occur. Rachman and Whittal (1989b) set out to demonstrate that an aversive event prior to exposure to a fearful stimulus results in greater return of fear. University undergraduates fearful of snakes participated in the study. They were seen on two occasions, two weeks apart. In the first session, all subjects received graded participant modelling until their reported fear of snakes was 10 or less on a 0 to 100 point visual analogue scale. In the second session, half the subjects were exposed to an arousing film involving gruesome footage of the aftermath of serious car accidents. The control group viewed an innocuous film about highway state patrol training. The films were shown immediately before exposure to the snake. Although the car accident film was effective in producing arousal, it did not result in a higher return of fear. In fact, subjects in the arousal group had <u>lower</u> return of fear scores.

In retrospect, it occurred to us that perhaps we had created a contrast effect. The car accident film was so aversive that by comparison, the snake did not seem as fearful. Subjects in the arousal film group rated the animal as less frightening than did control subjects who had no prior aversive experience. Spontaneous statements made by the subjects in the arousal group support this possibility. Several commented that "the snake was not nearly as bad as the film they had just observed" (S. Rachman and M. Whittal, personal communication).

An additional point about the Rachman and Whittal study is that the arousal film produced a rather complex emotional response. Subjects who viewed it reported feeling more sad, irritated, agitated and apprehensive. Sadness seemed to be the strongest emotion elicited. This suggests the interesting possibility that contrast effects can occur across moods. A recent study by Samsom and Rachman (1989) provides anecdotal evidence of this.

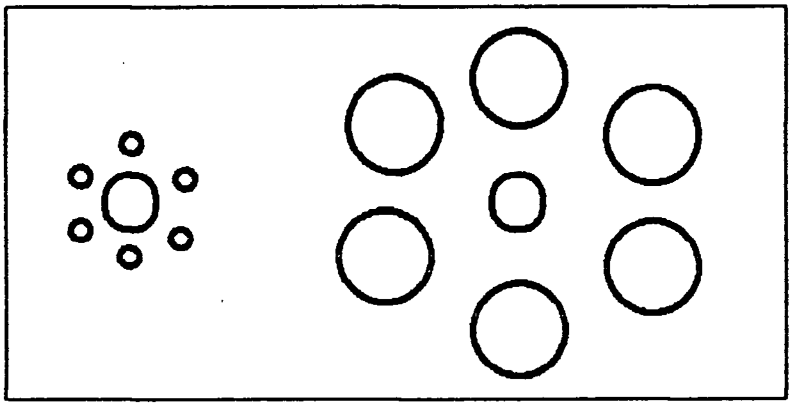
The purpose of the study was to assess the impact of mood on exposure-based fear reduction procedures in university undergraduates fearful of spiders and snakes. Happy and sad moods were induced using a musical mood induction procedure prior to fear reduction. In general, those subjects who underwent a sad mood induction reported greater fear than subjects who underwent a happy mood induction. There was, however, a handful of subjects whose fear seemed to <u>decrease</u> as a result of the sad mood induction. When informally questioned about this afterward, these subjects typically reported that because they felt so sad, the snake/spider "just did not seem to matter any more." For these subjects, the sad mood they experienced may have been extreme enough that by comparison the feared stimulus seemed less aversive. It should be pointed out that most subjects did not experience such extreme mood shifts as a consequence of the induction procedure.

Taken together, Lang's (1970) study, Klorman's (1974) study, and the research from our lab suggest that contrast effects can occur when individuals are exposed to feared stimuli. However, none of these studies was designed specifically to test this hypothesis, and thus results are open to alternative explanations. It remains to be clearly demonstrated that contrast effects occur in fear. This was the purpose of the first experiment in this series.

<u>Contrast Effects in Experimental Psychology</u>

Contrast effects are a robust and well-researched phenomenon in other branches of psychology. In 1964, Helson demonstrated contrasts in judgements of a variety of physical stimuli (such as sound, weight, brightness). For example, he showed that a given weight is judged as "heavy" when presented immediately after a series of lighter weights, and as "light" when presented immediately after a series of heavier weights.

Contrast effects have also been reported in the psychology of visual illusions (see Coren & Girgus, 1978). Judgements of the size, shape or angle of a figure vary according to the background in which the figure is imbedded. Perhaps the most well-known size contrast is the Ebbinghaus illusion shown below:



In this illusion, the apparent size of the central circle surrounded by small circles is larger than the apparent size of the central circle surrounded by large circles. The general principle invoked to explain such figural distortions is that figures are seen as larger when adjacent to medium or small forms and smaller when adjacent to large forms (Coren & Girgus, 1978). It is important to note that this statement is a description of the size contrast phenomenon and does not imply any particular underlying mechanism. We shall return to this point when discussing the theoretical underpinnings of contrasts.

Contrasts have also been observed in the performance of animals when they are shifted from large to small rewards. Under such conditions, they perform at a lower rate than animals who have been maintained on the same small reward (e.g., Bower, 1961; Collier & Marx, 1959).

In the late 1960s and 1970s contrast effects were reported in the social judgement literature (e.g., Manis & Armstrong, 1971; Ostrom & Upshaw, 1968; Parducci, 1968). A variety of settings and stimulus domains were used. For example, Manis and Armstrong (1971) asked subjects to describe photographs of facial expressions. For one group of subjects these target photographs were embedded in an array of positive facial expressions. For another, they were embedded in an array of negative facial expressions, and for the third, they were embedded in both positive and negative expressions. The subjects who viewed the positive array of photographs gave the least positive ratings of the target photographs, followed by those given the full range of photographs, and finally by those who saw the negative facial expressions.

More recently, Russell and Fehr (1987) expanded the research on contrast effects in facial expressions. They demonstrated shifts not only in the judged <u>intensity</u> of expressions, but also from one emotional <u>category</u> to another. Subjects who were shown a neutral facial expression after viewing a contented facial expression were most likely to categorize the latter as sad. However, if they were shown a bored facial expression first, they rated the target stimulus as interested, upset or calm, but none rated it as sad. These authors showed similar effects using an emotional (as opposed to neutral) target stimulus. In conditions where subjects were shown an anchor stimulus of low arousal, 68% rated the target emotion as "anger". In conditions with an anchor of high arousal, only 35% chose "anger". "Sad" was chosen more frequently in the high arousal conditions than in the low arousal conditions.

In a study by Pepitone and DiNubile (1976), contrast effects were demonstrated in judgements of the seriousness of the second of two sequential crimes. A homicide was judged to be a more severe criminal violation when subjects judged the seriousness of an assault case just preceding it, than when the same homicide was preceded by another homicide. In the same manner, an assault was judged to be less serious when it was preceded by a homicide than when it was preceded by another assault.

In the studies by Manis and Armstrong (1971) and Pepitone and DiNubile (1976), the point of comparison is the judgements of a moderate (or neutral) stimulus by control subjects who have experience with this stimulus only.

A second approach to the study of contrast is illustrated by the work of Manis and Pashewitz (1984). These researchers found that subjects exposed to "high pathology" definitions of vocabulary words subsequently rated midscale definitions as less pathological than did those subjects who were initially exposed to "low pathology" definitions. In this design, a comparison is made between the judgements of the two extreme groups, and a contrast effect is said to have occurred when there is a significant difference between them. No comparison is made with a control group of subjects who are exposed to moderate stimuli only. The major drawback to this approach is that one can never determine whether a demonstrated difference between the two groups is due to a large shift away from the extreme in one group only, or to equal shifts in both groups.

Contrast effects continue to be a topic of interest among social psychologists (e.g., Newman & Benassi, 1989). Research has focused primarily on judgements of external events and individuals. There are very few studies examining contrast effects in judgements of <u>internal</u> experiences. Using a correlational design, Brickman, Coates and Janoff-Bulman (1978) investigated this possibility. They collected ratings of happiness and pleasure from lottery winners and car accident victims. The researchers theorized that the two experiences (winning the lottery, and being permanently injured in an accident) represent opposite ends of the "pleasurable experience" continuum, and that individuals would use these events as a basis for comparing more common, minor pleasures. This comparison process was expected to result in a contrast effect. As predicted, lottery winners experienced significantly less pleasure from positive everyday events (such as talking with a friend, hearing a funny joke, or getting a compliment), and were no happier than controls. The accident victims also demonstrated a contrast effect, not by enhancing current pleasures, but by idealizing their past (which did not help their present happiness).

Manstead, Wagner and McDonald (1983) also examined contrast effects in judgements of internal emotional states. They showed participants scenes from two types of movies (comedy and horror), and varied the order of presentation (i.e., comedy-horror or horror-comedy). Subjects were asked to rate the extent to which they felt pleasant and relaxed while watching the films, as well as how funny they found the comedy scenes and how frightening they found the horror scenes. As predicted, subjects who were first shown horror scenes found the comedy scenes to be funnier, and reported feeling more pleasant and more relaxed while watching them than did subjects who saw the comedy scenes first. Similarly, subjects who were first shown comedy scenes found the horror scenes to be more frightening, and reported feeling more unpleasant while watching them than did subjects who saw the horror scenes first. They did not, however, report feeling less relaxed while watching the horror scenes. One explanation of these findings is that the emotional state produced by the first film provided a context for judging subsequent emotional states. A contrast effect occurred as a result of comparing the two emotional experiences.

The experiments by Brickman et al. and by Manstead et al. suggest that judgements of one's own feelings of happiness, pleasure and relaxation may be subject to the same comparison process as judgements of external stimuli. A study by Krupat (1974) extends this possibility to another emotion - fear.

Krupat (1974) exposed subjects to a five-minute driving simulation film involving a series of incidents of an intermediate degree of danger. Immediately prior to this, half of the subjects watched an extremely frightening driving film, while the other half saw a driving film involving little or no danger at all. Subjects were asked to play the role of the driver of the car on the screen. To facilitate this, each subject was seated only a few feet from the screen, projecting his/her own silhouette into the situation on the screen. While the subjects watched the film, they moved a lever to indicate feelings of safety. Skin resistance was continuously recorded as a measure of physiological arousal.

The results of the self-report measure (using the lever) suggested that a contrast effect had occurred. Subjects who were initially exposed to the "safe film" reported feeling less safe during the target film compared with those subjects who experienced the "unsafe film" initially.

Galvanic skin resistance scores, corrected for individual differences in resting levels and range of responses, paralleled subjective measures. Subjects previously exposed to the unsafe film were less physiologically aroused than were subjects who had seen the safe film. The uncorrected galvanic skin response scores were also in the direction of a contrast effect, although they fell short of statistical significance.

There are two problems with this experiment. There was no control group of subjects who experienced a moderately fearful film on both occasions. It is therefore impossible to determine if the observed contrast effect was the result of a shift in perception in both groups, or only in one. As mentioned previously, this is a problem with much of the contrast effect research.

The second problem arises from the fact that repeated exposure to a fearful stimulus generally results in habituation, and a decrease in fear. It can be argued that in the Krupat study, those subjects who experienced the unsafe film had an opportunity to habituate to fearful driving stimuli, while those in the safe film condition did not. This could easily account for the differences between the two groups, and is a much simpler explanation than the notion of contrast effects. Arguing against this, Krupat points out that measures for those subjects viewing the unsafe film remained unchanged during exposure to it, suggesting that habituation did not occur. Unfortunately, he does not state which measures (i.e. subjective and/or physiologic), nor does he provide the data upon which this statement is based. Moreover, it is possible that the driving scenes in the unsafe film became increasingly frightening, and thus measures of fear remained unchanged despite the fact that habituation was occurring.

Habituation does not present a problem for the interpretation of contrast studies in other areas of psychology. For example, if subjects are exposed to positive facial expressions (as in the study by Manis and Arstrong, 1971), they do not become less positive simply as a function of looking at them. It is clear that in order for contrast effects to be unambiguously demonstrated in fear, habituation must somehow be controlled. We will return to this point later.

Although contrast effects have been widely researched, the tendency has been to simply demonstrate their occurrence and leave it at that. Hence, there is still much about them that is unknown. For example, the temporal relationship between the contextual and target stimuli has not been examined. Research is typically designed such that the target is presented immediately after the context. Although this approach probably increases the likelihood of demonstrating a contrast, the external validity of it is questionable. Two related events may be separated by hours or days or weeks. It is unknown whether under such conditions, a contrast will still occur. The answer probably depends to a large extent on the importance and salience of the dimension under investigation.

A related issue is the stability of contrast effects over time. Once demonstrated, how long does a contrast last? Does it disappear as soon as the contextual anchor is removed? Researchers have become adept at demonstrating an immediate effect, but have not assessed its transience.

An interesting aspect of contrast effects that has been explored is the subjective awareness of participants. The cognitive process underlying a contrast effect seems to be an active comparison of the target stimulus with the contextual anchor. However, recent research on priming suggests that contrast effects occur even when subjects are unaware that they are comparing the stimulus with an anchor.

Priming studies are based on the idea that when subjects are asked to evaluate a stimulus along some dimension, a memory search for the appropriate category membership is conducted. In these studies, subjects are presented with information designed to prime, or activate a particular cognitive category. For example, subjects might be presented with the names "Dracula", "Ayatollah Khomeini", "Adolph Hitler" and "Charles Manson" in order to prime the category "Extremely Hostile" (Herr, 1986). This category then serves as a basis for interpreting incoming information. If the category is relevant and applicable to the incoming information, that information will be judged as an instance of or consistent with the category (Herr, 1986). In other words, the new information is assimilated into the primed category. This phenomenon has been demonstrated when moderately extreme categories are primed. However, when extreme categories are used (as in the above example), it has been shown that incoming information is not likely to be judged as a member of that category (Herr, Sherman & Fazio, 1983; Martin, 1986). This is because there is insufficient overlap between the features of the activated category and the target stimulus.

The stimulus is judged as a "nonexample" of the extreme category, and ratings of it are pulled away from the prime. This results in a contrast effect.

With regard to the issue of awareness, priming studies have shown that subjects need not be aware that they are making a comparison for contrast effects to occur. Bargh and Pietromonaco (1982) presented priming information outside of conscious awareness and demonstrated contrast effects. Herr (1986) presented his priming task as a separate experiment. The subjects had no idea that this task was in any way related to their subsequent ratings (where contrast effects were demonstrated).

The above findings suggest that awareness of a comparison process is not <u>necessary</u> for the occurrence of a contrast. However, they do not address the question of whether, under <u>usual conditions</u> individuals know that they are making a comparison. Moreover, the theoretical explanations of contrast effects (described below) also seem to avoid this issue.

<u>Theoretical Underpinnings of Contrast Effects</u>

Although contrast effects have been demonstrated using a wide range of stimuli, there is no consensus as to the mechanism behind the phenomenon. It is common for researchers to apply the concept of contrast as if it were an explanation, when in fact it is a description of a phenomenon. This point is made clear by Coren and Girgus (1978) in their discussion of contrast theories of visual illusions: "...on the basis of the simple formulation of the theories themselves, one cannot predict the set of stimulus configurations to which they can be applied. Investigators describe elements as being contrasted only after a perceptual distortion has been reported for a given array. Thus it seems that until the mechanism can be more clearly worked out, these theoretical positions remain primarily descriptive in nature rather than explanatory."

When a contrast effect is discussed as if it were an explanation, another overriding theory is implied. This is best described as the theory of relativism (Parducci, 1968). Relativism refers to the belief that there are no absolute judgements. Individuals, in virtually all facets of their lives, view the world in relative terms. Experiences are meaningful only in comparison with other experiences. The ubiquity of contrast effects certainly attests to the pervasiveness of our tendency to view the world relatively. In addition, there is a great deal of evidence showing that individuals make judgements on the basis of recent salient prior experiences (Tversky & Kahneman, 1982). One major limitation of the theory of relativism is that it cannot account for the direction of the comparison. Under some conditions, when a current event is compared with a prior event, we judge the events to be very similar. On other occasions, the comparison process results in our viewing the current situation as very different from the previous one. In other words, relativism cannot predict whether contrasts or assimilations will occur. Another limitation of relativism is that it is essentially a theory of judgements, and as such cannot readily account for the potential impact of prior events on physiology (as suggested in Klorman, 1974; Krupat, 1974; and Lang, 1970).

There are two major theories that have tried to take contrasts beyond a descriptive analysis. These are adaptation-level theory (Helson, 1964) and anchoring theories (e.g., Parducci, 1965; Upshaw, 1962; Volkmann, 1951). Both were originally formulated to explain contrast effects in psychophysics, and have since been extended to account for social judgement contrast effects.

1. Adaptation-Level Theory

The central assumption of adaptation-level (or AL) theory is that every stimulus is perceived, and hence judged, in relation to some psychological "zero" or "point of perceived neutrality" that represents the level of adaptation of the organism to the stimuli presented (Helson, 1964). This level of adaptation (AL) is a pooled effect of all past and present experience with the stimulus dimension in question. In other words, the perceiver is supposed to compute some kind of "average" of all the stimulus intensities to which s/he has been exposed. The intensity of any given stimulus is then assumed to be proportional to its distance from this "average" value. With every new exposure to a stimulus discrepant from this average, the average will change: the AL will be "pulled" in the direction of the new stimulus. A contrast effect is demonstrated on subsequent judgements because they are made based on the new AL.

According to Helson, adaptation levels are established by pooling the effects of three classes of stimuli. The first class is called focal stimuli. These stimuli are the center of an individual's attention and are usually the ones being judged. The second class is called background stimuli. These are other stimuli that occur closely in space and/or time to the focal stimulus, providing the immediate background against which a focal stimulus is judged. The final set is called residual stimuli. These are stimuli that are not current for the observer, but are the residue of stimuli experienced in the past. Helson defined adaptation level quantitatively as a weighted product of the three classes of stimuli. Because all three stimuli contribute to the equation, modifying one can lead to changes in AL. This has implications for the permanence of contrast effects. Removing the background stimulus means that AL is determined on the basis of only two variables: the focal and residual stimuli. This results in a shift in AL back to its previous value (i.e. before the background stimulus was introduced), and the contrast effect disappears.

In terms of subjective ratings, AL is defined as the stimulus intensity rated as "medium" or "neutral " on a judgement scale. This definition assumes that the subject is matching the centre point of the scale to his "point of perceived neutrality". As this point changes, so will the values of the stimuli judged as neutral. The subject's task is therefore assumed to be one of judging the distance of each stimulus from the prevailing AL.

With regard to contrast effects in fear, AL theory suggests that if individuals are exposed to a highly fearful stimulus for a sufficient period of time, they will "adapt" to this high level of fear. As a result of this rise in AL, other fearful stimuli will be experienced as less frightening. Similarly, if individuals are exposed to only a slightly fearful situation, they will adapt to a low level of fear, thereby lowering AL, resulting in increased fear of other fearful stimuli.

2. Anchoring Theories

Several researchers (e.g., Parducci, 1965; Upshaw, 1962; Volkmann, 1951) disagree with Helson's view that contrast effects reflect changes in actual sensory experience. Instead, they argue that the effects are merely semantic. Prior context influences the language with which the stimulus is labeled, rather than the actual experience of it. They argue that when judges are asked to rate a stimulus along a response scale, they align the scale with the range of stimuli they expect to judge. Thus, if all contextual stimuli are toward one end of a scale (e.g., lighter on a weight scale), the judges will position the response scale toward the light end of their subjective continuum. As a result, judges who expect to rate generally light weights will make higher ratings of a target stimulus than will judges who expect to evaluate a set of heavier weights. Such contrast effects on reported judgements reflect only different anchoring of the response scale, rather than changed attitudes or perceptions of the stimulus.

Anchoring theories are most applicable to research paradigms that involve the presentation of a series of contextual stimuli reflecting one end of a continuum (e.g., a neutral facial expression embedded in an array of positive expressions, or a moderate weight after a series of light weights). Under these conditions, an expectation about the range of stimuli to be evaluated is easily created, and subjects consequently adjust their anchor points accordingly. Anchoring theories imply that in the absence of contextual manipulations individuals expect to rate a broader, more balanced range of stimuli.

Anchoring theories have some difficulty accounting for contrast effects when only one contextual stimulus is utilized. It is not likely that this would be sufficient to cause subjects to change their expectations about the range of stimuli to be presented. The only way that a shift in an anchor point would occur is if the one contextual stimulus was so extreme that it fell outside the subject's expected range of stimuli. Upon presentation of it, subjects would have to extend the appropriate end of their rating scale to incorporate it.

Like AL theory, anchoring explanations imply that contrast effects are transient - once the context is removed, rating scales should shift back to their original position because no permanent changes in perception have occurred.

Although anchoring theory is different from adaptation-level theory, there is considerable overlap in the predictions they make. Expansion of the stimulus range by the introduction of anchors also leads, in most situations, to a shift in the value of AL predicted by Helson's theory, and to a contrast effect. Thus, simply demonstrating the occurrence of such contrast effects does not confirm one of the models as opposed to the other.

Early comparisons of the models, using psychophysical stimuli, were limited to a number of specific predictions involving parameters such as the interval properties of the judgement scale, the role of subject's expectations, and various features of the stimulus distribution. In an extensive review of this research, Eiser and Stroebe (1972) conclude that there is partial evidence for both theories. However, they prefer the anchoring theory because although it "has fewer of the trappings of a "grand theory" about it than AL Theory, ...it is by far the more economical in its assumptions and accurate in its predictions."

With the application of these theories to social judgement research, the central issue became whether contrast effects reflect changed perceptions or attitudes, rather than simply differential anchoring of the rating scale. The importance of this distinction becomes apparent in considering the effects of judgements on subsequent behaviour toward the target stimulus. To the extent that the contrast effect on judgements is due simply to shifts in response scales, without any changes in underlying beliefs about the object, the effect would not be expected to change behaviour. If, on the other hand, the effect involves changes in the subjective experience of the object, it should generalize to overt behaviour toward the target. Studies that have explored the relationship between contrast effects and behaviour provide some evidence for a perceptual interpretation.

In a previously mentioned study by Pepitone and DiNubile (1976), contrast effects were demonstrated in ratings of crime severity. Interestingly, judgements about the personality of the offender, and about appropriate punishment for him also shifted as a result of the contrast. Not only did subjects in the assault-homicide sequence rate the murder as more serious, they also judged the offender as having poorer moral character and less potential for rehabilitation. Finally, they recommended more punishment for him. A logical assumption is that the subjects viewed the offender more negatively because his crime was actually perceived to be more serious. This interpretation suggests that the contrast effect reflected a perceptual change, rather than simply a shift in the crime severity rating scale. However, there remains the possibility that changes in one response scale can mediate changes in cognitively related scales in the absence of perceptual shifts. Thus, the behavioural effects can be absorbed by either adaptation-level or anchoring theory.

Herr (1986) produced contrast effects by priming subjects with exemplars of extremely hostile and nonhostile social categories. This manipulation not only affected the judgement of an ambiguously described target person, it also affected behaviour directed toward that target. After rating the target on a number of different dimensions, including hostility, subjects participated with that person in a modified prisoners' dilemma game. Those subjects who rated the target as more hostile began the game more competitively. Those who rated the target as less hostile were more cooperative. By the end of the game, however, the subject's behaviour became more consistent with the actual behaviour of the target person.

Sherman, Ahlm, Berman and Lynn (1978) argue that behavioural changes resulting from contextual manipulations do not necessarily reflect an adaptation process as described by Helson (1964). Rather, it may be the actual rating of the target, whatever its basis, that influences subsequent behaviour. In other words, how one rates a given stimulus has an impact on subsequent behaviour toward it. If ratings are modified, as in contrast effect studies, behaviour is also changed to remain in line with them.

Sherman and his colleagues further specify that whether or not one's ratings will serve as a basis for subsequent behaviour depends upon the salience of the ratings. Only when the rating is salient (thereby capturing the individual's attention), is it likely to influence behaviour. Adaptation-level theory views the salience of the ratings as irrelevant to subsequent behaviour, because it is the contextual stimuli themselves that have a direct effect on behaviour. In other words, the individual's ratings of the target, as well as any other behaviour associated with it, are all the result of actual changes in perception. Sherman and his colleagues argue that there is no perceptual shift, but rather that changes in overt ratings mediate changes in other behaviour. In order for the ratings to impact on subsequent behaviour, they must be salient to the individual.

To examine these issues, Sherman et al. had subjects judge the importance of a target issue (recycling) in the context of either important or unimportant social issues. Subjects were subsequently asked in a separate setting for help on a local recycling project. Half the subjects were in a high salience condition, in which a confederate called attention to the subject's rating of the recycling issue just prior to the request for help. Under low salience conditions, no special attention was called to the recycling rating. As expected, contextual manipulation produced contrast effects on rating scale judgements of the importance of recycling. However, only if these judgements were made salient did they have an impact on behavioural support of the recycling project. The authors conclude from these findings that contrast effects on ratings are response based rather than perceptual in nature. If the context had induced perceptual changes, subsequent behavioural effects paralleling recycling ratings should have occurred irrespective of the degree of salience of these ratings. This argument is further supported by the inclusion of a control group in which a contrast was induced and then its effect examined on subsequent behaviour <u>without</u> having the subjects make any ratings beforehand. The results were similar to the low salience condition: contextual manipulations did <u>not</u> lead to contrast effects in behaviour.

The argument that changes in behaviour are actually the consequence of making overt ratings is a powerful one that can be applied to much of the research in this area. Subjects in most studies are not asked to engage in behaviour relevant to the target until they have rated it on some dimension. There is, however, another approach to the question of the mediational role of ratings. This is to consider whether contrast effects have been demonstrated using measures that cannot be directly modified by the subject. Studies that include physiological indices of contrasts are relevant in this regard.

In Krupat's (1974) research examining feelings of safety during a driving simulation film, not only did self-report measures reflect a contrast effect, so, too, did skin conductance measures. Subjects previously exposed to the unsafe film were less physiologically aroused than were subjects who had seen the safe film. This is clearly not a rating scale effect, nor could one persuasively argue that subjects changed their GSR to be consistent with their subjective reports of safety. In a similar vein, Lang (1970) and Klorman (1974) demonstrated group differences in heart rate patterns associated with fear as a function of prior context. Because of the limitations of these investigations (as previously discussed), the impact of contrasts on physiological measures needs further investigation.

In summary, research to date on contrast effects has shown that this is a robust phenomenon, demonstrated using a wide variety of stimuli. Priming studies suggest that the tendency for individuals to compare and contrast incoming information is so strong that it can occur outside of awareness.

Despite considerable research on this topic, its parameters have yet to be defined. The temporal relationship between the context and the target stimuli has not been examined, nor has the issue of the stability (or transience) of the effect over time been addressed.

Finally, the theoretical underpinnings of contrast effects remain uncertain. The central debate is whether they are the product of actual perceptual changes, or whether they simply reflect shifts in the rating scale used to judge the target stimulus. There is some evidence from research assessing behavioural and physiological changes that at least in some cases, contrast effects are perceptual in nature. However, this is still an unresolved issue.

Contrast Effects and Theories of Fear Reduction

If contrast effects are demonstrated in fear reduction procedures, existing theories of fear should be broad enough to encompass this finding. The two most current and widely supported of these theories are network theory (e.g., Lang, 1985, 1988) and habituation (Wilson & Davison, 1971; Rachman, 1978). In the following sections they will be evaluated with regard to their ability to account for contrast effects in fear. Specifically, the following pattern of results would require explanation. Subjects who experience a high level of fear prior to exposure to a moderately fearful stimulus find the second stimulus <u>less</u> frightening than subjects who experience a moderate amount of fear on both occasions. Subjects who experience a low level of fear prior to exposure to a moderately fearful stimulus find the second stimulus <u>more</u> frightening than subjects who experience a moderate amount of fear on both occasions.

1. Network Theory

The network theory is an information processing explanation of emotion. It was not developed specifically to explain contrast effects, but rather to account for the structure of emotions. Nevertheless, as a comprehensive theory of emotion, it should be able to account for contrast effects in fear.

According to Lang, information about affective stimuli and about responses are represented in associative memory. This information is structured in the form of a conceptual network. Concepts in the network are linked to each other via shared structures. An affect network is activated when external cues match concepts in the network. Such activation results in an emotional product. The match can occur in a variety of ways. For example, the appearance of a live snake, matching all stimulus concepts, readily activates the "snake phobia" network, producing subjective fear and avoidance. However, a degraded stimulus (e.g., a plastic snake) might prompt the same fear reaction, if some of the response information in the network were already activated. This might occur, for example, if an individual was already experiencing sympathetic arousal. In a similar manner, one affective state can enhance another. Zillmann (1983), for example, has shown that prior sexual arousal can potentiate aggression. Barlow, Sakheim and Beck (1983) have shown that fear can enhance sexual arousal. The network model presumes that these effects are mediated by the fact that the two emotions share some elements of a response structure.

At best, network theory can provide a partial explanation of contrast effects. If subjects are exposed to a highly fearful stimulus for a sufficient period of time, the fear network is activated, and when the stimulus is presented a second time, fear levels should be enhanced. Further, the greater the fear during the first exposure, the more likely it is that the network will be activated, and therefore the greater the fear response during the second exposure. This is the opposite pattern to contrast effects, where high fear of a stimulus on the first occasion should lead to reduced fear on the second occasion.

There is, however, one crucial variable that must be taken into account: the elapsed time between the first and second exposure. If this period is relatively brief, the first exposure should enhance fear during the second exposure. However, if there is a sufficient delay, two possibilities exist: 1) activation of the fear network will subside, leaving no mark on fear levels at the second exposure (unfortunately, Lang does not specify how long a fear network stays active). 2) Prolonged exposure to the first stimulus could lead to a change in the fear network - i.e. a reduction in fear of the stimulus - which would be reflected in reduced fear during exposure two. (Once again, Lang does not specify the conditions under which a fear structure is merely activated versus modified.) Although, the second possibility could explain the contrast effect of reduced fear when one moves from high to moderate fear, it does not explain why an increase occurs when one goes from low to moderate fear, or why there is no change when one moves from moderate fear to moderate fear. If pressed, the latter finding might be accounted for by hypothesizing that a certain level of fear must be attained for sufficient activation of the network. But one is still left with an inexplicable increase in fear as a result of low level exposure on the first trial. Lang might say that low levels of initial fear actually sensitize subsequent fear. However, this makes little theoretical sense, and at best provides us with an unparsimonious explanation of contrast effects.

2. Habituation Theory

According to habituation theory, the repeated presentation of a feared stimulus is followed by a decrement in responding; with repeated or prolonged exposures to the stimulus, fear gradually reduces.

Perhaps because of the simplicity of habituation theory, it falls short when attempting to explain contrast effects in fear. The theory can easily account for a decrease in fear after exposure to a high fear stimulus. In fact, this is the basis of the theory: exposure leads to fear reduction. The theory cannot, however, explain an increase in fear following exposure to a low fear stimulus. Habituation theory predicts that a low level of exposure should lead to a slight decrease in fear. As with network theory, sensitization is the only possible explanation for an increase in fear, but it is not likely that this would occur at low fear levels.

Functional and Subjective Dependency of Fears

The fact that habituation and network theories can account for decreases in fear when one shifts from a highly fearful to a moderately fearful situation presents an interpretive problem for research on contrast effects in fear. As mentioned previously, because of possible habituation, the results of Krupat's (1974) research on fear during a driving film could not clearly be attributed to contrasts. If contrast effects are to be unambiguously demonstrated, one must be able rule out an habituation explanation. One method of achieving this is to use <u>two</u> fearful stimuli when conducting the contrast experiment. One stimulus would be used to create the context, and the other to assess its impact. For example, with subjects who are fearful of both spiders and snakes, one animal could be used for each purpose. Provided that habituation to the first animal does not result in habituation to the second, then any reduction in the second fear would have to be a result of contrast effects. However, recent research suggests that exposure to one stimulus can have an impact on another. Rachman and Lopatka (1986) demonstrated that in some individuals (about 25% of their sample), animal fears are connected such that a decrease in one (via exposure) leads to a decrease in another. For the purposes of the present investigation it would therefore be necessary to demonstrate that exposure to a high fear stimulus leads to a decrease in fear of a subsequent stimulus, <u>independent of the relationship between the two stimuli</u>. If this can be demonstrated, habituation cannot account for the results. However, if such an effect is demonstrated only in subjects whose two fears are functionally dependent, then habituation is a more likely explanation.

The method that Rachman and Lopatka (1986) used to assess functional independence of fears is simple, and could easily be incorporated into a contrast study. Their procedure is based on the idea that if two fears are not functionally related, a deliberately induced change in one of the fears will leave the second fear unchanged. If the two fears are functionally dependent however, a deliberate change in one fear will be followed by a change in the second fear. Rachman and Lopatka first assessed each subject's response to the fearful stimuli. They then reduced or eliminated the fear response to one of the stimuli. The person's subsequent reaction to the "untreated" remaining fear provided an index of the extent to which the two original fears were inter-related.

Rachman and Lopatka also had subjects rate the extent to which they thought their fear reactions to the two stimuli were similar. These self-estimated judgements were made on a scale that ran from 0 (not at all similar) to 100 (totally identical). The authors discovered that this rating was unrelated to the functional dependence of the stimuli. In other words, there was no relationship between the subject's own estimation of the similarities between the two fears and the response of these two fears to experimental manipulation. In the present investigation, both functional and subjective independence were assessed. These assessments took place during the second session of the experiment so that they would not interfere with the demonstration of contrast effects.

The use of two different stimuli may control for the effects of habituation, but it is unclear what impact this will have on the demonstration of contrasts. According to Helson's adaptation-level theory, contrasts should still occur. Based on this theory, the only features of the contextual stimulus that affect ratings of the target stimulus are those that contribute to the actual dimension being judged. All other stimulus characteristics are considered irrelevant because they have no impact on AL, and therefore, no impact on contrast effects. To take an example from the psychophysics research, if subjects are asked to judge the weights of a series of objects, their judgements should not be influenced by, say, any differences in colour between the different stimuli, since such extraneous variation should have no effect on their AL for weight. In terms of our fear study, this means that a number of different fearful stimuli (e.g., spiders, snakes, enclosed spaces) could be used to shift an individual's AL for fear, and thus to demonstrate contrast effects. Helson, himself, however, has modified this position, largely as a result of research demonstrating that for contrast effects to occur, the anchor stimulus must be seen by the subject as relevant to the other stimuli being judged (Bevan & Pritchard, 1963; Brown, 1953). To account for these findings, Helson has added that different classes of objects may have different and unrelated AL's. Unfortunately, such classification processes do not fit easily into AL theory because the theory assumes that changes in judgement are fully accounted for by changes in the sensitivity of the organism to stimulation - the source of that stimulation should be irrelevant.

The introduction of different classes of stimuli is not problematic for anchoring theory. If subjects are to use a contextual stimulus as a basis for anchoring their rating scale, they must first view that stimulus as being relevant to the dimension they are rating.

With reference to the present investigation, the notion of classification suggests that contrast effects should occur only if subjects view the first stimulus as belonging to the same class as the second. If ratings of similarity can be considered a measure of this, then contrast effects should be dependent upon these ratings.

Thus anchoring theory and the modified version of adaptation-level theory suggest that contrast effects should be linked to subjective ratings of similarity between the two stimuli, but not necessarily to their functional dependence.

Network theory holds the opposite view. Functional dependence, rather than subjective similarity is crucial for one fear to have an impact on another. Within the network paradigm, functional dependence can be construed as an indication of the strength of association between two simple fear networks. If two fears are highly dependent (and thus there are strong links between the two networks), activating one fear structure should lead to activation of the second fear structure. Moreover, changes in one should lead to changes in the other.

Habituation theory also emphasizes the importance of functional dependence. One fear can have an impact on another because they share crucial fear elements. For example, shared frightening features of spiders and snakes may be their unexpected movement, or their tendency to lurk in dark corners. In the present study, changes in the fear of the second stimulus (and therefore contrast effects) should occur only if the two stimuli have shared critical elements. But if they have shared elements, they should also demonstrate functional dependency. Thus, according to habituation theory, contrast effects and functional dependency should be correlated.

Excitation Transfer Theory of Emotion

Excitation transfer theory (Zillmann, 1971) provides a description and explanation of the manner in which two emotional experiences are integrated. Because it pertains to sequences of emotional experience, it has particular relevance to the present investigation in which the interaction of two fearful situations is of interest.

Excitation transfer has its roots in the cognition-arousal theory of emotion (Schachter, 1964; Schachter & Singer, 1962), and thus they share core elements. According to Schachter and his colleagues, an emotional state is the product of an interaction between two components, physiological arousal (characterized as heightened sympathetic activation) and a cognition about the cause of that arousal. Since arousal is perceived as emotionally non-specific, it determines only the intensity of emotional states, while cognitions determine their quality.

Excitation transfer theory has two major premises: (a) sympathetic activity does not terminate abruptly, but dissipates slowly; and (b) individuals often fail to attribute sympathetic activation accurately to more than one cause. Based on these premises, the theory predicts that, in certain circumstances, residual arousal from a prior situation will combine with the arousal induced in a subsequent situation, thereby intensifying the emotional experience in the latter context. It is further proposed that for this effect to occur, the individual must mistakenly attribute all the arousal experienced in the second context to the emotional stimuli present there.

A number of studies have supported these basic predictions. For example, it has been shown that physical exertion can intensify feelings of anger and aggressive behaviour (e.g., Zillmann et al, 1972) and heightened sexual excitement (Cantor, Zillmann & Bryant, 1975); and that residual sexual arousal can promote aggression (e.g., Zillmann, 1971) and the enjoyment of music (Cantor & Zillmann, 1973). (For reviews see Reisenzein, 1983; Zillmann, 1978, 1983).

Several studies have also demonstrated that these effects are mediated by inaccurate attribution of physiological arousal. Thus, excitation transfer will occur only if the individual is placed in a second situation after obvious physiological arousal linked to the first situation has declined, but before the more subtle residual excitation has dissipated (Cantor et al, 1975). Also, transfer effects can be blocked by suggesting to the subjects that there is a causal link between the first arousing situation and their physiological responses during the second situation (Younger & Doob, 1978).

Several reviews of excitation transfer research conclude that there is a good deal of evidence demonstrating the phenomenon and supporting Zillmann's mediational interpretation of it (e.g., Reisenzein, 1983; Zillman, 1983).

Excitation transfer theory has important implications for contrast effects involving affective arousal. The theory can, for example, explain the results of the previously described experiment by Manstead, Wagner and MacDonald (1983). In that study, a comedy film was shown to intensify emotional reactions to horror films, and horror films were shown to intensify reactions to comedy films. This pattern of results is not necessarily indicative of contrast effects. It is possible that the intensification of the emotional experience in the latter context was due to the residual arousal from the prior film combining with the arousal induced by the second film.

One of the goals of the present research is to demonstrate that a high level of fear in one situation, leads to a decrease of fear in a subsequent fearful situation. However, if the second stimulus is presented at a time when the subject is still physiologically aroused from the first, then excitation transfer will occur, potentially causing an <u>increase</u> in fear of the second stimulus. The timing of the presentation of the second stimulus thus becomes a critical issue. To avoid excitation transfer, presentation must not occur until all arousal induced by the first stimulus has dissipated.

Research on excitation transfer has typically used exercise as a means of increasing arousal. Cantor, Zillmann and Bryant (1975) found that it took almost nine minutes for both heart rate and systolic blood pressure to return to baseline after one minute of riding a stationary bicycle. Zillman and Bryant (1974) compared one minute of bike riding with a disc threading task. Cycling produced substantial increases in heart rate and blood pressure, while disc threading yielded negligible changes only. Six minutes after the tasks, residual excitation derived from the bike task had decayed to a level such that arousal from the two tasks no longer differed. In both these studies, the heart rate increase resulting from exercise is much greater than is typically found in our lab when we expose individuals with small animal fears to fearful stimuli. On average we obtain heart rate scores of about 100 b.p.m., whereas cycling seems to increase heart rate to about 130 b.p.m. This suggests that it should take less time for the physiological arousal to dissipate in our research. Nevertheless, to be absolutely certain that there is no residual arousal, the present study encorporated a ten minute rest period between the first and second exposure.

With regard to contrast effects, the impact of waiting ten minutes before presenting the target stimulus is unknown. As previously mentioned, the common practice is to present it immediately after the contextual stimulus. Given the robust nature of contrasts, it is believed that they will withstand this necessary change in procedure.

<u>Research Hypotheses</u>

On the basis of the literature reviewed, we believe that contrast effects can be demonstrated in fearful situations. Specifically, it is hypothesized that:

(1) prior exposure to a stimulus causing a <u>high</u> level of fear will result in <u>reduced</u> fear of a moderately fearful stimulus.

(2) prior exposure to a stimulus causing a <u>low</u> level of fear will result in <u>greater</u> fear of a moderately fearful stimulus.

Moreover, it is hypothesized that:

(3) contrast effects reflect <u>perceptual</u> shifts, as opposed to

merely changes in the use of rating scales.

Hypothesis 3 leads to the prediction that contrasts will be evident in physiological, as well as self-report measures of fear.

The majority of studies on contrasts do not address the issue of awareness. Those that have specifically examined awareness have gone to elaborate lengths to conceal the relationship between the contextual and the target stimulus. Under these conditions, contrast effects have been shown to occur outside subjective awareness. There is, however, no reason to expect that within the usual experimental paradigm, subjects are unaware of contrasts. Stated formally, Hypothesis 4 is as follows:

(4) Individuals are generally aware of the occurrence of contrasts.

There is no research examining the stability of contrast effects over time. Theoretical explanations imply that, at least in laboratory settings, contrast effects are transient, lasting only as long as the contextual manipulation stays in place. This view is expressed in Hypothesis 5:

(5) Experimentally induced contrasts are transient in nature.

We do acknowledge the possibility that under less artificial conditions, involving highly meaningful experiences, contrast effects may be more stable.

The hypothesized decrease in fear as a result of prior exposure to high levels of fear can potentially be accounted for by current theories of fear (i.e. network theory and habituation). In other words, the notion of a contrast need not be applied. However, when two different stimuli are used (i.e. one to create the context and the other to assess its effect), both these theories predict that the high fear stimulus will have an impact only if it is functionally related to the target stimulus. A contrast effect explanation does not require this. It is our position that contrast effects reflect a different process than that proposed by habituation or network theories of fear. Thus, if two different stimuli are used, the demonstrated contrast effect is not expected to be dependent upon the functional relatedness of the two stimuli. However, the two theories put forth to account for contrasts do stipulate that individuals must view the contextual stimulus as being relevant to the target stimulus. It is therefore hypothesized that this condition must be met for contrasts to occur. Stated formally, Hypotheses (6a) and (6b) are as follows:

(6a) Contrast effects are not dependent on the functional relationship of the two stimuli.

(6b) Contrast effects are dependent upon the extent to which individuals perceive the stimuli to be related.

Interestingly, there is no current theory of fear that can adequately account for the hypothesized increase in fear after exposure to a low fear situation. If this effect is shown, it will be the first unequivocal demonstration of contrast effects in fear.

To test the six research hypotheses, we need to recruit subjects with demonstrated fears of two stimuli. We must assess these fears in terms of both self-report and physiology. We also require measures of the subjective similarity of the two fears, and of their functional dependence. In addition, we must assess awareness of contrasts, and their stability over time.

Experiment 1: A Search for Contrast Effects with Fear Evoking Stimuli

Experimental Rationale

This investigation was designed to demonstrate contrast effects in fear in a sample of university undergraduates fearful of spiders and snakes.

Subjects and Recruitment

The subjects in this experiment consisted of undergraduate students with fears of spiders and snakes. It was expected that a large percentage of the participants would be female because they are more likely to report and display fears of small animals (Rachman, 1978). It was not considered necessary to collect equal numbers of male and female participants, but rather to allow the sample to reflect population proportions.

Subjects were invited to participate on the basis of their responses on the Fear Survey Schedule (see Appendix A). Because this is a self-report measure, it was essential that behavioural evidence of fear be collected as well. To verify that subjects experience fear when exposed to the target stimulus, a Behaviour Avoidance Test (BAT) is usually conducted. This procedure, based upon research pioneered by Lang and Lazovik (1963), consists of asking subjects to approach and touch the feared target object. Those subjects who make physical contact with the object are excluded from the study, and, for those who remain, the degree of physical approach is taken as an index of fear. BATs are usually administered at the beginning of the experiment so that nonfearful subjects can be excluded right away. However, for the present investigation, doing the BAT at the start of the experiment was problematic because of interference with the experimental manipulation. This manipulation involved exposing individuals to high, moderate or low levels of fear. Administering an initial BAT results in all subjects experiencing a high level of fear prior to the experimental manipulation. This could potentially affect ratings of fear during the experimental manipulation, as well as during exposure to the target stimulus. To avoid this interference, the BAT was conducted during the second session, after the effects of the experimental contexts were fully assessed. This timing had the added benefit of assessing fear levels immediately prior to the fear reduction phase of the experiment. The only drawback was that nonfearful subjects could not be screened out immediately.

To ensure that the BAT was a useful screening device, a number of procedures as outlined by Bernstein and Paul (1971) were followed. Subjects were not asked to do something with the target stimulus that they would probably not know how to do. For example, asking subjects to pick up organisms with which they may be unfamiliar (such as spiders and snakes) may lead to avoidance simply because subjects do not know how to go about handling them. Therefore, the BAT in this investigation consisted of asking subjects simply to touch the stimulus, rather than handle it.

Another potential influence upon the subjects' behaviour during BATs is the content and presentation of instructions. It is likely that subjects told to approach and touch the target may be more likely to do so than those given similar instructions, but asked to do only what is comfortable for them (Bernstein & Paul, 1971).

While specific factors such as instructions and target familiarity play an important part in subject performance during a BAT, perhaps the most crucial influences are the context variables. These include mainly the rationale for the subject's presence at the BAT and the demand characteristics operating within it. Most subjects participating in a BAT know that they are there because of their reported fear, that their fear is being measured by the test, and possibly that failure to demonstrate some degree of fear will eliminate them from the project. In the present experiment, these demand characteristics were less powerful because the BAT did not occur at the beginning of the experiment and thus its purpose was less obvious. Also, subjects were not concerned about being excluded from the experiment because they had already participated in most of it.

Fear Reduction Techniques

Following Rachman and Lopatka's (1986) procedure, the functional dependence of two fears was assessed by reducing or eliminating the fear response to one of the stimuli. The person's subsequent reaction to the "untreated" remaining fear provided an index of the extent to which the two original fears were inter-related. The technique used to reduce one fear was a modified version of behaviour therapy for clinical phobias. Typically, this approach is done on an individual basis and involves in vivo presentation of stimuli. Treatment consists of gradual, graded exposure to the feared stimuli and therapist modelling. The patient is in control of the speed of exposure. These elements were incorporated in the fear reduction procedures of the present investigation. However, treatment differed from that of a clinical setting in that it took place in the laboratory under more controlled, truncated conditions. A detailed description of the treatment is presented in the "Methods" section of this paper. For the present purposes, it is important to state that the approach has been used in many other investigations and has been noted to have "remarkable and rapid 'therapeutic' power" (Grey, Sartory & Rachman, 1979).

Timing of Stimulus Presentation

Of critical importance in this investigation is the elapsed time between presentations of the context and target stimuli. On the basis of excitation transfer theory (previously discussed), if residual arousal (from the first stimulus) is present during exposure to the second stimulus, this will likely enhance the fear of the latter. This would be particularly so in the high fear group where residual arousal would be expected to be strongest. The net result would be to wipe out the expected contrast in this group. In the low fear group, if residual arousal is present, it would enhance fear of the target stimulus, thereby confounding excitation transfer effects with contrast effects.

Clearly, the best approach is to allow enough time for arousal to completely dissipate. On the basis of available research (discussed previously), it was decided that ten minutes is sufficient time for this process to occur.

Dependent Measures

The dependent measures for assessing fear were chosen in keeping with Lang's three-systems model of fear reactions. Lang (1970) described such reactions as being comprised of three loosely-coupled components - behavioural, physiological and verbal. These components are highly interactive yet also partially independent, and thereby capable of responding differentially at any given time. For this reason, it is essential to assess all three systems in order to completely measure fear reactions. For the present investigation, approach/avoidance served as the behavioural measure, anticipatory heart rate as the physiological measure and subjective units of distress scales (SUDS) as the self report measure. Although electrodermal activity has been used as an index fear, it is generally agreed that heart rate is the best measure (Cook, Melamed, Cuthbert, McNeil & Lang, 1988; Cuthbert & Lang, 1989; Hugdahl, 1989; Lang, Melamed & Hart, 1970; Marks & Huson, 1973; Mathews, 1971; Ost, 1989; Prigatano & Johnson, 1974; Sartory, 1989; Sartory, Rachman & Grey, 1977).

Subjective awareness of contrast effects was assessed indirectly by asking subjects to make predictions about their fear responses. A more direct measure was considered inappropriate because of its potential influence on actual fear responses.

Perceived similarity of the two fears was assessed because of its possible role as a mediator of contrast effects.

Research Predictions

In the present investigation, the effects of one fearful situation upon another were examined. The hypotheses presented in the previous section stem from the view that (a) the interaction of certain fearful events will result in a contrast effect and (b) that contrast effects are perceptual in nature. Based on these two points, our hypotheses are most consistent with adaptation-level theory. The three remaining theories (Anchoring, Habituation and Network) differ in their view of the underlying processes involved in the interaction of two fearful events. Consequently, specific predictions about the effect of fearful contexts on subsequent fear reactions differ according to each theory.

To avoid confusion, a table has been created with the major hypotheses and predictions, and the expected pattern of results for each of the theories discussed. The predictions are phrased in accordance with our hypotheses. Beside them is indicated whether the four major theories support or do not support the prediction.

Hypotheses (H) and Predictions (P)	Theory A-L	A	H	N
H.1: Prior exposure to a stimulus causing a high level of fear will result in reduced fear of a moderately fearful stimulus.				
P.1: Subjects who experience a high level of fear prior to exposure to a moderately fearful stimulus will report that the second stimulus is less frightening than will subjects who experience a moderate amount of fear on both occasions.	A	A	A	A
H.2: Prior exposure to a stimulus causing a low level of fear will result in greater fear of a moderately fearful stimulus.				
P.2: Subjects who experience a low level of fear prior to exposure to a moderately fearful stimulus will report that the second stimulus is more frightening than will subjects who experience a moderate amount of fear on both occasions.	A	A	D	D
H.3: Contrast effects reflect perceptual shifts, as opposed to merely changes in the use of rating scales.				
P.3: Subjects who experience a high level of fear prior to exposure to a moderately fearful stimulus will demonstrate a reduced heart rate response to the second stimulus compared with subjects who experience a moderate amount of fear on both occasions.	A	D	N/A	N/A
P.4: Subjects who experience a low level of fear prior to exposure to a moderately fearful stimulus will demonstrate greater heart rate response to the second stimulus compared with subjects who experience a moderate amount of fear on both occasions.	A	D	N/A	N/A
H.4: Individuals are generally aware of the occurrence of contrasts				
P.5: Subjects will predict that a contrast effect will occur. (Note that prediction is considered a measure of awareness)	A	A	N/A	N/A

Note: A = Agree, D = Disagree, N/A = Not Applicable

A-L = Adaptation-Level, A = Anchoring, H = Habituation, N = Network

Hypotheses (H) and Predictions (P)	Theory A-L	A	H	N
H.5: Experimentally induced contrasts are transient in nature.				
P.6: The effects of prior fearful contexts (as described in predictions 1,2,3 & 4) will <u>not</u> be evident when subjects are reassessed one week later.	A	A	N/A	N/A
H.6a: Contrast effects are <u>not</u> dependent on the functional relationship of the two stimuli				
P.7: The impact of one fearful stimulus upon another will <u>not</u> depend upon the extent to which the two fears are functionally related.	N/A	N/A	D	D
H.6b: Contrast effects <u>are</u> dependent upon the extent to which individuals perceive the stimuli to be related.				
P.8: The impact of one fearful stimulus upon another <u>will</u> depend upon the extent to which <u>subjects rate the stimuli as being similar</u>.	A	A	D	D

<u>Note</u>: A = Agree, D = Disagree, N/A = Not Applicable

A-L = Adaptation-Level, A = Anchoring, H = Habituation, N = Network

Method

To test these predictions, subjects with intense fears of two harmless animals (spiders and snakes) were recruited. They were randomly assigned to one of three experimental conditions, and, with the exception of the screening procedure, were individually tested. To demonstrate contrast effects, all subjects had to be exposed on separate occasions to two fearful stimuli. Spiders and snakes (randomly ordered) were used for this purpose. The first exposure session was manipulated so that experimental groups would differ in the amount of fear evoked by the stimulus (high fear, moderate fear, and low fear). Exposure to the second animal was designed to produced a moderate level of fear in all subjects.

To test the stability of contrast effects, individuals came back after one week to have their fear levels reassessed. Finally, to determine if contrast effects are dependent upon a demonstrated connection between the two animal fears, one of them (chosen at random) was reduced during the second session.

The following sections of this paper provide a detailed description of the way in which the procedures were carried out.

Subjects and Design

Seventy-five UBC undergraduate students with a demonstrated fear of spiders and snakes were the participants in this experiment. Sixty-eight (94%) were females. All subjects received course credit in return for their participation. They were tested in a laboratory setting on two occasions, one week apart.

The experiment was conceptualized as a between-groups design. The between-subjects factor was the level of fear experienced during the first exposure (high, moderate, low).

Experimental Design

	Exposure 1	Exposure 2
Group 1	High Fear	Moderate Fear
Group 2	Moderate Fear	Moderate Fear
Group 3	Low Fear	Moderate Fear

Experimenters

Two experimenters were required to carry out this investigation. In session one, the role of the first experimenter was to conduct the initial exposure trial. A senior graduate student (female) in clinical psychology carried out this procedure.

The role of the other experimenter was to conduct the exposure to the second animal. Two female undergraduate psychology students served in this capacity.

During the second session, fear levels of the target stimulus were reassessed, and then desensitization of one fear was undertaken. Only one experimenter was required to carry out these procedures. The graduate student who served as the first experimenter in session one conducted the second session.

To prevent experimenter bias in session one, the second experimenter was blind to the research hypotheses. In addition she was not told the experimental condition of the subjects (i.e. whether the subject had been exposed to a high, moderate or low amount of fear prior to the second exposure). As an added precaution, subjects were instructed not to talk to the second experimenter about earlier procedures.

Procedure

This investigation is divided into the following three sections:

(a) Screening and Selection

Fear Survey Schedule

(b) Session One

Prediction of fears for stimulus 1 and 2
Selection of approach point for stimulus 1
Exposure to stimulus 1
Ten minute rest period
Selection of approach point for stimulus 2
Exposure to stimulus 2

(c) Session Two

Reassessment of fear (stim.2)
Determining Closest Approach Points
Fear reduction
Reassessment of fear
Debriefing

Presented below is a diagram of the procedures involved in this experiment (after initial screening) and the points at which data were collected:

Session 1					
1 Ss. seated consent form (4 min. adapt.)	DATA HR	2 pred made (spider/snake)	3 Ss select distance stim.1	4 Ss exposed to stim.1	DATA SUDS HR DIST

Session 1 (continued)							
5 After 3 min. exposure	DATA SUDS HR DIST	6 10 min. relaxation	DATA HR	7 pred made. stim.2	DATA pred. stim.2	8 Ss exposed to stim.2	DATA SUD HR

Session 2										
9 4 min. adapt.	DATA HR SQ PRED	10 Ss exposed to stim.2	DATA SUDS HR	11 BAT 1 BAT 2	DATA SUDS HR CAP	12 FR	DATA DUR SUDS HR	13 BAT 3	DATA SUDS HR SQ

BAT-behavioural approach test
CAP-closest approach point
DIST-distance away from stim.
DUR-duration of fear reduction
FR-fear reduction
HR -heart rate
PRED-prediction of fear
SQ-similarity questionnaire
SUDS-subjective units of distress

Screening

The Fear Survey Schedule (see Appendix A) was administered to students enrolled in undergraduate courses in psychology. Those who indicated on this questionnaire that they were "extremely fearful of" or "terrified of" spiders and snakes were contacted by telephone and asked to participate in the experiment. Twelve percent of participants who completed the questionnaire met this criterion. They were told the following:

"This is _____________ calling from the UBC department of psychology. If you recall, you recently completed a questionnaire for us about fear. At present we are conducting a research project on factors that influence fear and were wondering if you would like to participate. Before you decide, let me tell you a little about our experiment. It consists of two sessions, one week apart, each of which will take about half an hour. You will receive course credit for participating. In each session we will be asking you to slowly approach live, harmless animals, of which you may or may not be afraid. On some occasions, we will ask you to predict how fearful you might feel, and at other times, to tell us how frightened you actually are. Of course, you would be free to withdraw from the experiment at any time if you felt the need to. Do you have any questions at all?"

Ninety-five percent of the individuals contacted agreed to participate. All of these were subsequently tested.

Session One

Upon arrival at the laboratory, subjects were seated comfortably in a chair where they remained throughout the experiment. The heart rate monitor was explained to them and clipped to their earlobe. They were then asked to read and sign the consent form (see Appendix B).

Heart rate was assessed with a Sanyo Pulse Meter. This meter has a pulse sensor that clips onto the earlobe. Pulse is displayed with a time count in 7-digit LCD. To assess heart rate, the experimenter recorded the highest single heart rate value over a five second interval.

Prediction of Fears

Participants were asked to make several predictions about their fears of spiders and snakes. They were told the following:

"In our studies on fear, we often ask participants to rate their degree of fear using a "0" to "100" point scale where "0" means you are not at all fearful, and

"100" means terrifying fear. I'd like you to make some predictions for me using this scale. Inside a container, I have a live, harmless garter snake. The snake is about 16 inches long. The lid is off the container, but the snake can't get out. I would like you to tell me how close you would have to get to the snake to experience terrifying fear (i.e. a fear level of 100 on the scale)? How about just a slight amount of fear (i.e. a fear level of 10 on the scale)? And a medium level of fear (i.e. 50/100)? And a fear level of about 30? And finally, a fear level of about 70? Okay, now I would like you to make the same predictions again, only this time imagine that I have a live harmless black spider in a container. The spider is about 4 inches in diameter. The lid is off the container, but the spider can't get out."

The predictions made by the subject for the snake and spider were recorded by the experimenter.

Selection of Approach Point (Stim.1)

Once the subjects had predicted the distances that corresponded to various levels of fear, they then selected from a choice of three distances that would produce high, moderate or low fear. All participants were told the following:

"Now I would like you to approach the spider/snake. How close you get to it depends on the piece of paper you select from this container. They are numbered from 1 to 5, and each number corresponds to one of the distances you just provided me with. Go ahead and select."

In actuality, the subject selected one of three choices (high, moderate and low fear). Once the subject selected a number from the bowl, the experimenter told him/her the task to which it corresponded (i.e. how close the subject would have to get to the animal). Note that by using this procedure the subject assigned him/herself to an experimental condition.

Exposure 1

The experimenter then went over to the stimulus (which was sixteen feet away from the subject) and said the following:

"Inside this container is a live, harmless garter snake/spider. Can you see it from where you're sitting? In a moment I am going to ask you to report the peak amount of fear you are experiencing using the 0 to 100 scale (Remember, "0" is no fear and "100" is terrifying fear). I will move the snake/spider toward you until *distance selected by subject* . When I stop I would like you to report the peak amount of fear you are experiencing using the scale. Please continue to look at the animal at all times. Do you have any questions?" (EXPERIMENTER SLOWLY MOVES SNAKE/SPIDER TOWARD SUBJECT). Now I'd like you to report the peak amount of fear you are experiencing using the 0 to 100 point scale."

If the subject's fear was not exactly as he/she had previously predicted, the experimenter adjusted the distance appropriately. In this manner, subjects in condition 2 always experienced a fear level of 50 and subjects in condition 3 always experienced a fear level of 10. Subjects in condition 1 experienced a fear level ranging from 80 to 100. There was some variability in this group because it was not considered ethical to force all subjects to experience a fear level of 100. For some individuals, a fear level of 80 was the maximum they were willing to tolerate.

The experimenter recorded the subject's reported fear, heart rate, and the adjusted distance (if applicable). She then told the subject the following:

"It is important that we keep your fear level at around *10 or 50 or 80-100* for the next three minutes. I would like you to continue looking at the animal, and if your fear level starts to change, please let me know and I will adjust the distance of the animal accordingly."

Every 30 seconds the experimenter would ask the subject to rate his/her fear level on the 0 to 100 point scale. This enabled the experimenter to monitor the subject's fear, and to adjust the distance of the animal whenever necessary. For subjects in condition 1, it was sometimes necessary for the experimenter to move the animal around in the bowl or take it out of the bowl in order to maintain a high level of fear for three minutes. (The initial exposure was extended to a period of three minutes to ensure a strong anchoring effect).

After exposure to the first stimulus, subjects were told to simply relax in the chair for ten minutes. They were informed that a second experimenter was going to complete the study, and were reminded not to mention any of the earlier procedures to her.

Selection of Approach Point (Stim.2)

Subjects were once again asked to select a slip of paper from a bowl to determine how close they must get to the second stimulus. All the papers in this bowl had the same number on them (although the subjects were unaware of this). This number corresponded to the distance associated with a moderate level of fear. After the subjects were told the distance of their second approach task, they were asked to again predict how much fear they expected to experience doing this task. Their prediction was recorded by the experimenter. The second stimulus was then brought toward the subject in the same manner as the first. However, the distance was never adjusted, and the exposure lasted for five seconds, rather than three minutes. The reported fear score and heart rate were recorded by the experimenter.

Session Two

Reassessment of Fear (Stim.2)

Subjects returned one week later. Upon arrival, they were once again seated in a chair where they remained throughout the session. They were asked to rate on a visual analog scale the extent to which their fears of spiders and snakes were related to each other (see Appendix C). A 10 cm. line with anchor points of 0 and 100 was utilized. The zero end of the line was labelled: "Not at all related" and the 100 mm. point was labelled "Completely related". Subjects placed a mark anywhere along the line that they felt was appropriate.

Subjects were then told that the experimenter was going to bring the second stimulus (from session 1) toward them to the same distance as the previous week. They were asked to predict their peak amount of fear using the fear thermometer. The experimenter recorded the prediction and then brought the animal toward the subject in the same manner as in the first session. Reported fear and heart rate were recorded by the experimenter.

Determining Closest Approach Points

Before fear reduction of one animal could begin, it was necessary to more carefully assess the degree of fear for each stimulus. Subjects were asked to approach each animal until they could go no further. To begin, subjects were seated sixteen feet from the first animal (randomly determined) and told the following:

"Inside the container is the live, harmless garter snake (or live, harmless spider). In a moment I am going to ask you to report the peak amount of fear you are experiencing using the 0 to 100 point scale. I will move the container toward you and when I reach where you are sitting, I would like you to touch the snake (or spider) for five seconds while continuing to look at it. I will tell you when the five seconds are up. If you are unable to touch the animal, please let me know when it is as close to you as you can possibly tolerate? Do you have any questions?" (EXPERIMENTER SLOWLY MOVES SNAKE/SPIDER TOWARD SUBJECT). "Now, I'd like you to report the peak amount of fear you are experiencing using the 0 to 100 point scale."

The subject's reported fear, heart rate, and the distance of the subject to the target stimulus at the end of the approach test were recorded. This procedure was then repeated for the second animal. Those subjects who were able to touch one or both of the animals with a fear level of less than 75 were excluded from the study (i.e. none of their data was analyzed) because they did not demonstrate sufficient fear for the purposes of this investigation. Out of 75 subjects, 9 (12%) were excluded on this basis.

Fear Reduction

Once the subjects had undergone the behavioural approach test, their fear of one of the animals (randomly chosen) was reduced. Subjects remained seated and the phobic stimulus was presented and advanced by the experimenter. To begin, the experimenter stood at a distance equal to the closest tolerated point indicated by the subject during the approach test. The experimenter had the animal with her in a glass container. She gradually approached the subject at a speed that was comfortable for the subject. Once the subject was able to hold the container, the experimenter took the stimulus out of the container and modelled various ways of handling it. The subject was encouraged to look at and to handle the phobic stimulus. In addition, s/he was asked at various points to report fear levels using the fear thermometer.

Fear reduction was considered complete when the subject reported a fear level of "10" or less (out of 100) while the stimulus was at a distance that corresponded to the closest approach point from the previous approach test. It should be noted that this criterion implies that subjects were required to express a 65 point reduction (at least) in fear from the beginning to the end of the fear reduction procedure.

The fear reduction procedure was timed, and the duration before reaching completion recorded by the experimenter. Heart rate was also recorded at the end of the fear reduction procedure.

Reassessment of Fear

After the fear of one animal had been successfully reduced, the other animal was brought toward the subject to the same point as in the first behavioural approach task. Subjective ratings of fear and heart rate were recorded by the experimenter. Finally, subjects were once again asked to indicate (as previously described) the extent to which their fears of spiders and snakes are related to each other.

Debriefing

Upon completion of the experiment, subjects were thoroughly debriefed (see Appendix D) and given course credit.

Results

Missing Data

One subject did not return for her second session. Her data were therefore excluded from the study. This left a total of 65 subjects with completed data who met the research criterion. All analyses were carried out on these individuals. Twenty-one subjects were in group 1 (high fear), twenty-two subjects were in group 2 (moderate fear) and twenty-two subjects were in group 3 (low fear).

Preliminary Analyses

1) The first analysis of the data was undertaken to determine if the three groups differed in baseline heart rate. Analysis of variance indicated that there were no significant differences on this variable, $F(2,62)=0.46$, n.s. The mean heart rate for the entire sample was 78.1 b.p.m. ($SD=13.0$).

2) Experimental Manipulation

In order to verify that significantly different levels of fear were induced and maintained during exposure to the first stimulus, measures of subjective fear and heart rate were collected at the beginning and end of the three minute exposure period. Four analyses were conducted to examine differences across groups. The alpha level was reduced to .0125 (.05/4) to control for inflation of Type 1 error. Analyses of variance of subjective fear scores revealed that the three groups differed at both the beginning and end of exposure sessions. Follow-up Tukey tests indicated that all groups were significantly different from each other at both assessment points.

Heart rate responses were assessed using analysis of covariance, with baseline heart rate as the covariate. The results indicated significant differences across groups at the beginning and end of exposure sessions. Follow-up Tukey tests suggested that at the beginning of exposure, the high fear group had a significantly greater heart rate response than the other two groups. The heart rates of the moderate fear and low fear groups were not significantly different. At the end of exposure, only the high and low fear groups were significantly different. Overall, these results confirm that fear levels were successfully manipulated (see Table 1).

Major Analyses

1) In order to test predictions 1 to 4, predicted fear was recorded immediately prior to the second exposure, and measures of subjective fear and heart rate were collected during the second exposure. It was predicted that the three groups would differ significantly on these three variables (predicted fear, subjective fear and heart rate). To determine this, two analyses of variance were conducted with predicted fear and reported fear as the dependent measures. Analysis of covariance was utilized to assess heart rate responses, with baseline heart rate (assessed just prior to the second exposure) as the covariate. To control for inflation of Type 1 error, the alpha level was reduced to .0167 (.05/3). The results suggested that the three groups differed significantly on all variables. Follow-up Tukey tests indicated that for predicted fear, group 1 was significantly different from the other two. With regard to subjective fear, all three groups differed significantly from each other in the predicted manner, confirming the occurrence of contrast effects. In terms of heart rate, the low fear group had a significantly greater response than the other two groups, providing partial physiological evidence of contrasts. The results of

Table I

Mean Subjective Fear and Heart Rate at the Beginning and End of Exposure I

Variable	Group: Hi n=21	Mod n=22	Lo n=22	Significance	Marginal Mean N=65
Beginning of exposure period:					
Reported Fear	88.8[a] (6.5)	50.0[b] (0.0)	10.0[c] (0.0)	*$F(2,62)=2448.7$	49.0 (32.5)
Heart Rate	92.0[a] (15.2)	85.4[b] (10.7)	83.4[b] (11.4)	*$F(2,62)=7.18$	86.9 (13.1)
End of exposure period:					
Reported Fear	85.5[a] (9.4)	48.1[b] (5.0)	10.2[c] (1.0)	*$F(2,62)=804.1$	47.4 (31.4)
Heart Rate	88.6[a] (15.8)	82.0[ab] (11.1)	78.8[b] (10.9)	*$F(2,62)=5.83$	83.1 (13.5)

*$p<.0125$

Note: Heart rate means are adjusted. Reported Fear was rated on a 0 to 100 scale. Unit for heart rate is b.p.m. Numbers in parentheses are standard deviations. Means having no letter in their superscripts in common contrast significantly at $p<.05$.

these analyses are presented in the top portion of Table II.

Additional analyses were done to determine if predicted and reported fear (session one) were significantly different. A 3 (group) by 2 (predict/report) analysis of variance (ANOVA) for repeated measures indicated a significant main effect for group ($F(2,62)=13.50$, $p<.001$) and a significant interaction ($F(2,62)=4.01$, $p<.05$). T-tests for dependent measures were utilized to evaluate within-group differences. In order to control for inflation of Type 1 error, the alpha level was reduced to .033 (.1/3). Results indicated that in the high fear group, predicted fear was significantly greater than reported fear, $t(20)=2.29$, $p<.033$). This is suggestive of an overprediction in fear. (See Figure 1). There was no significant difference in the low fear or moderate fear groups.

2) Heart Rate Analysis

In order to more carefully examine differences in heart rate across the three groups, several analyses were performed. First, a 3 (group) by 2 (time) ANOVA for repeated measures was conducted with baseline heart rate and heart rate at the beginning of exposure one as the dependent variables. There was no significant effect for group ($F(2,62)=1.80$, n.s.), a significant effect for time ($F(1,62)=73.75$, $p<.001$), and a significant interaction ($F(2,62)=5.64$, $p<.01$). T-tests for dependent means were utilized to examine the interaction. The alpha level was reduced to .01 to control for increased probability of Type 1 errors. Results indicate that for all three groups there was a significant increase in heart rate from baseline to exposure one (high: $t(20)=6.44$, $p<.001$; moderate: $t(21)=3.86$, $p<.001$; low: $t(21)=4.29$, $p<.001$). See Figure 2.

Table II

Mean Scores on Major Dependent Variables

Variable	Group: Hi $n=21$	Mod $n=22$	Lo $n=22$	Significance	Marginal Mean $N=65$
Session #1					
Prediction 1	43.3[a] (13.4)	56.6[b] (13.8)	58.0[b] (11.8)	*$F(2,62)=8.2$	52.8 (14.6)
Reported Fear (stim.2)	36.4[a] (18.1)	49.2[b] (16.7)	62.5[c] (16.5)	*$F(2,62)=12.5$	49.6 (20.1)
Heart Rate	79.6[a] (13.6)	77.9[a] (11.7)	85.1[b] (10.1)	*$F(2,62)=6.5$	80.9 (12.8)
Session #2					
Prediction 2	42.4 (23.3)	43.8 (24.0)	56.6 (17.2)	$F(2,62)=2.9$	47.7 (22.1)
Reported Fear (stim.2)	38.8 (25.0)	39.5 (25.4)	49.1 (18.4)	$F(2,62)=1.3$	42.6 (23.2)
Heart Rate	77.2 (24.0)	82.2 (14.3)	81.0 (12.2)	$F(2,62)=0.8$	80.1 (17.6)

*$p<.0167$

Note: Heart rate means are adjusted. Reported Fear was rated on a 0 to 100 scale. Unit for heart rate is b.p.m. Numbers in parentheses are standard deviations. Means having no letter in their superscripts in common contrast significantly at $p<.05$.

Figure 1

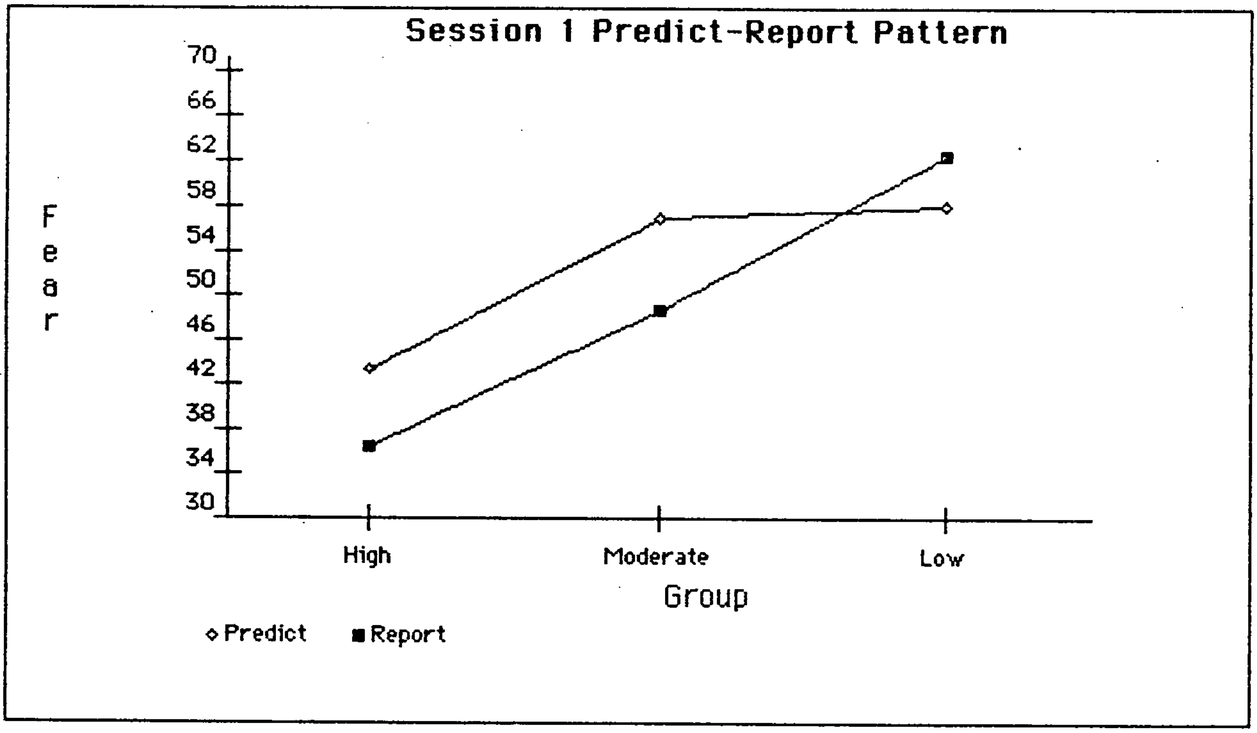
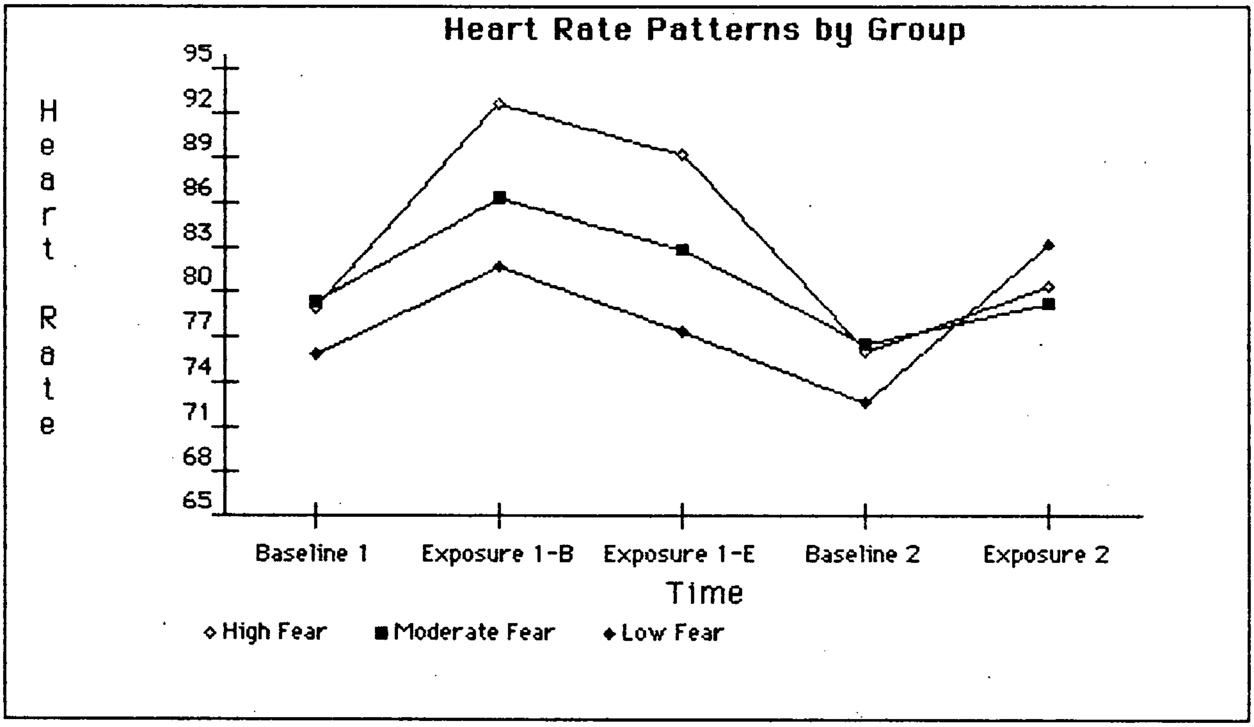

Session 1 Predict-Report Pattern
70
66
62
58
54
50
46
42
38
34
30
Fear
High
Moderate
Low
Group
Predict
Report

Figure 2


Heart Rate Patterns by Group
Heart Rate
95
92
89
86
83
80
77
74
71
68
65
Baseline 1
Exposure 1-B
Exposure 1-E
Baseline 2
Exposure 2
Time
High Fear
Moderate Fear
Low Fear

A second analysis was conducted to determine if removal of stimulus one led to a significant decrease in heart rate. A 3 (group) by 2 (time) ANOVA indicated a significant main effect for time ($\underline{F}(1,62)=43.8$, $\underline{p}<.001$), and a significant interaction ($\underline{F}(2,62)=4.55$, $\underline{p}<.02$). There was no significant main effect for group ($\underline{F}(2,62)=2.35$, n.s.). Follow-up t-tests (with alpha adjusted to .01) indicated that for the high and moderate groups, there was a significant decrease in heart rate once the stimulus was removed (High: $\underline{t}(20)=4.33$, $\underline{p}<.001$; Mod: $\underline{t}(21)=5.63$, $\underline{p}<.001$). There was no significant change in the low fear group ($\underline{t}(21)=2.64$, n.s.). See Figure 2.

To examine changes in heart rate as a consequence of exposure to stimulus 2, we conducted a 3 (group) by 2 (time) ANOVA with baseline 2 heart rate and exposure 2 heart rate as the dependent measures. There was no significant main effect for group ($\underline{F}(2,62)=0.01$, n.s), a significant main effect for time ($\underline{F}(1,62)=41.1$, $p<.001$), and a significant interaction ($\underline{F}(2,62)=7.26$, $p<.001$). Follow-up t-tests (with alpha adjusted to .01) indicated that for the moderate and high fear groups there was no difference in baseline 2 and exposure 2 heart rates (high: $\underline{t}(20)=2.26$, n.s.; moderate: $\underline{t}(21)=1.92$, n.s.). In the low fear group, there was a significant increase in heart rate from baseline to exposure ($\underline{t}(21)=7.29$, $p<.001$). These findings (displayed in Figure 2) are consistent with the results of the covariate analysis of heart rate responses, and suggest that in the low fear group, contrasts were evident in physiological indices of fear.

Finally, we wanted to examine whether within group shifts in heart rate during exposures one and two were significantly different from each other. Two change scores were calculated by subtracting baseline heart rates from exposure heart rates (i.e. Change1=Exposure1-Baseline1; Change2=Exposure2-Baseline2). A 3 (group) x 2 (time) ANOVA with Change1 and Change2 as the dependent measures indicated significant main effects (group: $F(2,62)=3.27$, $p<.05$; time: $F(1,62)=5.39$, $p<.05$), and a significant interaction ($F(2,62)=10.15$, $p<.001$). Follow-up analysis of the interaction (with alpha reduced to .01) indicated that the high fear group experienced a greater change in heart rate during <u>exposure 1</u> ($t(20)=3.41$, $p<.01$, and the low fear group experienced a greater change in heart rate during <u>exposure 2</u> ($t(21)=2.70$, $p<.01$). The changes experienced by subjects in the moderate fear group were not significantly different ($t(21)=2.04$, n.s.). These results are displayed in Figure 3.

In order to examine the relationship between subjective fear and heart rate, the following four variables were correlated: Reported Fear1, Change1 (H.R.), Reported Fear2, Change2 (H.R.). The family-wise error rate was set at .10, and then a sequential Bonferroni procedure was utilized. The results (see Table IV) suggested that there was an inverse relationship between fear during exposure 1 and fear during exposure 2.

3) To test the stability of contrast effects over time (prediction 5), subjects returned to the laboratory one week after their first session. Predicted fear, reported fear and heart rate were assessed for the second stimulus. Analyses of variance with these three measures indicated that there were no significant differences among the three groups. (Heart rate was again analyzed with baseline heart rate as a covariate). Variable means and standard deviations are presented in the bottom portion of Table II. These findings suggest that contrast

FIGURE 3

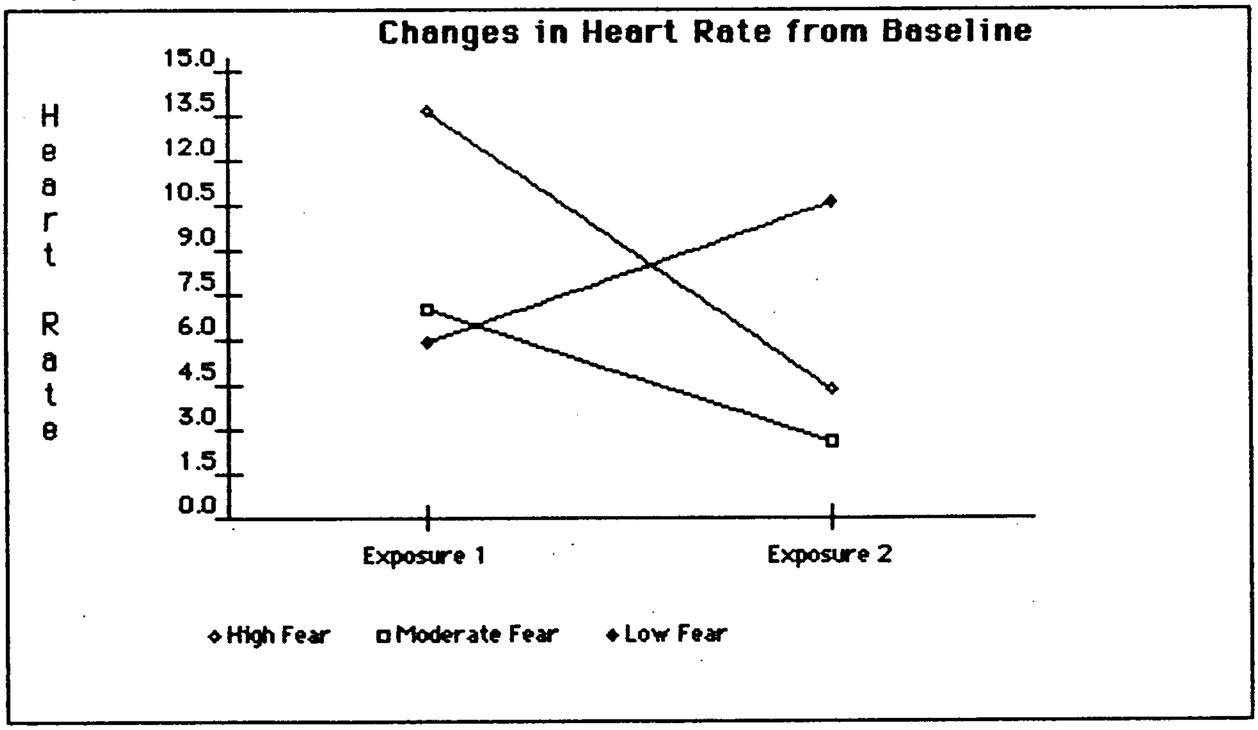

Changes in Heart Rate from Baseline
Heart Rate
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
Exposure 1
Exposure 2
High Fear
Moderate Fear
Low Fear

Table III

<u>Mean Heart Rates Throughout Session One</u>

Variable	Group Hi <u>n</u>=21	Group Mod <u>n</u>=22	Group Lo <u>n</u>=22	Marginal Mean <u>N</u>=65
Heart Rate During:				
Baseline	78.9 (10.9)	79.4 (14.0)	75.9 (14.0)	78.1 (13.0)
Exposure One: Beginning	92.6 (15.2)	86.4 (10.7)	81.7 (11.4)	86.8 (13.1)
End	89.2 (15.8)	82.8 (11.1)	77.4 (10.9)	83.0 (13.5)
After 10 minute rest:				
Baseline	76.0 (13.1)	76.5 (12.7)	72.6 (11.8)	75.0 (12.5)
Exposure Two:	80.3 (13.6)	79.1 (11.7)	83.2 (10.0)	80.9 (11.7)

<u>Note:</u> Unit for heart rate is b.p.m. Numbers in parentheses are standard deviations

Table IV

Intercorrelations Between Subjective Fear and Changes in Heart Rate During Exposures 1 and 2.

	Fear1	Change1 (H.R.)	Fear2
Change1 (H.R.)	.362*		
Fear2	-.538*	-.266*	
Change2 (H.R.)	-.351*	.015	*.252

Note: N=65

effects no longer existed after a one week period.

An additional analysis was done to assess heart rate changes at follow-up. A 3 (group) by 2 (time) ANOVA for repeated measures was conducted with baseline heart rate and heart rate at the beginning of exposure as the dependent variables. There was no significant effect for group ($\underline{F}(2,61)=1.87$, n.s.), a significant effect for time ($\underline{F}(1,62)=7.52$, $\underline{p}<.01$), and no significant interaction ($\underline{F}(2,61)=1.20$, n.s.). This suggests that there was an overall increase in heart rate as a result of exposure to the target stimulus. The three groups, however, did not differ from one another in this increase.

To assess within group changes (from session 1 to session 2) in reported fear, a 3 (group) by 2 (time) ANOVA was conducted. There was a significant main effect for group ($\underline{F}(2,62)=5.83$, $p<.005$) and for time ($\underline{F}(1,62)=6.93$, $p<.05$). A significant group x time interaction was also evident ($\underline{F}(2,62=3.40,p<.05$). Follow up comparisons indicated that only in the low fear group was there a significant change in reported fear from session 1 to session 2 ($\underline{t}(22)=2.77$, $\underline{p}<.033$). This change reflected a significant drop in fear during the second exposure. See Figure 4.

With regard to second session predicted and reported fear, a 3 (group) by 2 (predict/report) ANOVA indicated a significant main effect, showing that predictions were higher than reports ($\underline{F}(1,62)=8.02$, $p<.01$. There was no significant interaction ($\underline{F}(2,62)=0.45$, n.s.). (See Figure 5).

3) To evaluate predictions 6a and 6b, that contrast effects would be dependent upon the degree of similarity between the two animals, four analyses were conducted:

a) Subjects were divided into two groups based on the extent to which

Figure 4

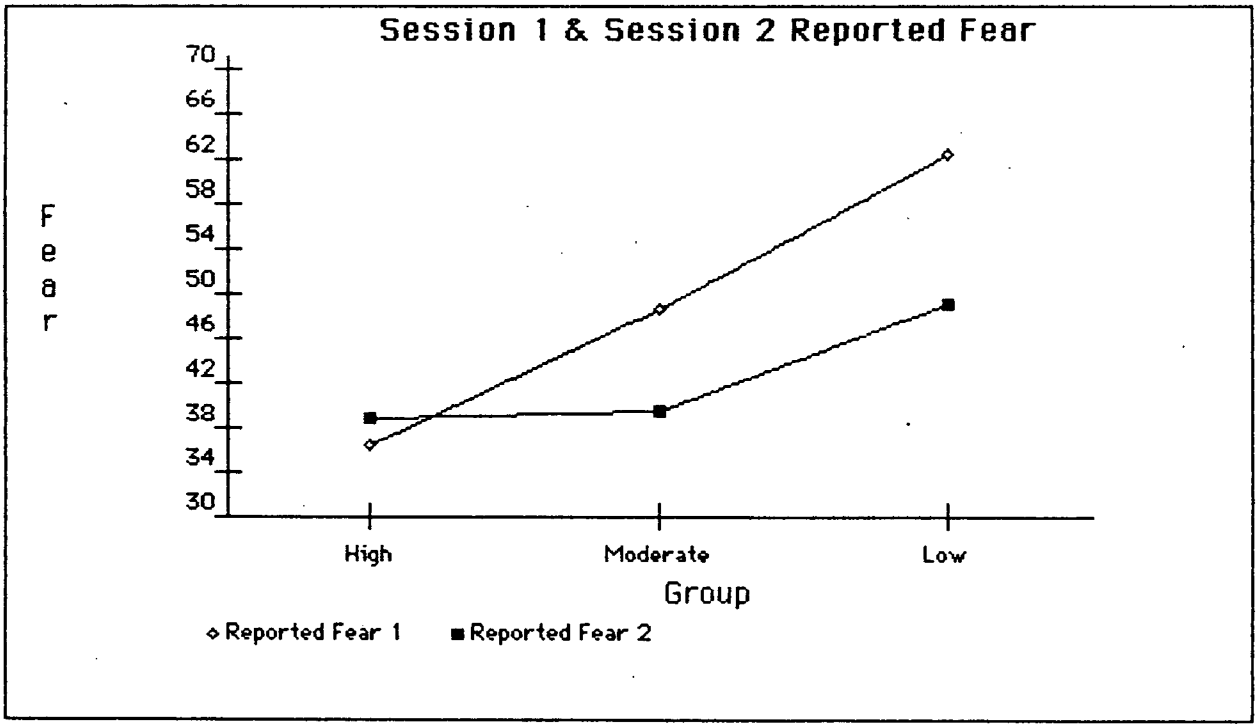
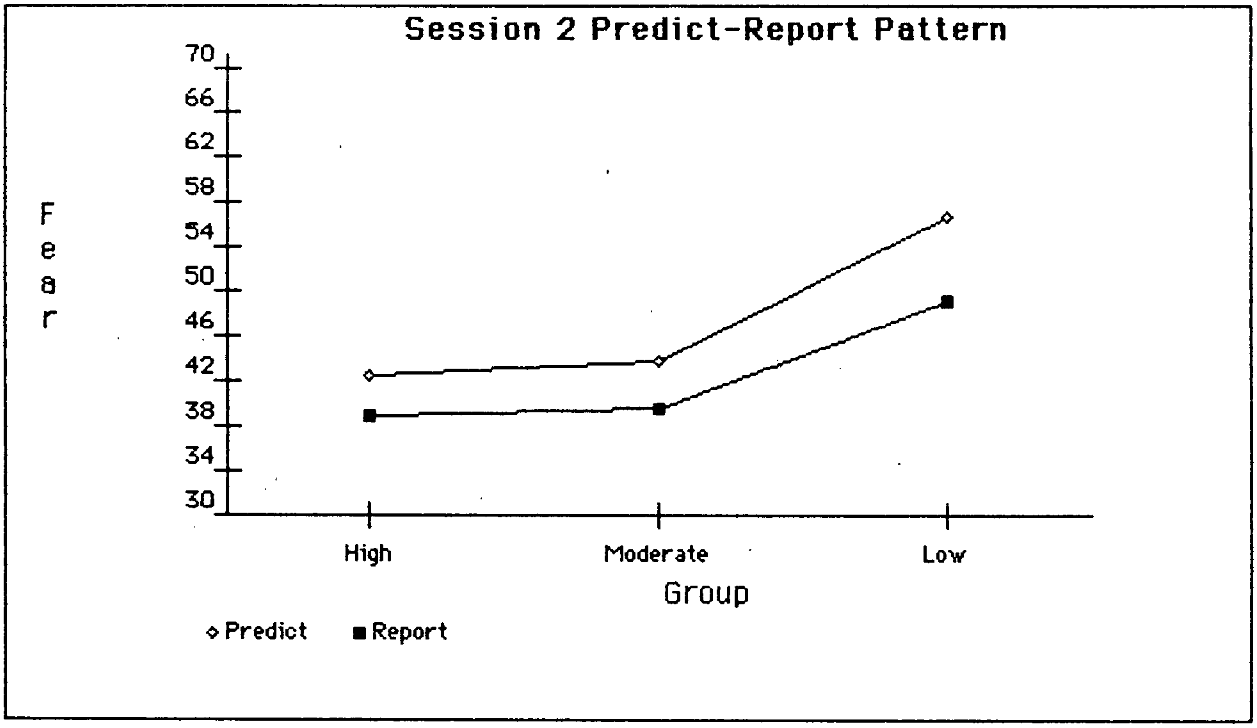

Session 1 & Session 2 Reported Fear
70
66
62
58
54
50
46
42
38
34
30
F
e
a
r
High
Moderate
Low
Group
Reported Fear 1
Reported Fear 2

Figure 5


Session 2 Predict-Report Pattern
70
66
62
58
54
50
46
42
38
34
30
Fear
High
Moderate
Low
Group
Predict
Report

their fears were functionally dependent. The subjects were sorted into dependent or independent groups based on the following criteria. If the subject's "untreated" fear was at least 40 points (out of 100) higher than the treated fear at the end of the second session, then he/she was placed into the functionally <u>independent</u> group. However, if the "untreated" fear was within 35 points of the treated fear, after the completion of the fear reduction procedure, then the individual was classified as having functionally <u>dependent</u> fears. On the basis of these criteria, 23 subjects were assigned to the dependent group and 42 subjects to the independent group. Two 3 (group) x 2 (dependency) ANOVAs were conducted with predicted fear and reported fear (session1) as the dependent variables. A significant interaction between functional dependency and group (high, moderate, or low fear) would indicate that the existence of contrast effects was moderated by the functional dependency of the two fears. No such interaction was demonstrated (predicted fear: $F(2,58)=0.14$; reported fear: $F(2,58)=0.34$). See Figures 6 and 7.

b) In the above analyses, the groups were defined on the basis of arbitrarily chosen criteria. There may have been no significant differences between groups because the definition of <u>functionally dependent</u> fears was not stringent enough. The groups were therefore redefined, and the data reanalyzed. The dependent group consisted of subjects whose "untreated" fear was within <u>20</u> points of the treated fear at the end of the second session. Subjects in the independent group had an "untreated" fear at least <u>20</u> points higher than the treated fear. On the basis of the new criteria, 18 subjects were assigned to the dependent group, and 47 to the independent group. Two 3 (group) by

Figure 6

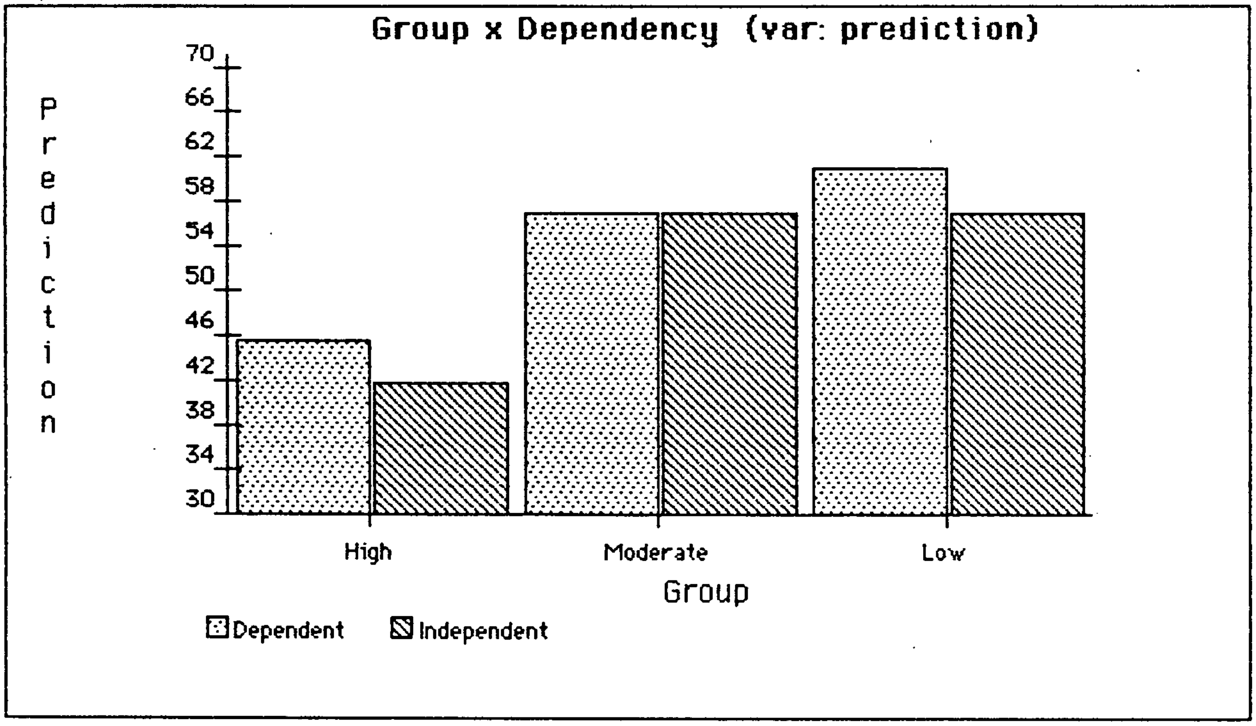
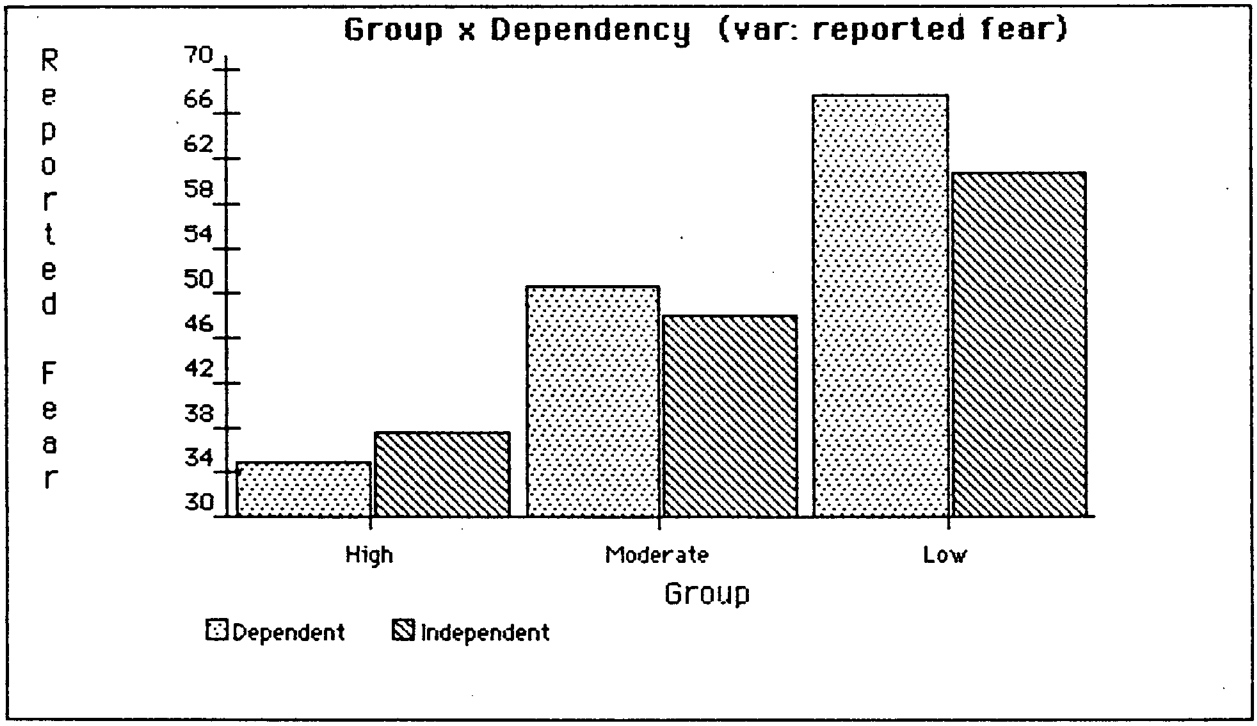

Group x Dependency (var: prediction)
Prediction
70
66
62
58
54
50
46
42
38
34
30
High
Moderate
Low
Group
Dependent
Independent

Figure 7


Group x Dependency (var: reported fear)
Reported Fear
70
66
62
58
54
50
46
42
38
34
30
High
Moderate
Low
Group
Dependent
Independent

2 (dependency) ANOVAs were conducted with predicted fear and reported fear (session 1) as the dependent variables. Once again, there were no significant interactions for either of these two variables (predicted fear: $F(2,58)=0.35$, n.s.; reported fear: $F(2,58)=0.63$, n.s.).

c) To further assess the importance of dependency, a Pearson correlation between contrast effects and functional dependency was calculated. In order to measure contrast effects, the reported fear scores (session 1) of subjects from groups 1 and 3 were utilized. These scores were subtracted from the mean subjective fear scores of the control group (group 2). The absolute value was taken as the magnitude of the contrast. Functional dependency was defined as the difference between the treated and untreated fear at the end of session 2. The correlation between these two variables was not significant, $r=-.09$, n.s.

d) A correlation was also calculated between subjective ratings of similarity and contrast effects (as defined above). This correlation was not significant, $r=.15$, n.s.

In summary, the analyses undertaken to evaluate predictions 6a and 6b indicate that contrast effects were not dependent upon either the functional similarity or the subjective similarity of the context and target stimuli.

Discussion

The purpose of this preliminary investigation was threefold: 1) to demonstrate that contrast effects occur in fearful situations, 2) to shed some light on the theoretical underpinnings of contrasts and 3) to provide direction for future research. Key findings will be discussed with these goals in mind.

Before addressing the major hypotheses and predictions, it was important to determine if the experimental manipulation was effective in producing different levels of fear. This was confirmed in both subjective and physiological indices of fear. During the first exposure, the high fear group reported experiencing greater fear than the moderate group, and the moderate group in turn reported greater fear than the low fear group. In terms of physiological measures, the high fear group had significantly greater heart rate than that of the low fear group.

Let us turn now to the hypotheses and predictions put forth at the start of this experiment. (These have been reproduced on the following two pages). The first two hypotheses dealt with the demonstration of contrasts in self-report measures of fear. Results confirm the occurrence of contrasts. As predicted, those subjects who initially experienced a high level of fear, subsequently reported less fear of a moderately fearful stimulus. Those subjects who were initially exposed to a low level of fear, reported greater fear of the second stimulus. These differences were evident when the high fear and low fear groups were compared with a control group of subjects who experienced moderate levels of fear on both occasions. These results are consistent with those of Klorman's (1974) investigation in which

Hypotheses (H) and Predictions (P)	Theory A-L	A	H	N
H.1: Prior exposure to a stimulus causing a high level of fear will result in reduced fear of a moderately fearful stimulus.				
P.1: Subjects who experience a high level of fear prior to exposure to a moderately fearful stimulus will report that the second stimulus is less frightening than will subjects who experience a moderate amount of fear on both occasions.	A	A	A	A
H.2: Prior exposure to a stimulus causing a low level of fear will result in greater fear of a moderately fearful stimulus.				
P.2: Subjects who experience a low level of fear prior to exposure to a moderately fearful stimulus will report that the second stimulus is more frightening than will subjects who experience a moderate amount of fear on both occasions.	A	A	D	D
H.3: Contrast effects reflect perceptual shifts, as opposed to merely changes in the use of rating scales.				
P.3: Subjects who experience a high level of fear prior to exposure to a moderately fearful stimulus will demonstrate a reduced heart rate response to the second stimulus compared with subjects who experience a moderate amount of fear on both occasions.	A	D	N/A	N/A
P.4: Subjects who experience a low level of fear prior to exposure to a moderately fearful stimulus will demonstrate greater heart rate response to the second stimulus compared with subjects who experience a moderate amount of fear on both occasions.	A	D	N/A	N/A
H.4: Individuals are generally aware of the occurrence of contrasts				
P.5: Subjects will predict that a contrast effect will occur. (Note that prediction is considered a measure of awareness)	A	A	N/A	N/A

Note: A = Agree, D = Disagree, N/A = Not Applicable

A-L = Adaptation-Level, A = Anchoring, H = Habituation, N = Network

Hypotheses (H) and Predictions (P)	Theory A-L	A	H	N
H.5: Experimentally induced contrasts are transient in nature.				
P.6: The effects of prior fearful contexts (as described in predictions 1,2,3 & 4) will <u>not</u> be evident when subjects are reassessed one week later.	A	A	N/A	N/A
H.6a: Contrast effects are <u>not</u> dependent on the functional relationship of the two stimuli				
P.7: The impact of one fearful stimulus upon another will <u>not</u> depend upon the extent to which the two fears are functionally related.	N/A	N/A	D	D
H.6b: Contrast effects <u>are</u> dependent upon the extent to which individuals perceive the stimuli to be related.				
P.8: The impact of one fearful stimulus upon another <u>will</u> depend upon the extent to which <u>subjects rate the stimuli as being similar</u>.	A	A	D	D

<u>Note</u>: A = Agree, D = Disagree, N/A = Not Applicable

A-L = Adaptation-Level, A = Anchoring, H = Habituation, N = Network

prior low fear stimuli seemed to sensitize subjects to higher levels of fear intensity.

The demonstration of contrasts in both directions (i.e. from high to moderate, and from low to moderate) cannot be accounted for by current theories of fear reactions. Neither habituation nor network theory can explain the increase in reported fear as a result of prior exposure to a low fear stimulus (hypothesis and prediction 2).

The two theories developed specifically to explain contrast effects (adaptation-level and anchoring) can account for the self-report results of this investigation. The major difference between these theories is whether they view contrast effects as reflecting perceptual changes (adaptation-level), or as differential anchoring of response scales. Hypothesis 3 was derived on the basis of the former belief. If contrast effects are due to shifts in response scales, without any changes in the perception of the stimulus, the effects would not be evident in physiological measures of fear, but only in self-report measures. The fact that contrast effects were evident in heart rate responding as well as in self-report is more easily accommodated by the adaptation level theory than by the anchoring explanation. Group differences in heart rate were demonstrated with an analysis of covariance (with baseline heart rate as the covariate). Follow-up tests indicated that the low fear group had a greater heart rate response to the moderate fear stimulus than the other two groups. A more detailed repeated measures analysis of changes from baseline levels indicated that during exposure to the target stimulus, only the low fear group experienced a significant increase in heart rate. Although the high and moderate fear groups also demonstrated heart rate acceleration, the level was not significantly different from baseline. This confirms that the low fear context resulted in greater heart rate response to a moderate stimulus, supporting prediction 4 and the adaptation-level view that contrasts are more than just a rating scale phenomenon.

Unfortunately, we did not find a similar pattern in the high fear group (prediction 3). That is, these subjects did not experience a significantly smaller increase in heart rate compared with the moderate group.

The above pattern of results underscores the importance of including a moderate control group in research on contrast effects. Without such a group, it would have been impossible to determine the relative contribution of high and low fear contexts to the heart rate effects.

Despite the fact that subjects in the high fear group did not differ significantly from those in the moderate group on heart rate measures, they nevertheless reported experiencing less fear. This does not necessarily rule out the possibility that the contrast was perceptual in nature. It may be that the same degree of physiological arousal is experienced differently, depending on prior arousing experiences. When a comparison is made of the changes in heart rate during the first and second exposure, it turns out that the high fear group experienced a significantly smaller increase in heart rate on the second occasion, the moderate group experienced the same increase, and the low fear group experienced a significantly greater increase. It may be that when individuals experience high levels of arousal, they become accustomed to the associated sensations, and subsequent arousal is experienced as less aversive. Unfortunately, subjective experience of arousal was not examined in this investigation, and thus this interpretation remains speculative. Further research examining the effects of contrasts on subjective appraisal of physiological sensations is recommended.

Overall, the heart rate data provide partial support for the view that fear contrasts reflect perceptual changes.

Another area of interest in this investigation was the extent to which individuals were aware of the occurrence of contrast effects. It was hypothesized that subjects would be aware of contrasts. This was assessed by asking subjects to predict their fear of the target stimulus after experiencing the contextual stimulus. Prior to this, all subjects had provided the distance at which they expected to experience a fear level of 50 (out of 100). After presentation of the contextual stimulus, subjects were informed that the second stimulus would be moved to the distance corresponding to "50", and they were asked to predict their fear. The extent to which their predictions differed from "50", therefore reflected their opinion of the impact of the preceding context. Prediction 5 stated that subjects would predict that a contrast effect was going to occur. We found that subjects in the high fear group decreased their prediction of fear, while the moderate fear and low fear groups increased their predictions. One interpretation of these findings is that subjects in the high and low fear groups knew that a contrast would occur. If this is the case, the high fear group underestimated the effect. Their predicted fear was significantly higher than their reported fear. There was no difference in predicted and reported fear in the low fear group.

The puzzling finding is the reaction of the moderate fear group. For some reason, they increased their predicted fear of the second stimulus. This raises the possibility that for all groups, predicted fear may have little to do with awareness of contrasts, but rather it may be based on information gleaned from predicted and reported fear of the first stimulus. Recently, Rachman and Bichard (1988) have argued that fearful people demonstrate a strong tendency to overpredict their fears. However, with practice, they become increasingly accurate. The experimental paradigm used in these studies is simple. Subjects predict peak fear scores prior to an exposure trial to the feared object. After the trial, they report the peak fear actually experienced. Subjects begin with exposure to the highest amount of fear they are willing to tolerate (at least 80/100). The results of these investigations are summarized below: (Rachman & Bichard, 1988)

1. Fearful subjects tend to overpredict how much fear they will experience.

2. Their predictions of fear tend to become more accurate with practice.

3. Predicted fear tends to increase after an underprediction and to decrease after an overprediction.

4. Predictions tend to remain unchanged after a correct prediction.

5. Reports of fear tend to decrease with repeated exposures, regardless of the accuracy of the earlier predictions.

These findings have implications for the present investigation. The table below summarizes the prediction patterns for stimulus one in the high, moderate and low fear groups:

(Number of Subjects)

	Over	Under	Correct
High	14	3	4
Moderate	8	8	6
Low	4	10	8

Let us consider those subjects who experienced a high level of fear on the first occasion. This condition is most similar to the usual research in this area because the initial prediction is based on a highly fearful situation (i.e. subjects predict <u>peak</u> fear). Consistent with previous findings, the majority of subjects overpredicted their fear. Prior to exposure, all the subjects in this group predicted that they would experience a fear level of 100 (out of 100). In fact, only four subjects predicted their fear level accurately. Three subjects underpredicted their fear (and therefore were unable to get as close to the animal as they thought they could). Of greatest significance, however, is that 14 (67%) of the subjects <u>over</u> predicted their fear. They did not experience a fear level of 100, but rather of 85 (on average). In fact, five of these subjects did not even reach a fear level of 80 (and thus the animal had to be brought closer to the individual). This confirms the findings of Rachman and colleagues that at high fear levels, individuals tend to overpredict their fears.

In the high fear condition of the contrast study, the majority of subjects learned that exposure to a highly fearful situation is not as frightening as they thought it would be. From this information, they can reasonably expect that lower levels of fear will be less aversive than originally believed. So, not surprisingly, they adjust their predictions about their fear of the second animal. This is consistent with the Rachman studies demonstrating that predicted fear decreases after an overprediction. It also extends the generalizability of this pattern: in the present research an overprediction affected predictions about a <u>different</u> stimulus.

In the low fear group, the pattern of predictions is opposite. Almost half the subjects (10/22) <u>under</u> predicted their fear. Four overpredicted, and the remaining eight were accurate predictors. Interestingly, the tendency to overpredict does not appear to be present in low fear situations. Rachman and colleagues demonstrated this phenomenon in high fear situations, where it could be argued that overpredictions serve a useful function in that they promote avoidance (thereby preventing significant distress). However, avoidance of only mildly fearful situations does not serve a particularly useful function. Instead, we find a tendency to underpredict fear. It is not clear why this occurs. We would expect individuals to accurately predict, given that they probably have the greatest amount of experience with low levels of fear, relative to moderate or high levels. This group did have the highest number of accurate predictors, but still most were inaccurate.

As a result of underpredictions, many subjects in the low fear group learn that they are <u>more</u> frightened of the stimulus than they had anticipated. To make matters worse, this was only a mildly fearful situation. Consistent with previous research, they increase their predictions for the next situation.

In the control group, roughly equal numbers of subjects over, under and accurately predicted their fear (8, 8, and 6, respectively). Based on established prediction patterns, on the next trial, overpredictors should decrease their prediction, underpredictors should increase their prediction, and accurate predictors should not change their predictions. However, we also know from previous research that underpredictions are more powerful than overpredictions, (i.e. they lead to more dramatic shifts in subsequent predictions). The net effect is an increase in prediction for the control group.

In summary, the group differences in prediction found in this research can be explained on the basis of known predict/report fear patterns. Thus, it remains unclear whether subjects were aware that a contrast effect would occur. Clearly, prediction measures are not the most useful way of assessing awareness. However, more direct measures are problematic because they may sensitize subjects to the presence of contrasts. In future studies, further consideration should be given to this issue.

The stability of contrast effects was examined by having subjects return for reassessment one week later. As stated in hypothesis 6, contrasts are viewed as transient, and thus it was predicted that contrasts would not be evident at follow-up. The results confirm this prediction. There were no significant differences across groups in predicted fear, reported fear or heart rate during the second session. There was, however, an interesting change in the low fear group. Compared with their first session, these subjects reported significantly less fear of the stimulus. They also predicted this decrease in fear. In the high fear group, there were slight increases in predicted and reported fear. Although these are not statistically significant, they are noteworthy because the usual pattern is for predicted and reported fear to decrease slightly (as in the moderate group) from one exposure to the next. Thus, the advantage that the high fear group held in session one was no longer present in session two.

The transient nature of the contrast effects in this investigation is consistent with both A-L theory and anchoring theory.

Predictions 7 and 8 were concerned with whether contrast effects would be dependent on the relationship between the two stimuli. Interestingly, there was no evidence, after several analyses, that this was the case. Contrast effects were linked to neither the functional dependence of the stimuli, nor to the subject's own view of whether or not the stimuli were connected. These are somewhat surprising findings. The theories discussed thus far led to the prediction that contrasts would be dependent on one or the other of these variables. The only exception to this is the original version of Helson's theory (i.e. without the qualification that the context and target must belong to the same class of stimuli). It may be that the original theory is most appropriate when trying to explain contrasts in fearful situations. Another possibility is that the similarity measure used in this study did not adequately assess classification. The results of heart rate assessment suggest that physiological arousal may be the crucial link between stimulus one and stimulus two. Perhaps we should be asking subjects about similarities in their responses toward the stimuli, rather than about the actual animals.

In summary, several of the hypotheses put forth at the start of this investigation have been confirmed. Contrast effects do occur in fearful situations (hypotheses 1 and 2). Further, physiological data provide partial evidence for the view that such contrasts reflect perceptual shifts, as opposed to merely changes in the use of rating scales (hypothesis 3). This hypothesis was supported in the low fear group, but not in the high fear group. Of the four theories discussed, AL theory seems to account best for these experimental findings.

The last three hypotheses were set out in an effort to go beyond simply demonstrating contrasts, to a greater understanding of their nature. It is still unknown whether individuals are aware of the occurrence of contrasts. What we do know is that prediction scores are not the best means of addressing this issue. We also do not know how long contrast effects in fear last. We have learned that they do not last a week, but what about minutes or hours? Finally, it is puzzling that contrast effects were not shown to be dependent upon the relationship (either functional or subjective) between the contextual and the target stimulus. Presumably, these two stimuli must be linked in order for the first to have an impact on the second. It is likely that our simple method of assessing subjective similarity was not powerful enough to pick up this relationship. A more detailed assessment of similarity is warranted.

Experiment 2: Replication and Extension

The primary purpose of the first experiment was to demonstrate contrast effects in fearful situations. In doing so, several questions regarding the nature of contrasts arose. The purpose of Experiment 2 is to address these questions, as well as to replicate the basic findings of Experiment 1. The specific goals are as follows:

1) to replicate the finding from Experiment 1 that contrast effects can be demonstrated in fearful situations.
2) to reassess subjective awareness using an improved measure.
3) to reexamine the role of perceived similarity using improved assessment measures.
4) to examine the interaction between mood states and context.

1. Replicating the Findings

Although contrast effects have been demonstrated incidentally in Lang's (1970) and Klorman's (1974) research on desensitization, Experiment 1 was the first explicit attempt to study fear contrasts as such. It was also the first demonstration of contrast effects with two different fearful stimuli. It would therefore be reassuring to confirm these findings. The current investigation includes a replication of Experiment 1, embedded within a larger research design. This will be described in the Method section of this paper.

2. Assessment of Subjective Similarity

It was previously hypothesized that contrast effects would be dependent upon the extent to which individuals perceived the context and target stimulus to be related. This hypothesis was based on research in psychophysics demonstrating that for contrast effects to occur, the anchor stimulus must be seen by the subject as relevant to the stimulus being judged (Bevan & Pritchard, 1963; Brown, 1953). In Experiment 1, relevance was assessed by asking subjects to rate on a 0-100 point scale the extent to which they felt their fears of the two stimuli (spiders and snakes) were related. Contrary to prediction, this rating was unrelated to the magnitude of the contrast effect. There were, however, several problems with this measure that may have reduced its power as a predictor of contrast effects. First, participants seemed to have difficulty understanding the question. They often asked the experimenter for clarification of the term "related". It is likely that there were large individual differences in the way subjects were interpreting this question (particularly those who did <u>not</u> ask for clarification). A second problem was that the question was very broad. Perhaps subjects needed to view the stimuli as related <u>in a particular way</u> for contrast effects to occur. For example, they may have needed to see them as related in appearance (e.g., they both look ugly or scary), or in the reactions they cause (e.g., pounding heart, sweating palms).

To more fully assess the possible ways in which fears of spiders and snakes are linked, three assessment measures are included in the second experiment. These are (a) the Adjective Questionnaire, (b) the Sensation Questionnaire, and (c) the Cognition Questionnaire.

The Adjective Questionnaire (see Appendix F) consists of fourteen potential descriptors of harmless spiders and snakes. These adjectives came from a larger sample of eighteen items used by Rachman and Whittal (1989a). Nine of the adjectives were chosen because they were relevant to both spiders and snakes, and because they received an average pretreatment rating of at least 50 out of 100 in the Rachman and Whittal study. These adjectives are: (1) uncontrollable, (2) unpredictable, (3) disgusting, (4) creepy, (5) ugly, (6) threatening, (7) quick, (8) dangerous, (9) sinister. An additional five adjectives were included that either pertain to one animal only (smooth, slimy, hairy), or that were not typically endorsed by the subjects in the Rachman and Whittal (1989) study (attractive, cute). These six items were added to balance the questionnaire, and were not included in scoring.

When completing the Adjective Questionnaire, subjects were asked to read each descriptor and to then indicate whether they thought it adequately described "spiders", "snakes", "both", or "neither" of these animals. A similarity index was calculated by summing the number of "both" responses, and dividing this by the total number of items minus those that subjects did not view as relevant to either animal.

The Sensation Questionnaire (see Appendix G) comprises items concerning sensations associated with autonomic arousal. The original version was developed and validated by Chambless, Caputo, Bright and Gallagher (1984). The questionnaire was initially applied to agoraphobic populations, but has since been used to assess a variety of fears (see Rachman, 1988). The seventeen sensations listed on the questionnaire are: (1) heart palpitations, (2) tightness in the chest, (3) shortness of breath, (4) dizziness, (5) blurred/distorted vision, (6) nausea, (7) butterflies in the stomach, (8) wobbly/rubber legs, (9) sweating, (10) dry mouth, (11) feeling disoriented/confused, (12) numbness in arms or legs, (13) tingling in fingertips, (14) numbness in another part of the body, (15) knot in stomach, (16) lump in throat, (17) feeling disconnected from one's body.

For the purposes of our investigation, this questionnaire was completed and scored in the same manner as the Adjective Questionnaire.

The Cognitions Questionnaire (see Appendix H) comprises thoughts concerning negative consequences of experiencing fear or anxiety. It was taken from the same source as the Sensations Questionnaire (i.e. Chambless et al., 1984), and has also been used extensively in research on fear and panic. The original version is a 14-item scale used to assess agoraphobic individuals. In our research on small animal fears, we have found that five of the cognitions are rarely, if ever endorsed, and thus we have deleted them from the questionnaire. The remaining nine cognitions are: I am going to: (1) throw up, (2) pass out, (3) have a heart attack, (4) act silly, (5) lose control, (6) scream, (7) babble/talk foolishly, (8) be paralyzed by fear, (9) cry. We further modified the questionnaire by adding the following three cognitions that are specific to small animal fears: The animal will: (10) jump at me, (11) bite me, (12) crawl into my clothing. Instructions and scoring were the same as described above.

3. Assessment of Subjective Awareness

In Experiment 1, awareness of contrast effects was assessed indirectly by asking subjects to predict their fear of the target stimulus after experiencing the contextual stimulus. Prior to this, all subjects had expected that they would experience a fear level of 50 (out of 100). The extent to which their expections changed, therefore reflected their opinion of the impact of the preceding context. Although changes in predictions were evident, it was unclear what information subjects had used to adjust their predictions. Awareness of contrast effects was just one of at least two possible explanations.

The difficulty with assessing subjective awareness directly is that simply asking about contrast effects might make the subjects aware of them. This is particularly problematic if such questions are posed while the experiment is in progress because subjects might modify their behaviour in the remaining part of the study. The only way to circumvent these problems is to assess awareness of contrasts at the end of the experiment, using open-ended questions that do not refer directly to the phenomenon. The questionnaire designed for this purpose is included in Appendix I. It contains the following questions:

(1) Do you think that your <u>fear</u> of the second animal was in any way influenced by your experience with the first animal?
If so, please explain:

(2) Do you think that the amount of fear that you <u>predicted</u> you would have of the second animal was in any way influenced by your experience with the first animal?
If so, please explain:

This questionnaire was administered verbally to subjects at the end of the experiment, immediately prior to debriefing.

4. Mood States: Their Relationship to Contrasts

In a recent study by Samsom and Rachman (1989), it was demonstrated that induced mood states during exposure to a feared animal have an impact on the amount of fear experienced. Specifically, subjects in a sad mood reported greater fear and lower self-efficacy when exposed to a spider or snake than did subjects in a happy mood. Because the experiment did not include a control group of subjects who did not undergo mood induction, the relative impact of happy and sad moods could not be determined. When the results of the study were compared with other fear research in our laboratory, the sad group showed the common pattern of fear reduction, and the happy group seemed to demonstrate inflated reduction in fear. This suggests that the difference between the happy and sad groups in the Samsom and Rachman (1989) study was due primarily to an enhancement of fear reduction in the happy group. In the absence of an actual control group, however, this conclusion must be considered speculative.

The first experiment in the current series provides us with additional information about fear - namely, that prior experience with a feared stimulus can have an impact on subsequent fear experiences. One of the goals of Experiment 2 is to examine the interaction between current mood state and past fear experiences. Of central importance is the question of what happens to a contrast effect when mood during presentation of the target is different from mood during presentation of the anchor? It is hypothesized that under certain conditions, a change in mood will block a contrast effect.

Consider the following hypothetical example: Ms. Jones has a spider phobia and is receiving systematic desensitization to reduce her fear. In one session, when she feels moderately happy, she is able to touch a small live spider. However, upon her return one week later, she is feeling depressed. When faced with the task of simply putting her finger near the small spider, she reports that she finds this difficult, stating that she just does not feel "up to it today". The clinician points out to her that this task should not present a problem because compared to last week's task, it is relatively easy. She responds with the statement: "But this week I'm feeling kind of low, and I'm just not up to facing the spider. Last week, I was in a pretty good mood, so it was fairly easy".

In the above example, the client is discounting her previous experience with the spider because her mood has changed. The difficulty of the first task is not viewed as relevant to the current situation, and is not used as a basis for comparison. No contrast occurs. Interestingly, mood becomes the important point of comparison.

Consider another client, Mr. Smith, who tackles a fairly simple task on one occasion, and then in the next session, is asked to do something more difficult (a common occurrence in systematic desensitization). The client arrives at the next session in a very happy mood. He reports that although this task is harder than the one he did last week, he feels much more confident in his ability to handle the spider and is less frightened by it.

In both of the above examples, the contrast effect is blocked because the preceding experience is not viewed as relevant to the current situation. Note that this occurs because the information provided by the prior experience was inconsistent with the individual's prevailing mood. Although the contrast effect is blocked, prevailing mood may still affect fear levels. Based on the study by Samsom and Rachman (1989), an induced happy mood should enhance fear reduction. Because that study did not include a neutral control group, we continue to hypothesize that an induced sad mood impedes fear reduction.

In order to assess the participants' view of the impact of mood states on fear, the following two questions were added to the Awareness Questionnaire (Appendix I):

(1) Do you think that your <u>fear</u> of the second animal was in any way influenced by your mood state while you were looking at or handling it?

If so, please explain:

(2) Do you think that the amount of fear that you <u>predicted</u> you would have of the second animal was in any way influenced by your mood state?

If so, please explain:

<u>Possible Results</u>

The combining of prior contrasts and mood leads to several potential patterns of results. These are described below:

1) <u>Main Effect: Context</u>

Contrast effects may <u>not</u> depend upon mood during exposure to the target stimulus. This suggests that <u>regardless of the mood of the subject</u>, (a) prior exposure to a stimulus causing a <u>high</u> level of fear results in <u>reduced</u> fear of a moderately fearful stimulus, and (b) prior exposure to a stimulus causing a <u>low</u> level of fear results in <u>greater</u> fear of a moderately fearful stimulus. It is hypothesized that contrasts and mood interact, and thus this pattern of results is not expected.

2) <u>Main Effect: Mood</u>

When mood state is changed during exposure to the second stimulus, prior contexts may have <u>no effect</u> on fear. In other words, <u>regardless of the anchor stimulus</u>, a happy mood will lead to a decrease in fear and a sad mood will lead to an increase in fear (compared to a neutral control group). This pattern of results is not expected.

3) Interactions Between Contexts and Mood

a) Mood State-Dependency

Research on state-dependency is confined to its effects on memory recall (Eich, 1980). Mood state-dependence implies that what one remembers during a given mood is determined in part by what one learned (or focused upon) when previously in that mood. With regard to the current investigation, if a contrast effect is a state-dependent phenomenon, then any shift in mood from exposure one to exposure two, should disrupt the contrast. In other words, a contrast effect should occur only when mood during exposure to the anchor stimulus is congruent with mood during exposure to the target stimulus.

It is hypothesized that contrast effects are only partially mood state-dependent. Certain changes in mood are expected to disrupt the contrast, while other changes are expected to maintain (or possibly enhance) it. This is explained more fully in the following section.

b) Mood x Context

If there is a change in mood between exposure to the anchor and exposure to the target, contrast effects should occur only when the effect of the contrast is congruent with the effect of the mood change. When high and low contexts are crossed with happy and sad moods, the following two conditions are defined as congruent: high fear-happy mood and low fear-sad mood. In the former condition, both variables are expected to decrease fear of the target stimulus. In the latter condition, both variables are expected to increase fear. No contrast is expected to occur in the incongruent conditions (high fear-sad mood, low fear-happy mood). As explained previously, the contrast effect should be blocked in these conditions because the preceding experience is not viewed as relevant to the current situation. This should occur because the information provided by the prior experience is inconsistent with the individual's prevailing mood. In the incongruent conditions, mood is still expected to have an impact on fear levels. Thus, a happy mood should decrease fear and a sad mood should increase fear.

In proposing the above pattern of results, two assumptions are made about the mood of participants: (1) subjects will not be in an extremely happy or sad mood during exposure to the first animal, and (2) the first exposure will not alter their mood significantly. Samsom and Rachman (1989) reported mean baseline happiness and sadness ratings of 63 and 21 respectively, suggesting that subjects were in a slightly happy mood when they entered the lab. After they underwent a behavioural approach test (during which they experienced a fear level of at least 75), their mood did not change significantly. These findings suggest that the assumptions made about mood in the current study are reasonable. However, as an added precaution, mood was assessed before and after the first exposure to confirm that this manipulation did not have an impact on ratings of happiness/sadness.

Research Hypotheses and Predictions

In summary, the goals of Experiment 2 are to replicate previous findings; improve the assessment of subjective similarity and awareness of contrasts; and examine the relation between current mood and prior context. The research hypotheses and specific predictions are as follows:

(H.1) Contrast effects are dependent upon the extent to which subjects view the context and the target stimuli as similar.

It is unknown which of the three domains (stimulus features, cognitions, or bodily sensations) will prove to be the best predictor of contrasts. No differential predictions will therefore put forward. Instead, Prediction 1 is as follows:

(P.1) Each of the three domains assessed will be correlated with the magnitude of the contrast.

Although there is evidence that under special circumstances contrast effects can occur outside subjective awareness, there is no reason to assume that within the usual experimental paradigm, subjects are unaware of contrast effects. As in Experiment 1, we hypothesize that:

(H.2) Individuals are aware of their own experience of a fear contrast.

We therefore predict that :

(P.2) The majority of subjects will indicate at the end of the experiment that their fear responses reflected a contrast process.

The third hypothesis deals with the interaction between mood and prior context:

(H.3) Mood blocks a contrast effect only when contrast information is incongruent with the prevailing mood.

This leads to the following four predictions:

(P3a) Exposure to a low fear stimulus, followed by a happy mood induction will lead to a decrease in fear. (This is in comparison to the expected increase in fear if no mood is induced.)

(P3b) Exposure to a highly fearful stimulus, followed by a sad mood induction will lead to an increase in fear. (This is in comparison to the expected decrease in fear if no mood is induced.)

(P3c) Exposure to a low fear stimulus, followed by a sad mood induction will lead to an increase in fear, similar to when no mood is induced.

(P3d) Exposure to a highly fearful stimulus, followed by a happy mood induction will lead to a decrease in fear, similar to when no mood is induced.

Method

To test these hypotheses and predictions, subjects with intense fears of two harmless animals (spiders and snakes) were again recruited. They were randomly assigned to one of six experimental conditions (described below), and, with the exception of the screening procedure, were tested individually. To demonstrate contrast effects, all subjects had to be exposed on separate occasions to two fearful stimuli. Spiders and snakes (randomly ordered) were used for this purpose. The exposure sessions were manipulated so that experimental groups differed in (a) the level of fear evoked by the first stimulus (high or low) and (b) the type of mood induction that took place between the presentation of the contextual and target stimuli (happy, sad, or no mood induction).

Most of the procedures were identical to those used in Experiment 1. The details will not be provided again, but the reader will be referred to the appropriate pages of the thesis.

Subjects and Design

One hundred and forty-two female UBC undergraduate students with a reported fear of spiders and snakes participated in this experiment. Females were chosen as participants because they are more likely to display fears of small animals (Rachman, 1978). In Experiment 1, it was noted that among the male subjects who indicated high levels of fear on the Fear Survey Schedule, very few of them actually displayed this fear in the laboratory. Fewer subjects would therefore be discarded during data collection if participation was restricted to female students. All subjects received course credit in return for their participation.

The experiment was conceptualized as a 2 x 3 between-subject design. The first between-subject factor was the level of fear (high or low) evoked by the context stimulus, and the second factor was mood (happy, sad, or no mood induction) during presentation of the target stimulus. The crossing of these two variables defined the following 6 experimental conditions:

		EXPOSURE 1 FEAR LEVEL	
		High	Low
EXPOSURE 2 MOOD	Happy	1 congruent	2 incongruent
	No M.I	3	4
	Sad.	5 incongruent	6 congruent

Twenty subjects were randomly assigned to each experimental condition. Unlike Experiment 1, there was no control group of subjects who experienced a moderate level of fear prior to exposure to the target stimulus. We have argued in the Introduction section of this paper that contrast studies should ideally include such a group. We decided not to do so because of the limited availability of subjects who are fearful of both spiders and snakes. In addition, we demonstrated in Experiment 1 that prior exposure to a moderately fearful stimulus has no effect on subsequent fear of the target stimulus. It was unlikely that a different result would be obtained in the current study, given that the same laboratory, subject population, experimenter and stimuli were utilized.

Experimenters

As in Study 1, two experimenters were required to carry out this investigation. The role of the first experimenter was to conduct the initial exposure trials, and to carry out the appropriate mood induction procedure. It was therefore impossible for her to be blind to experimental conditions. Because the principal investigator served as the first experimenter, she was also not blind to the research hypotheses. This was not expected to bias the results because all dependent measures were collected by the second experimenter.

The role of the second experimenter was to conduct the exposures to the second animal. A research assistant with an undergraduate degree in psychology served in this capacity. She was blind to the research hypotheses, and was not told the experimental condition of the subjects.

Mood Induction

The method used to induce happy and sad moods was the musical MIP (mood induction procedure) devised by Sutherland, Newman and Rachman (1982). This is the same method that was used in the previously mentioned study by Samsom and Rachman (1989). The procedure involves playing mood-suggestive music and asking subjects to use the music as a background to their own efforts. It is stressed that the music by itself will not automatically induce the desired mood state and that participants should try very hard to get into the mood; using whatever means they find most effective. The first study of musical MIP allowed subjects to choose between several different pieces of music. However, most subsequent studies have used the same piece of music for all subjects allocated to a particular mood induction.

The present investigation utilized the same music as in the study by Samsom and Rachman (1989). In that investigation, the music was successful in inducing the desired mood in 85% of research participants. Eich (1986) reports a 90% success rate using the same music.

The other commonly used technique for inducing moods in a laboratory setting is Velten's MIP (Velten, 1968). This method involves reading aloud sixty negative self-referent statements (eg. "I'm discouraged and unhappy about myself"). The statements progress from neutrality to dysphoria. The overall tone is that of indecisiveness, tiredness, unhappiness, inefficiency and pessimism.

Comparisons between studies using Velten's MIP and musical MIP indicate that the latter affects a larger number of people. Sutherland et al (1982) report two mood induction studies, one using Velten's MIP (Polivy & Doyle, 1980) and one using musical MIP (Clark & Teasdale, 1985). Comparable mood measures, subject populations and mood change criteria were used in the two studies. One hundred percent of the subjects met the predetermined mood change criterion in the study employing musical MIP compared to 68% in the study employing Velten's MIP. Clark and Teasdale (1985) asked subjects in a post-experimental questionnaire whether they had experienced a genuine change of mood during the musical MIP; 87% of subjects replied "yes", whereas only 50% of subjects replied affirmatively to a similar question in Polivy and Doyle's study of Velten's MIP. These results have been replicated in another comparison study by Clark (1983).

In order to assess the effectiveness of the mood induction procedure, subjects were asked to complete the Mood Questionnaire (see Appendix J). This questionnaire was designed by Sutherland et al. (1982) and was used by Samsom and Rachman (1989). It consists of a list of six moods. For each one, subjects are asked to indicate on a 0 to 100 point scale the extent to which they currently feel that emotion. At the zero end of each line is the statement "I do not feel at all ____________"; and the 100 mm point on the scale is labelled "I feel extremely ____________". The six adjectives on the questionnaire are: happy, sad, anxious, apprehensive, relaxed and agitated.

Procedure

This investigation was divided into the following five sections:

(a) Screening

(b) Providing the Context
  Assessment of subjective similarity
  Prediction of fears for stimulus 1 and 2
  Selection of approach point for stimulus 1
  Exposure to stimulus 1

(c) Mood Induction

(d) Exposure to the Target
  Selection of approach point for stimulus 2
  Prediction of fear
  Exposure to the animal

(e) Final Assessment
  Behaviour Approach Test
  Questionnaires
  Debriefing

Screening

Screening procedures were the same as in Experiment 1 (see pages

45- 46).

Providing the Context

After completion of the consent form and attachment of the heart rate monitor (see page 46), subjects filled out the Adjective Questionnaire, the Cognitions Questionnaire, the Sensations Questionnaire and the Mood Questionnaire. They were then asked to make several predictions about their fears of spiders and snakes, and to select an approach point for one of the animals (see pages 46-47). All subjects selected one of <u>two</u> choices (high or low fear).

Exposure to Stimulus 1

Exposure to the first stimulus was conducted in the same manner as in Experiment 1 (see pages 47-48).

Mood Induction

The musical mood induction procedure will be discussed in detail, as it was not included in Experiment 1.

Those subjects undergoing mood induction were told the following:

"In today's session you will listen to a selection of classical music that should help you develop a happy (sad) mood. However, music alone cannot create the desired mood, so you should try to think about something that makes you happy (sad). You may find it especially helpful to concentrate on happy (sad) events that you have personally experienced. While you are listening to the music, I will come in periodically and ask you to fill out some brief questionnaires. When I think that you have developed an appropriate mood, I will send in another experimenter and she will let you know what is going to happen next. Do you have any questions so far?"

Upon receiving these instructions, subjects were given a Sony Walkman Stereo Cassette Player. Through the headphones was played, at a comfortable listening volume, one of two selections of "happy" music (a segment of Eine Klein Nachtmusik (5 min: 10 sec) or Divertimento #136 (4:10), both by Mozart) or one of two selections of "sad" music (Albinoni's Adagio in G Minor (6:32) or Barber's Adagio pour Cordes; (5:33)).

Immediately before mood induction, three minutes after the music began, and every three minutes thereafter, subjects rated their current mood. The music continued to play while the subjects made these ratings. Before the experiment could continue, subjects were required to give themselves a rating of at least 75 (out of 100) in response to the appropriate item (i.e. pertaining to happiness or sadness) on the Mood Questionnaire. In addition, ratings of the noncongruent mood had to be less than 25. Based on these criteria, 10 out of 142 subjects (7%) were excluded from participation. Ratings of all other moods did not play a part in mood induction criteria, but were analyzed after data collection.

Participants in the happy and sad groups underwent mood induction for a minimum of ten minutes, and a maximum of fifteen minutes. In order to equate experimental groups, a matching procedure was utilized. If a subject undergoing mood induction required more than ten minutes to develop the requisite mood, then the next control subject to enter the study was matched with respect to length of time between exposure 1 and exposure 2. Those participants in the control group who were not matched to a mood induction subject waited ten minutes before exposure to the second stimulus.

An additional point concerning the required levels of happiness/ sadness is worth making. Subjects did not know that their continued participation was contingent upon their achieving a certain level of happiness or sadness. If the subjects had been aware of this contingency, it is possible that they would have rated their mood as being more extreme than it actually was in order to complete the experiment more quickly.

Exposure to the Target

The procedure for selecting the approach point for the second stimulus was the same as in Experiment 1 (see page 49). Exposure was also conducted in the same manner.

Behaviour Approach Test

After exposure to the target stimulus, the maximum fear level for each animal was assessed. This was necessary in order to screen out those subjects who did not have sufficient fear for the purposes of this investigation. As with the first experiment, this screening had to be done at the end of the experiment so that it did not interfere with the demonstration of contrasts. (For a full explanation, see pages 35-36). Twelve out of 132 subjects (9%) did not meet the research criterion of a fear level greater than 75 (out of 100), and were therefore excluded from the study (i.e. none of their data were analyzed). The behaviour approach test was the same as that described in Experiment 1 (see page 50).

Final Questionnaires and Debriefing

At the end of the experiment, subjects were asked to fill out the Awareness Questionnaire, the Mood Questionnaire, as well as a questionnaire asking them to state *honestly* whether or not their mood changed during the experiment (see Appendix K). They were then thoroughly debriefed (see Appendix L) and given course credit.

Results

A total of 120 subjects met the research criteria for participation in this study. Twenty subjects were randomly assigned to each of the six experimental conditions (see below).

EXPOSURE 1
FEAR LEVEL

EXPOSURE 2	MOOD	High	Low
	Happy	1 congruent	2 incongruent
	No M.I	3	4
	Sad	5 incongruent	6 congruent

<u>Preliminary Analysis</u>

1. Analyses of variance indicated that there were no significant group differences on baseline measures of mood, fear and heart rate. (See Table V for means and standard deviations.)

2. Experimental Manipulations

(a) Context

In order to verify that significantly different levels of fear were induced and maintained during exposure to the first stimulus, measures of subjective fear and heart rate were collected at the beginning and end of the three-minute exposure period. Four analyses were conducted to examine differences between high and low fear groups. The alpha level was reduced to .0125 (.05/4) to control for inflation of Type 1

Table V

Baseline Measures Prior to Experimental Manipulations

Variable	Mean	(Standard Deviation)
Self-Reported Happiness	57.08	(20.41)
Self-Reported Sadness	8.81	(13.61)
Self-Reported Anxiety	47.06	(22.92)
Heart Rate	77.42	(11.76)
Fear of Spiders:		
SUDS	86.76	(7.07)
Heart Rate	86.30	(11.66)
Closest Approach Point	8.40	(12.84)
Fear of Snakes		
SUDS	86.41	(6.87)
Heart Rate	86.66	(12.19)
Distance	8.20	(11.88)

$\underline{N}$=120

Note: Reported fear, happiness, sadness and anxiety were rated on a 0 to 100 point scale. Unit for heart rate is b.p.m. Unit for closest approach point is inches.

error. Analysis of variance of subjective fear scores revealed that the two groups differed at both the beginning and end of exposure sessions. Heart rate responses were assessed using analysis of covariance, with baseline heart rate as the covariate. The results indicated that the two groups were significantly different at both assessment points. These findings confirm that fear levels were successfully manipulated (see Table VI).

In planning Experiment 2, it was hypothesized that exposure to the first feared stimulus would not significantly affect subjective reports of happiness/sadness. To check this hypothesis, two 2 (context) by 2 (time) ANOVAs for repeated measures were conducted with happiness and sadness ratings before and after exposure as the dependent measures. The results indicated significant main effects for time (happy: $F(1,118)=16.51$, $p<.001$; sad: $F(1,118)=6.20$, $p<.05$), no significant effects for context (happy: $F(1,118)=0.044$, n.s.; sad: $F(1,118)=0.003$, n.s.), and no significant interactions (happy: $F(1,118)=1.667$, n.s.; sad: $F(1,118)=0.461$, n.s.). Contrary to expectations, subjects became slightly less happy and more sad as a consequence of exposure to a feared stimulus. Although the shifts in mood were statistically significant, the changes were of small magnitude. Sadness shifted from $M=8.8$ ($SD=13.6$) to $M=11.3$ ($SD=15.23$) and happiness shifted from $M=57.1$ ($SD=20.4$) to $M=50.7$ ($SD=22.4$).

(b) Mood

In order to verify that the mood induction procedure was effective in producing happy and sad moods, self-reported measures of happiness and sadness were taken before mood induction, immediately after mood induction, and after exposure to the second stimulus. For each of the

Table VI

Mean Subjective Fear and Heart Rate at the Beginning and End of Exposure 1

Variable	Group Hi n=60	Lo n=60	Significance	Marginal Mean N=120
Beginning of exposure period:				
Reported Fear	87.8 (7.9)	10.0 (0.0)	*$F(1,118)=5883.97$	48.9 (39.5)
Heart Rate	93.1 (11.4)	84.8 (13.2)	*$F(1,118)=31.42$	88.9 (12.7)
End of exposure period:				
Reported Fear	88.8 (7.8)	10.0 (0.0)	*$F(1,118)=6065.77$	49.4 (39.9)
Heart Rate	92.3 (12.9)	80.7 (11.8)	*$F(1,118)=59.069$	86.5 (13.2)

*$p<.0125$

Note: Heart rate means are adjusted. Reported Fear was rated on a 0 to 100 point scale. Unit for heart rate is b.p.m. Numbers in parentheses are standard deviations.

six measures, a 2 (context) x 3 (mood) ANOVA was calculated. There were no significant effects for context, nor were there any significant interactions. On pre-mood induction scores, there were no significant differences across mood conditions (happy: $F(2,114)=2.77$, n.s.; sad: $F(2,114)=2.22$, n.s.). Immediately after mood induction, the three groups differed significantly (happy: $F(2,114)=193.09$, $p<.001$; sad: $F(2,114)=869.09$, $p<.001$). Follow-up Tukey tests revealed that for happiness, all groups differed significantly from each other. For sadness, the sad group differed from the happy group ($t(3,19)=37.05$, $p<.01$), and from the no mood induction group ($t(3,19)=35.38$, $p<.01$).

After exposure to the second stimulus, there continued to be a significant difference across groups (happy: $F(2,114)=9.02$, $p<.001$; sad: $F(2,114)=30.52$, $p<.001$). Follow-up comparisons revealed that subjects in the sad group were significantly less happy than those in the happy group ($t(3,19)=3.99$, $p<.05$) and the no mood induction group ($t(3,19)=3.40$, $p<.05$). The same pattern was evident in sadness scores - the sad group differed from the happy group ($t(3,19)=6.95$, $p<.05$), and from the no mood induction group ($t(3,19)=6.56$, $p<.05$).

In summary, the happy and sad groups can be differentiated from the control group on self-reported happiness (see Figure 8). However, because most subjects entered the study reporting very little sadness, the happy group cannot be differentiated from the control group on this measure (see Figure 9).

To examine the subsidiary effects of the mood induction procedure, subjects were asked to rate their current feelings of sadness, happiness, anxiety, apprehension, agitation and relaxation on the mood questionnaire. Inter-item correlations on responses collected before

FIGURE 8

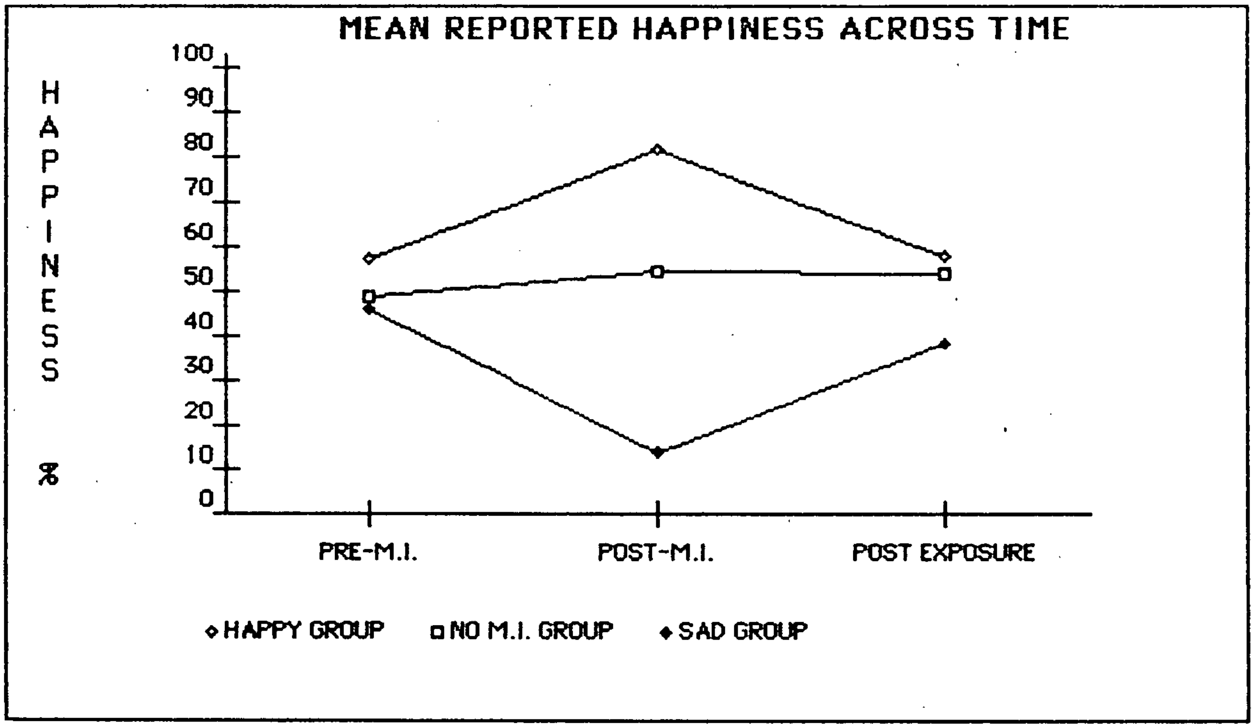
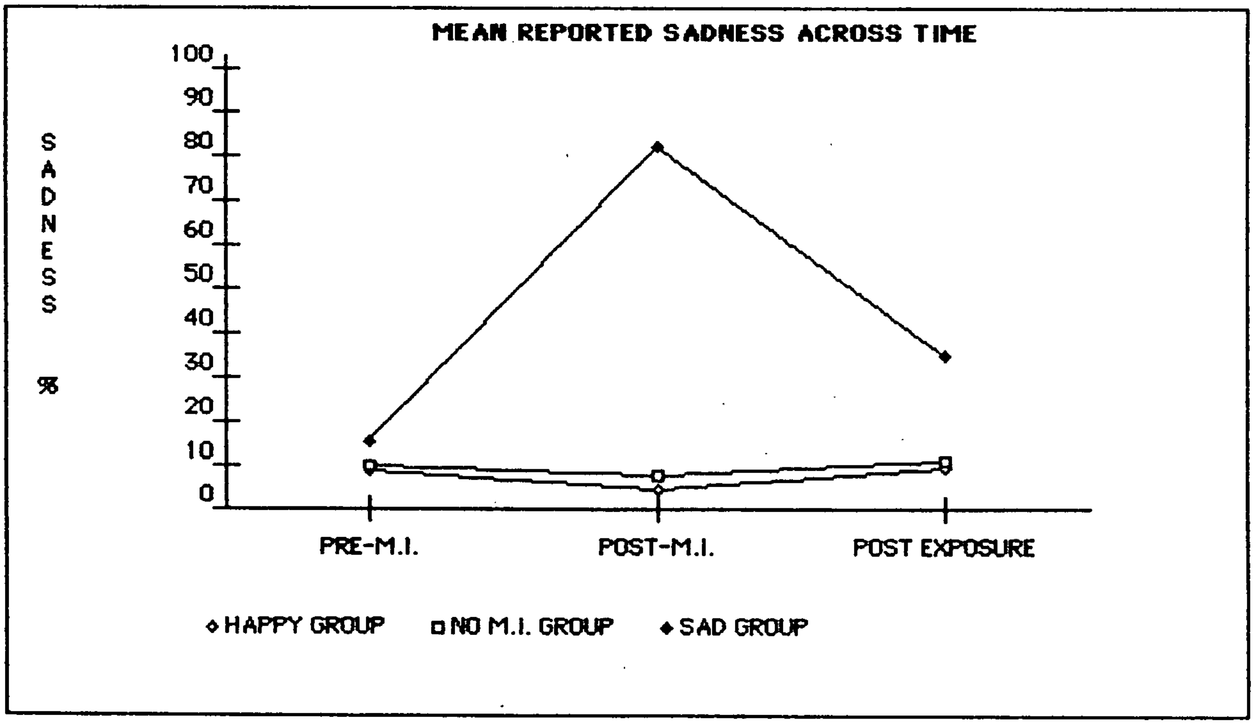


FIGURE 9



and after mood induction were calculated using Pearson's correlation coefficients. The family-wise error rate was set at .15, and a sequential Bonferroni procedure was utilized. Significant correlations are displayed in Table VII. Before mood induction, *agitated* correlated positively with *anxious* and *sad*; *relaxed* correlated negatively with *anxious* and *agitated*, and positively with *happy*; and *apprehensive* correlated positively with *anxious* and *agitated*. After mood induction, all but one of these relations were maintained, and in addition, *sad* correlated negatively with *happy* and *relaxed*.

As a final check on the mood manipulation, the percentage of subjects who indicated that their mood had 'honestly changed' during the experiment was calculated. Seventy out of 80 subjects (87.5 %) replied affirmatively.

<u>Major Analyses</u>

1. Replication of Experiment 1

(a) In order to determine the occurrence of contrast effects in Experiment 2, predicted fear was recorded immediately prior to the second exposure, and measures of subjective fear and heart rate were collected during the second exposure. Groups 3 and 4 (no mood induction) parallel the high and low fear groups in Experiment 1. It was predicted that the two groups would differ on the three dependent variables (predicted fear, reported fear and heart rate). To determine this, two analyses of variance were conducted with predicted fear and reported fear as the dependent measures. Analysis of covariance was utilized to assess heart rate responses, with baseline heart rate (assessed just prior to the second exposure) as the covariate. Results indicated that there was a significant difference in reported fear

Table VII

Intercorrelations Between Items on Mood Questionnaire Pre- and Post-Mood Induction

	anxious		sad		agitated		happy		relaxed	
	pre	post	pre	post	pre	post	pre	post	pre	post
sad	.115	-.022								
agitated	.488*	.524*	.249*	.222*						
happy	.020	.032	-.194	-.812*	-.118	-.202				
relaxed	-.417*	-.181	.015	-.253*	-.307*	-.273*	.354*	.347*		
appreh.	.400*	.377*	.203	.036	.426*	.463*	.011	.011	-.203	-.114

Note: N=120

($F(1,38)=13.204$, $p<.001$), and heart rate ($F(1,38)=4.742$, $p<.05$), but not in predicted fear ($F(1,38)=3.785$, n.s.). The differences in reported fear and heart rate are indicative of a contrast effect, and replicate the findings from Experiment 1. These results are displayed in Table VIII. For ease of comparison, the results of Experiment 1 have also been included in this table.

Additional analyses were undertaken to determine if predicted and reported fear were significantly different. A 2 (context) x 2 (predict/report) ANOVA for repeated measures indicated a main effect for context ($F(1,38)=13.502$, $p<.01$), and a significant interaction ($F(1,38)=6.261$, $p<.05$). T-tests for dependent measures were utilized to evaluate with-in group differences. In the high fear group, predicted fear was significantly greater than reported fear, $t(19)=2.24$, $p<.05$, indicating an overprediction of fear. In the low fear group, predicted and reported fear were not significantly different, $t(19)=1.11$, n.s. These predict/report patterns are similar to those found in the first experiment.

(b) Heart Rate Analysis

To further examine heart rate changes, several analyses were performed, again comparing the two no mood induction groups (high fear vs. low fear). First, a 2 (context) x 2 (time) ANOVA was conducted with baseline 2 heart rate and exposure 2 heart rate as the dependent measures. There was no significant main effect for context ($F(1,38)=1.115$, n.s.), a significant main effect for time ($F(1,38)=32.347$, $p<.001$), and a significant interaction ($F(2,38)=4.194$, $p<.05$). Follow-up t-tests indicated that for both the

Table VIII

Replication of Contrast Effects in the No Mood-Induction Group

Variable	High Fear		Lo Fear		Significance
	Study 1 (n=21)	Study 2 (n=20)	Study 1 (n=22)	Study 2 (n=20)	(Study 2)
Predicted Fear	43.3 (13.4)	49.8 (14.5)	58.0 (11.8)	57.3 (9.4)	$F(1,38)= 3.785$
Reported Fear	36.4 (18.1)	36.8 (23.0)	62.5 (16.5)	60.8 (18.6)	**$F(1,38)=13.203$
Heart Rate	79.6 (13.6)	79.8 (10.4)	85.1 (10.1)	85.4 (11.8)	*$F(1,38)= 4.742$

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

Note: Heart rate means are adjusted. Reported Fear was rated on a 0 to 100 point scale. Unit for heart rate is b.p.m. Numbers in parentheses are standard deviations.

high and low fear groups there was a significant increase in heart rate from baseline to exposure (high: $\underline{t}(19)=3.30$, $\underline{p}<.01$; low: $\underline{t}(19)=4.63$, $\underline{p}<.001$). However, this increase was significantly greater for the low fear group ($\underline{t}(19)=2.05$, $\underline{p}<.05$). These results are displayed in Figure 10.

The second heart rate analysis was undertaken to determine if shifts in heart rate during exposures 1 and 2 were significantly different for the two contexts. Two change scores were calculated by subtracting baseline heart rates from exposure heart rates (i.e. Change1=Exposure1 - Baseline1; Change2=Exposure2 - Baseline2). A 2 (context) x 2 (time) ANOVA with Change1 and Change2 as the dependent measures indicated no significant main effects, and a significant interaction ($\underline{F}(2,38)=16.248, \underline{p}<.001$). Follow up analysis of the interaction (with alpha level reduced to .01) indicated that the high fear group experienced a greater change in heart rate during exposure 1 ($\underline{t}(10)=3.31$, $\underline{p}<.01$). In the low fear group, heart rate changes during exposures 1 and 2 were not significantly different at the .01 alpha level ($\underline{t}(19)=2.31$, $\underline{p}<.05$). In Experiment 1, a significant difference was found.

In order to examine the relation between subjective fear and heart rate acceleration, the following four variables were correlated: Reported Fear1, Change1 (HR), Reported Fear2, Change2 (HR). The family-wise error rate was set at .10, and a sequential Bonferroni procedure was utilized. The results (see Table IX) are consistent with those of Experiment 1, suggesting an inverse relationship between fear during exposure 1 and fear during exposure 2.

In summary, comparison of groups 3 and 4 confirmed the occurrence of contrast effects in fear. The effect was evident in both subjective and physiological measures, replicating Experiment 1.

FIGURE 10

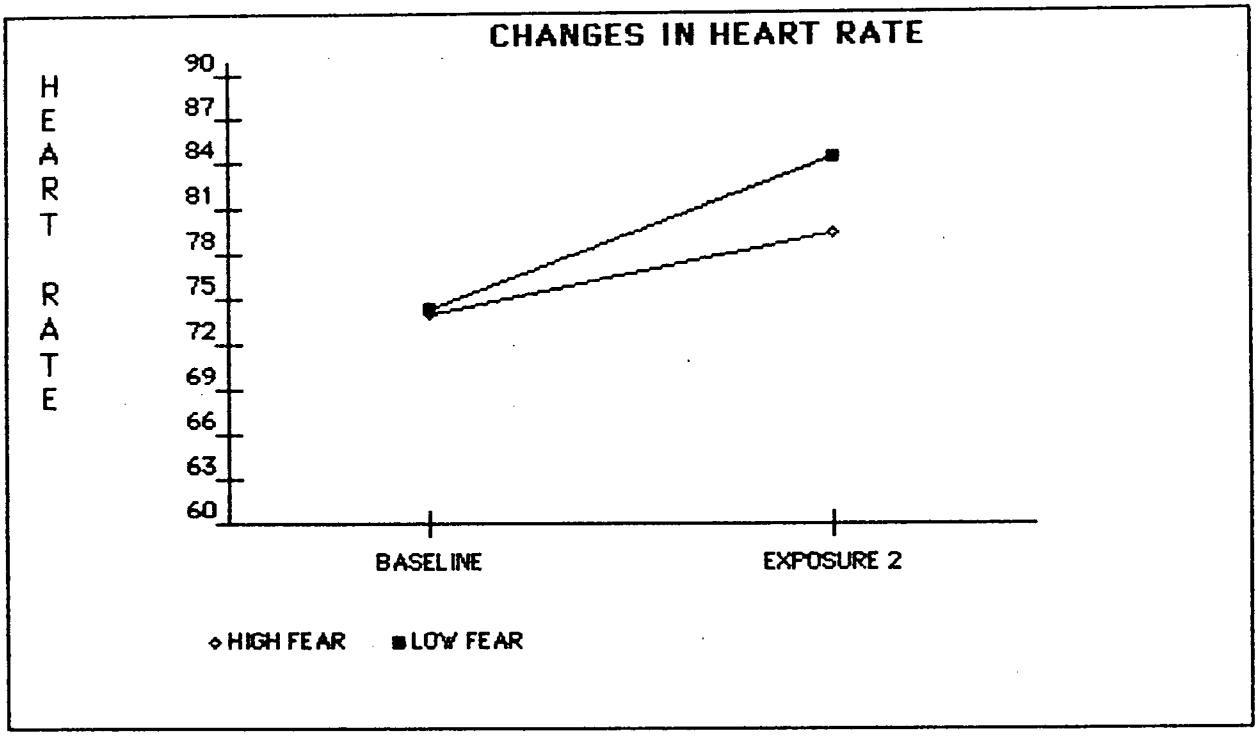

CHANGES IN HEART RATE
HEART RATE
90
87
84
81
78
75
72
69
66
63
60
BASELINE
EXPOSURE 2
HIGH FEAR
LOW FEAR

Table IX

Intercorrelations Between Subjective Fear and Changes in Heart Rate During Exposures 1 and 2

	Fear1	Change1 (H.R.)	Fear2
Change1 (H.R.)	.505*		
Fear2	-.541*	-.198	
Change2 (H.R.)	-.331*	-.142	.292

Note: N=65

2. Subjective Similarity

To test hypothesis 1, that contrast effects are dependent upon the extent to which subjects view the context and target stimuli as similar, participants completed the Adjective Questionnaire, the Sensations Questionnaire and the Cognitions Questionnaire. For each of these, a "similarity index" was calculated by summing the items that subjects indicated were relevant to both spiders and snakes, and dividing this by the total number of items minus those that subjects did not view as relevant to either animal. These scores were then correlated with the magnitude of the contrast. In order to measure contrast effects, the reported fear scores of subjects from group 3 (high fear-no M.I.) and group 4 (low fear-no M.I.) were utilized. These scores were subtracted from the mean reported fear scores of the control group from Experiment 1. The absolute value was taken as the magnitude of the contrast. As can be seen from the correlation matrix displayed in Table X, none of the three questionnaires was correlated with the magnitude of the contrast. The only significant correlation was between the similarity indices for sensations and cognitions (r=.588, p<.001).

3. Awareness of Contrasts

Hypothesis 2 stated that individuals are aware of their own experience of a fear contrast. To examine this issue, the Awareness Questionnaire was administered verbally. Each subject's response to the first question (see Appendix I) was scored as either reflecting or not reflecting awareness of a contrast. To analyze these data, participants were divided into two groups: those who experienced a contrast effect, and those who did not. A contrast effect was defined

Table X

Inter-Correlation of Three Similarity Indices (S.I.) and Contrast Effects (for the No Mood-Induction Group)

	Contrasts	Adjectives S.I.	Cognitions S.I.
Adjectives S.I.	.169		
Cognitions S.I.	.038	.112	
Sensations S.I.	-.080	.171	.588*

Note: N=40

as a shift in fear (in the appropriate direction) of greater than half a standard deviation from the mean of the control group in Experiment 1 ($\underline{M}$=49.2 ± 8.4). Thus, to be categorized as experiencing a contrast, subjects exposed to a highly fearful context had to report a subsequent fear level of less than 40.8, and subjects exposed to a slightly fearful context had to report a fear level of greater than 57.6. Subjects from condition 1 (high fear-happy mood) and condition 6 (low fear-sad mood) were not included in the analysis because changes in their fear levels could not be clearly attributed to prior context. Of the participants who experienced a contrast effect ($\underline{n}$=42), eight (19%) were aware of this. Of the subjects who clearly did not experience a contrast ($\underline{n}$=38), two (5%) reported that a contrast had occurred. A chi square test (with Yate's correction for discontinuity) was not significant ($\underline{x}^2(1)$=2.32, n.s.) indicating that subjects who experienced a contrast were no more likely to report such an effect than subjects who did not experience a contrast effect (see Table XI).

A similar analysis was undertaken to determine if subjects were aware of the effects of mood on fear. A mood effect was defined as a shift in fear (in the appropriate direction) of greater than half a standard deviation from the combined mean of the no mood induction groups (i.e., $\underline{M}$=48.8 ± 10.6). Subjects from conditions 1 and 6 were again excluded from the analysis because changes in their fear could not be clearly attributed to mood. In addition, participants from groups 3 and 4 were not included because they did not experience significant mood change. Of the 40 remaining subjects, 18 reported that their fear level was influenced (in the hypothesized direction) by their mood

Table XI

Chi Square Showing the Number of Subjects Who Reported a Contrast Effect Contingent Upon Experiencing a Contrast Effect

	Reported	
	Contrast	No Contrast
Experienced	n=10	n=70
Contrast	8	34
No Contrast	2	36

$\chi^2(1)=2.32$, n.s.

N=80

(Question 3 of the Awareness Questionnaire, Appendix 1). Of the 23 subjects who clearly demonstrated a mood effect, 15 (65%) were aware of it. Three (18%) of the remaining 17 who did not experience a mood effect nevertheless reported such an occurrence. A chi square test (with Yate's correction) was significant ($\chi^2(1)=7.09$, $p<.01$), suggesting that subjects who experienced a mood effect were more likely to report this than subjects who did not experience a mood effect (see Table XII).

In summary, data from the Awareness Questionnaire suggest that contrary to prediction 2, participants were generally unaware of contrast effects. Interestingly, most subjects were aware of the effects of mood on fear.

4. Interaction of Mood States and Contexts

Three analyses were conducted to examine the interaction between mood states (happy, sad and no M.I.) and context (high fear, low fear). The dependent measures were predicted fear, reported fear and heart rate response. The first two measures were assessed using analysis of variance. Heart rate was examined using analysis of covariance, with baseline heart rate (assessed just before exposure to the second stimulus) as a covariate. The means and standard deviations for the three variables are presented in Table XIII. The alpha level was reduced to .017 (.05/3). With regard to predicted fear, there was a main effect for mood ($F(2,114)=4.513$, $p<.017$), but no effect for context, nor was there a significant interaction. For reported fear, there was a main effect for mood ($F(2,113)=10.406$, $p<.017$), a main effect for context ($F(1,113)=7.702$, $p<.017$), and a significant interaction ($F(2,113)=4.243$, $p<.017$). There were no significant effects for heart rate.

Table XII

Chi Square Showing the Number of Subjects Who Reported a Mood Effect Contingent Upon Experiencing a Mood Effect

	Reported	
	Mood Effect	No Mood Effect
Experienced	n=18	n=22
Mood Effect	15	8
No Mood Effect	3	14

$\chi^2(1)=7.09$, $p<.01$

N=40

Table XIII

Mean Predicted Fear (P), Reported Fear (R) and Heart Rate (HR) by Context by Mood

MOOD	CONTEXT: High Fear	CONTEXT: Low Fear
	(1)	(2)
	P: 53.8 (17.4)	P: 48.0 (17.4)
Happy	R: 37.0 (19.4)	R: 45.3 (15.9)
	HR: 79.5 (11.1)	HR: 77.9 (11.8)
	(3)	(4)
	P: 49.8 (14.5)	P: 57.3 (9.4)
No M.I.	R: 36.8 (23.0)	R: 60.8 (18.6)
	HR: 79.8 (10.4)	HR: 85.4 (11.8)
	(5)	(6)
	P: 63.8 (15.9)	P: 58.8 (19.9)
Sad	R: 62.3 (19.4)	R: 60.4 (22.8)
	HR: 81.5 (9.0)	HR: 78.3 (14.5)

N=120

Note: Heart rate means are adjusted. Predicted and Reported Fear were rated on a 0 to 100 point scale. Numbers in parentheses are standard deviations.

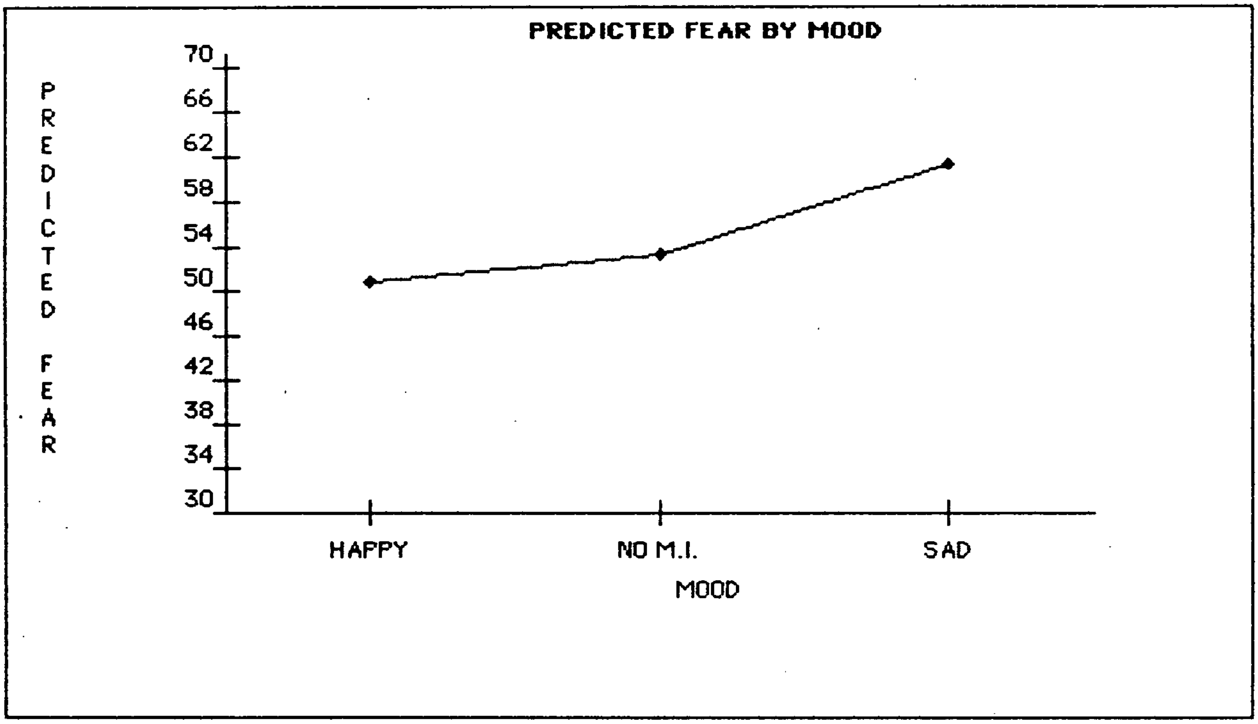
Post hoc analysis (in the form of Tukey tests) of the main effect for Predictions indicated that happy and sad groups differed significantly ($\underline{t}(3,114)=4.084$, $\underline{p}<.05$). The other two comparisons were not significant. These findings suggest that predictions made by the sad group were higher than those made by the happy group (see Figure 11).

To follow-up the significant interaction for Reported Fear, four planned comparisons were done, based on the predictions set forth prior to data collection. Prediction 3a stated that exposure to a low fear stimulus, followed by a happy mood induction will lead to a decrease in fear. This is in comparison to the expected increase in fear if no mood is induced. To test this prediction, the mean reported fear scores from conditions 2 and 4 were compared. A significant difference was found ($\underline{F}(1,114)=6.01$, $\underline{p}<.05$), suggesting that reported fear in condition 2 (low fear - happy mood) was lower than reported fear in condition 4 (low fear - no M.I.), supporting prediction 3a.

Prediction 3b was as follows: Exposure to a highly fearful stimulus, followed by a sad mood induction will lead to an increase in fear. This is in comparison to the expected decrease in fear if no mood is induced. To test this prediction, the mean reported fear scores from conditions 3 and 5 were compared. A significant difference was found ($\underline{F}(1,114)=16.26$, $\underline{p}<.01$), indicating that reported fear in condition 5 (high fear - sad mood) was higher than reported fear in condition 3 (high fear -no M.I.), supporting prediction 3b.

The final two predictions were based on the expectation that significant differences between the two groups would <u>not</u> be found. Prediction 3c stated that exposure to a low fear stimulus, followed by a sad mood induction will lead to an increase in fear comparable to a no

FIGURE 11


PREDICTED FEAR BY MOOD
PREDICTED FEAR
70
66
62
58
54
50
46
42
38
34
30
HAPPY
NO M.I.
SAD
MOOD

mood induction control group. To test this prediction, the mean reported fear scores from conditions 4 (low fear - no M.I.) and 6 (low fear - sad mood) were compared. The results supported the prediction that the two groups would not be significantly different ($F(1,114)=.004$, n.s.).

The final prediction (3d) stated that exposure to a highly fearful stimulus, followed by a happy mood induction will lead to a decrease in fear comparable to a no mood induction control group. A comparison of mean reported fear scores for conditions 1 (high fear - happy mood) and 3 (high fear - no M.I.) supported this prediction ($F(1,114)=.001$, n.s.).

In summary, the four predictions put forth at the start of Experiment 2 were all supported by the data, confirming the underlying hypothesis that mood blocks a contrast effect when contrast information is incongruent with prevailing mood (see Figure 12).

5. Predict/Report Patterns

To examine patterns of predicted and reported fear, a new variable was computed by subtracting reported fear from predicted fear. A 2 (context) by 3 (mood) ANOVA was then calculated with this difference score as the dependent measure. The results indicated a significant main effect for context ($F(1,114)=11.205$, $p<.01$), no effect for mood ($F(2,114)=2.866$, n.s.), and no significant interaction ($F(2,114)=1.495$, n.s.). With regard to the context effect, examination of the means suggests that the High Fear group overpredicted their fear, and the Low Fear group predicted accurately (see Figure 13). The overprediction of the former group appeared to be due to a decrease in reported fear, rather than to an inflation in predictions.

Figure 12

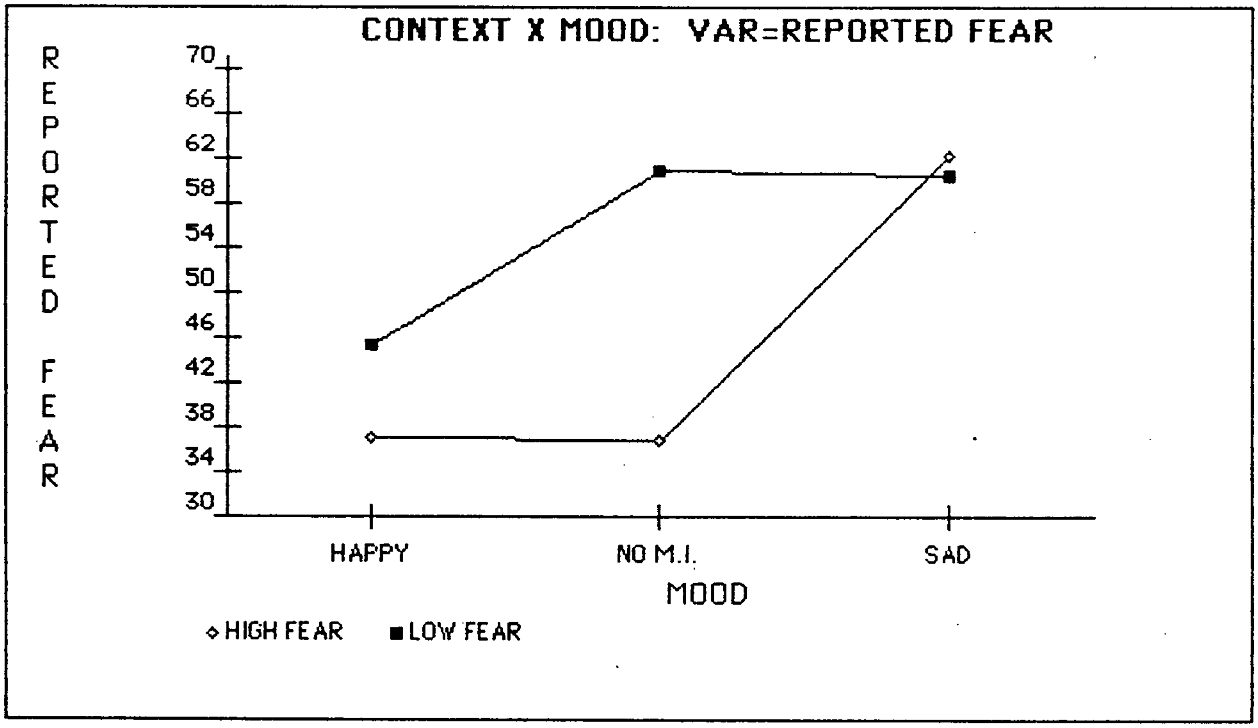
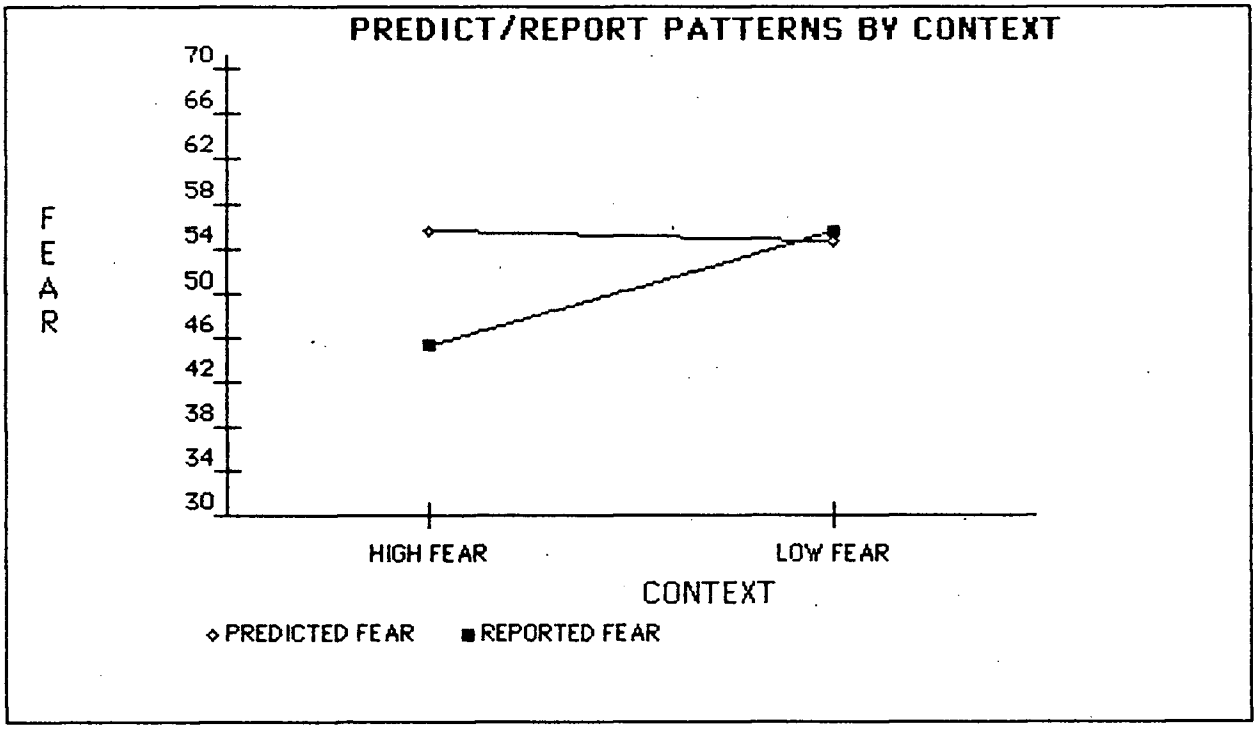

CONTEXT X MOOD: VAR=REPORTED FEAR
REPORTED FEAR
70
66
62
58
54
50
46
42
38
34
30
HAPPY
NO M.I.
SAD
MOOD
HIGH FEAR
LOW FEAR

FIGURE 13


PREDICT/REPORT PATTERNS BY CONTEXT
70
66
62
58
54
50
46
42
38
34
30
FEAR
HIGH FEAR
LOW FEAR
CONTEXT
PREDICTED FEAR
REPORTED FEAR

Discussion

The purpose of Experiment 2 was to replicate the occurrence of fear contrasts, and to expand our understanding of the nature and parameters of this phenomenon. Statistical comparison of the two no mood induction groups confirmed the occurrence of contrast effects. As predicted, those subjects who initially experienced a high level of fear subsequently reported less fear of the target stimulus. Those subjects who were initially exposed to a low level of fear reported greater fear of the target stimulus. Heart rate measures paralleled these findings. Subjects in the low fear group demonstrated greater heart rate responses to the second fear stimulus than did those in the high fear group. The mean reported fear and heart rate scores were remarkably similar to those obtained in the first experiment.

The comparability of the results of the two studies extended to patterns of predicted and reported fear. In both studies, the high fear group over-predicted fear, and the low fear group predicted accurately.

Unlike Experiment 1, the current investigation did not include a control group of subjects who experienced a moderate level of fear on both occasions. However, given the high degree of similarity between the responses of the high and low fear groups of the two studies, and the fact that the same laboratory, subject population and experimenter were utilized, it is reasonable to assume that similar results would have been obtained had Experiment 2 included a control group.

In summary, the major findings from Experiment 1 were replicated in the current investigation, confirming the occurrence of contrast effects in fear.

In addition to demonstrating contrasts, Experiment 1 included subjective ratings of the degree of similarity between the target and context stimulus. It was hypothesized that contrast effects would be dependent upon the extent to which individuals perceived these two stimuli to be related. This hypothesis was unsupported by the data, but there were several problems with the assessment measure. The current investigation therefore included improved assessment procedures for examining perceived similarity. Three domains of similarity were assessed (stimulus features, cognitions and bodily sensations), and it was predicted that each would correlate with the magnitude of the contrast. This prediction was not supported. None of the domains was significantly correlated with contrast effects.

Presumably the context and target stimuli must be linked in order for the first to have an impact on the second, yet assessments of functional similarity, and of several dimensions of subjective similarity did not illuminate this linkage. One possible connection that has not been explored is the contextual similarity of the two exposures. Similar features of the context include the lab in which the exposures took place, the seating of the subject, the housing of the animals, and the manner in which the animals were brought toward the subject. Perhaps it was these similarities that made the first experience relevant to the second. This hypothesis could be tested in the lab by varying the degree of similarity between the two exposures. As similarity decreases, there should be a corresponding decrease in the magnitude of the contrast effect.

In Experiments 1 and 2, the issue of awareness of contrasts was also of interest. In the latter study, this was assessed with a post-experimental questionnaire. It was hypothesized that individuals are aware of contrasts, and thus it was expected that most would report this effect. This prediction was not supported. Only 13 percent of participants provided a response that was suggestive of a contrast. Moreover, these responses were not contingent upon actually experiencing a contrast effect.

Awareness of mood effects was also assessed. A higher percentage of subjects (45%) reported a mood effect than reported a contrast effect. Unlike contrasts, reporting a mood effect was contingent upon actually experiencing one.

A potential problem with the use of post-experimental questionnaires is their demand characteristics. For example, in the current study, participants underwent mood induction; were shown a frightening stimulus; and were then asked if their fear level was affected by their mood. Clearly, it could be argued that there was a high demand to answer this question affirmatively. Despite this possibility, less than half the subjects did so. Moreover, the majority of those who replied affirmatively had actually experienced such an effect. These findings argue against the view that subjects' positive responses simply reflected demand characteristics inherent in the assessment procedure.

With regard to awareness of contrasts, most participants did not report this effect, again suggesting that they were not responding to demand characteristics. However, for those subjects who did answer affirmatively, the possibility of demand effects could not be ruled out because affirmative responses were not contingent upon actually experiencing the effect.

The formats for collecting the data on awareness of contrasts and awareness of mood effects were identical. It is therefore unlikely that subjects did not demonstrate awareness of contrasts because the assessment measure was insensitive to this phenomenon. It appears, rather, that participants were generally unaware of their own experience of a fear contrast. This finding is consistent with priming studies demonstrating that individuals need not be aware that they are making a comparison for contrast effects to occur (Bargh & Pietromonaco, 1982; Herr, 1986). Further, the results suggest that the comparison process that underlies a fear contrast tends to occur automatically. The generalizability of these results to contrasts with other kinds of stimuli remains to be examined.

The final topic of interest in this investigation was the interaction of mood states and prior contexts. Before addressing the hypothesis and predictions, it was essential to confirm that the mood induction procedure had been effective in producing happy and sad moods. For this purpose, self-reported mood measures were taken immediately after mood induction, and after exposure to the target stimulus. Happy and sad groups differed significantly at both assessment points on measures of happiness and sadness. In addition, the sad group differed from the no mood induction group on both measures at both assessment points. There was, however, some difficulty differentiating the happy group from the no mood induction group, particularly on measures of self-reported sadness. Participants generally entered the study feeling moderately happy, and not particularly sad . As a consequence, the mood scores of those undergoing happy mood induction did not have to shift as much as those of subjects undergoing sad mood induction. This raises the question of whether happy and sad mood changes were of comparable intensity. Although this is an important issue generally for research using mood induction procedures, it has few implications for the results of the current investigation. As will be discussed shortly, both happy and sad mood inductions had the predicted effect on reported fear, indicating that they were of sufficient intensity to adequately test the research hypotheses.

As an additional measure of the impact of mood induction, subjects who underwent this procedure were asked at the end of the study to indicate on a questionnaire whether their mood had changed during the mood induction procedure. This questionnaire emphasized honesty in responding. Eighty-eight percent indicated that their mood had changed as a consequence of the induction. This value is similar to the 87 percent reported by Clark and Teasdale (1985), and to the 94 percent reported by Samsom and Rachman (1989).

To assess subsidiary effects of the mood induction procedure, intercorrelations between items on the mood questionnaire were examined. Before mood induction, a sad mood was positively correlated with feeling agitated. After mood induction, this relation was maintained, and in addition, significant negative correlations emerged between feeling sad and relaxed, and between feeling sad and happy. Happiness remained positively correlated with feeling relaxed. These correlations are similar to those obtained in other investigations using the musical mood induction procedure (e.g., Sutherland et al., 1982; Samsom & Rachman, 1989). They suggest that a sad mood is accompanied by a moderate level of agitation, and a happy mood is accompanied by feeling relaxed. These patterns are consistent with the view that individuals do not typically experience "pure" emotional states (Ekman, Levenson & Freeman, 1983; Izard, 1971). For our purposes, it is important to point out that although the correlations of happiness and sadness with other mood states were statistically significant, they were of small magnitude. Overall, the mood manipulation appears to have produced the desired mood changes.

The hypothesis underlying the interaction of mood states and contexts is that mood blocks a contrast effect only when contrast information is incongruent with prevailing mood. Four specific predictions were derived from this hypothesis, all of which were supported by the data. In discussing these predictions, it is useful to keep in mind the results from the control group in Experiment 1. In the absence of contextual manipulations and mood manipulations, reported fear of the target stimulus was about 50 out of 100. In the second study, when no mood was induced, a high fear context resulted in a decrease in fear, and a low fear context resulted in an increase in fear. When a happy mood was induced prior to exposure to the target stimulus, a low fear context no longer led to an increase in fear, confirming prediction 3a. However, a high fear context resulted in the expected decrease in fear. This decrease was not significantly different from that of the high fear-no M.I. group, confirming prediction 3d. When a sad mood was induced, a high fear context did not result in a decrease in fear (prediction 3b) . In fact the reported fear in this group was well above 50. Finally, a low fear context followed by a sad mood induction resulted in an increase in fear similar to that of the low fear-no M.I. group (prediction 3c).

In general, heart rate measures did not parallel subjective reports of fear. This desynchrony may have been the result of mood induction procedures. Research to date suggests that the physiological activity associated with happiness and sadness cannot be easily differentiated. Ekman et al. (1983) found that heart rate changes associated with sadness were greater than those for happiness. However, in an earlier investigation by Schwartz, Weinberger and Singer (1981), there were no physiological differences between happiness and sadness. To further complicate the issue, the current study manipulated mood states and fear. The physiological changes expected with such an interaction are unknown. In the two conditions where no mood was induced, heart rate responses and subjective fear were synchronous.

The confirmation of predictions 3a to 3d supports the hypothesis that contrast effects are blocked when prevailing mood is incongruent with contrast information. However, the results of the two congruent groups are less easily interpreted. The decrease in fear evident in the high fear-happy mood condition can be attributed to either the mood of the subject or the contextual manipulation (or some combination of these). Because the mean reported fear for this group was highly similar to that of the high fear-no M.I. group, the most parsimonious explanation is that both effects are due to the high fear context. However, the possibility that the result reflects a mood effect cannot be ruled out entirely. The same issue is true for the low fear-sad mood group. The increase in fear may have been due to the contextual manipulation or to the mood manipulation. Both would be expected to increase fear. Once again, because the reported fear of this group was very similar to that of the low fear-no M.I. group, a reasonable explanation is that the low fear context was responsible for both results.

In the conditions where contrast effects were blocked, mood appeared to have had the predicted impact on fear. A sad mood increased fear (mean=62) and a happy mood decreased fear (mean=45). However, without a moderate fear-no M.I. control group, a statistical analysis of these effects cannot be made. It is noteworthy that the sad mood seemed to have a greater impact than the happy mood, consistent with the possibility that the induced sad mood was of greater intensity than the induced happy mood.

If we hypothesize for a moment that the reported fear scores in the congruent groups were influenced by mood, rather than by context, the implication is that contrast effects are mood state-dependent. In other words, any change in mood (congruent or incongruent with contextual information) wipes out the contrast effect. The current investigation was not designed for a detailed examination of state-dependency of contrasts. This is, however, an interesting area for future research.

General Discussion

The results of the two studies (E1 and E2) are summarized below:

1. Contrast effects occurred in fearful situations (E1, E2).
2. Contrast effects were evident in self-reported fear (E1, E2).
3. In the low-to-moderate fear condition, contrast effects were evident in physiological indices of fear (E1, E2).
4. Fear contrast effects were transient; lasting less than one week (E1).
5. Fear contrast effects were not dependent upon the functional similarity (E1) or subjective similarity (E1, E2) of the context and target stimuli.
6. Individuals were generally unaware of the occurrence of fear contrasts (E2).
7. Individuals were aware of the effects of mood on fear (E2).
8. Mood blocked a contrast effect when contextual information was incongruent with prevailing mood (E2).

The hypothesis that contrast effects occur in fear received considerable support from both studies. The findings from Experiment 1 are an unambiguous demonstration of fear contrasts because of the inclusion of a moderate fear group, and also because the effects of habituation were controlled by using two different fearful stimuli.

In the low-to-moderate fear condition, contrast effects were evident in heart rate responding as well as in self-report. It has been argued that this is indicative of a perceptual change, rather than differential anchoring of response scales. There is, however, an alternative interpretation that should be mentioned. The act of reporting fear may have played a mediational role in heart rate responses. Participants may have responded to their own fear reports with increased or decreased heart rate. A similar explanation was presented by Sherman et al. (1978) to account for the behavioural effects of contrasts. To test the theory, a contrast study could be designed that excluded verbal reports of fear, or assessed them after recording heart rate.

Fear contrasts appear to be similar to other contrast effects. They can be demonstrated using a similar research paradigm, and many of the same issues apply to them (e.g., issues of awareness, similarity of stimuli, transience). Several of these topics were examined in the current investigation, however some have not been pursued by other researchers, and thus it is unknown whether our findings are unique to fear contrasts. In Experiment 1, fear contrasts were not evident when participants were reassessed after one week. Because others have not investigated contrast effects over time, it is unknown whether transience is common to all contrasts. The present studies also support the view that subjects are not aware of contrasts. This finding does not appear to be unique to fear. Others have also concluded that contrasts can occur outside of awareness.

As researchers move beyond simply demonstrating contrast effects, we can begin to evaluate the extent to which various contrasts reflect the same underlying process. Thus far, we have no reason to believe that fear contrasts are unique. Thus, the phenomenon is extended to ratings of one's own emotional experiences.

In the introduction of this paper, four theories were reviewed with regard to their abilility to account for fear contrasts. Two of these theories (habituation and network) cannot fully explain the pattern of results of this investigation. Neither habituation nor network theory can account for the increase in reported fear as a result of prior exposure to a low fear stimulus. The two remaining theories, adaptation-level and anchoring, were developed specifically to explain contrast effects, and can account for this finding. The major difference between these theories is whether they view contrast effects as reflecting perceptual changes (adaptation-level), or as differential anchoring of response scales. We have argued that if contrast effects are due to shifts in response scales, without any changes in the perception of the stimulus, the effects would not be evident in physiological measures of fear, but only in self-report measures. The fact that contrast effects were evident in heart rate responding as well as in self-report is more easily accommodated by the adaptation level theory than by the anchoring explanation. However, the issue is complicated by the fact that heart rate effects were demonstrated in the low fear group only, leaving us with partial support for both theories. Throughout this investigation, we have taken the parsimonious position that contrasts from high to moderate fear and from low to moderate fear can be explained by the same underlying process. It is possible, however, that different mechanisms are at work in each of these situations.

Despite limited knowledge of the parameters of contrasts, there is certainly broad evidence of their existence. Do they exist because they are somehow adaptive? The answer seems to depend on the direction of the contrast. To take an example from the social comparison literature, if we compare ourselves with others who are worse off than us, we generally feel better about our own situation (see Hemphill & Lehman, 1990 for a more detailed discussion). However, if we compare ourselves with those who are better off than us, we generally feel worse about ourselves. The former contrast likely has more adaptive value than the latter. If we consider the results of the current investigation, the same pattern seems to be true. Tackling one's worst fear is adaptive because it decreases fear of less frightening stimuli. This may account for some of the positive effects of flooding procedures, which involve exposure to items at the top of the fear hierarchy. As a consequence, fears of items lower down on the hierarchy seem to collapse. It does not necessarily follow, however, that mechanisms that facilitate short-term fear reduction are also of greater benefit in the long-term. In fact, under some conditions, the reverse is true. It has been demonstrated in habituation research, for example, that weak short term effects can result in greater long term habituation. Thus, moving from high to low fear may be more effective with-in session, but lead to greater return of fear between sessions.

Initial exposure to low fear situations does not appear to be helpful in reducing fear of stimuli higher up on the hierarchy. As both Klorman (1974) and Lang (1970) pointed out, this has negative implications for systematic desensitization, which is based on moving from low to high fear stimuli in a graded fashion. It is, however, important to bear in mind that fear contrasts are transient, suggesting that in the long run it may make little difference which direction one moves along the hierarchy. However, to maximize within-session effects, there does appear to be some merit in Klorman's (1974) suggestion of moving from high to low fear.

To enhance our understanding of fear contrasts, it is useful to delineate the conditions under which they occur. This was the purpose of examining the interaction of mood states with contrasts. In planning this research, we began with the premise that mood has an impact on fear. There is evidence from several sources that a sad mood strengthens fear responses. Clinical evidence suggests that dysphoria impedes exposure techniques for treating excessive anxiety (Philips, 1985) and obsessional-compulsive disorders (e.g., Foa, 1979, Rachman, Cobb, Grey, McDonald, Mawson, Sartory & Stern, 1979; Foa, Grayson, Steketee, Doppelt, Turner & Latimer, 1983). A recent study conducted in our lab was designed to examine the effects of mood on fear using a controlled experimental design (Samsom & Rachman, 1989). Results of that study suggested that a happy mood enhances fear reduction, and that a sad mood has no impact on fear. The results of Experiment 2 in the current series support the former finding. However, contrary to the earlier study, they also suggest that a sad mood has a negative effect on fear. The discrepancy between the two studies can be accounted for by their methodological differences. Samsom and Rachman (1989) examined the effects of mood on extremely high levels of fear (at least 80 out of 100). It was therefore unlikely that fear would actually increase as a result of a sad mood induction. In addition, the effects of habituation were not controlled for. As a consequence, all fears were decreasing over time, making it extremely difficult to demonstrate a negative effect for sadness.

The mechanism by which mood states impact on fear is not entirely clear. Research by Bower (1981) indicates that mood states can affect cognitive processing such that when people are in a sad mood this leads to thoughts of past failings, whereas a positive mood is accompanied by thoughts of personal accomplishment (as well as other pleasant thoughts). Further, these cognitions appear to affect a person's belief in self-efficacy. People judge their capabilities to be higher when under a hypnotically-induced positive mood than when in a neutral state, and they regard themselves as least-efficacious when in a depressed mood (Kavanagh & Bower, 1985). It may be that the broad decrease in self-efficacy associated with a sad mood results in reduced ability to cope with fearful stimuli.

Other possible factors influencing the relation between mood states and fear are the subsidiary effects of the mood induction procedure. Increased feelings of relaxation were associated with a happy mood, and increased agitation was associated with a sad mood induction. In addition, many of the subjects in the happy group reported that they were not as frightened of the target stimulus because they felt calmer and more relaxed as a consequence of mood induction. However, the associated changes in agitation and relaxation cannot entirely explain the effects of mood on fear because the difference between happy and sad groups was still evident when self-reported relaxation and agitation were covaried out.

By what mechanism did changes in mood block contrasts? One possible explanation is that mood effects are simply more powerful than contextual effects. Changes in mood were highly salient and recent in comparison to prior contextual information, and as such they may have overridden contrast effects. It may be that contrasts occur only in the absence of more powerful influences on fear. The same might be true of other kinds of contrast effects. Consider, for example, the research on judgements of facial expressions. The information upon which subjects must base their ratings of emotion is very limited. In reality, there are often many more clues to a person's emotional state than just facial expression (e.g., body posturing, situational cues). However, in the absence of this additional information, judgements may be based on comparisons of other recently encountered facial expressions.

One would not expect, then, that a change in mood necessarily wipes out contrast effects for all types of stimuli. It is only expected to do so when mood is relevant to the stimulus being judged.

A second explanation for the impact of mood on contrasts is that a change in mood state alters the similarity between the context and target situation to the extent that the first is no longer relevant to the second. Although the fearful stimulus has not been altered by mood, the individual's "background" emotion has. Given that subjects are asked to make ratings of an internal experience (i.e. how frightened they feel), rather than an external judgement (i.e. how scary the target stimulus is), it is likely that changes in mood can alter the relevance of the contextual situation. It is argued in the introduction to Experiment 2, that this occurs only if contextual information is incongruent with the mood change. It is difficult to evaluate this statement on the basis of the results of the study because as mentioned previously, the congruent cells can be interpreted in more than one way.

A third explanation for the impact of mood on contrasts is that mood provides a new comparison situation for judging fear. Sad mood and fear are both negative affective states, and as such there is some overlap between the two emotions. This overlap may make sadness a relevant comparison emotion when rating fear. However, instead of a contrast effect occurring, assimilation takes place. In Experiment 2 of the current series, and in the study by Samsom and Rachman (1989), a small minority of participants experienced a contrast effect after induction of a sad mood. For them, a sad mood resulted in a decrease in fear. The vast majority, however, experienced assimilation effects. Perhaps there are certain kinds of stimuli that are condusive to assimilations, rather than contrasts. Current happiness and sadness may fall into this category. In support of this possibility, several studies of the effects of mood states on judgements have demonstrated the occurrence of a shift toward, rather than away from these feeling states (e.g., Isen & Shalker, 1982; Schiffenbauer, 1974).

A final explanation for the relation between mood and prior context is that contrast effects are mood state-dependent. In order for a previous situation to have an impact on current judgements, the situation must first be retrieved from memory. A change in mood state might impede this retrieval process, thereby preventing a comparison of the context and the target stimuli from taking place.

In summary, four explanations for the impact of mood on contrast effects have been presented. All are consistent with the results of the current investigation. Each one can be evaluated by making various modifications to the existing experimental paradigm. To evaluate mood state-dependency, for example, mood could be altered during exposure to both the context and the target stimuli. In some conditions, the mood states would be the same for both exposures, and in others, they would be different. Contrasts would be expected to occur only when mood states during exposure to the context and exposure to the target are congruent.

To clarify whether mood blocks contrast effects by altering the similarity between the context and target situations, mood states could be induced during exposure to the contextual stimulus, rather than the target stimulus. In this manner, mood effects would not be confounded with contextual effects during exposure to the target stimulus, making results easier to interpret.

<u>Methodological Considerations</u>

The design of the two experiments in this series was derived from contrast studies in other areas of psychology. It proved to be an effective paradigm for demonstrating fear contrasts. The utilization of two fearful stimuli was a useful way of circumventing the confounding effects of habituation.

In both studies, the fear rating scale was made salient by asking participants to predict distances for five levels of fear. Further, the amounts of fear that individuals had to endure during exposure sessions were made salient by having subjects actively select them. These procedures were implemented in an attempt to enhance the comparison process inherent in contrast effects, with the goal of strengthening the effect. An alternative, much simpler approach would have been to record distances corresponding to only three levels of fear (10, 50 and 100), and to then expose participants to the appropriate levels, without any selection on their part. There are two reasons for believing that a contrast effect would have occurred even under these less elaborate conditions. The results of the current investigation suggest that the comparison process involved in contrasts is fairly automatic, and does not require a great deal of active cognition on the part of the individual.

Also, the results of other, less well-controlled research on fear suggests that contrasts occur even when the range of fear responses is not made salient (e.g., Klorman, 1974; Krupat, 1974; Lang, 1970).

Experiment 2 could have been improved by adding another level of the context factor (i.e. moderate fear). Unfortunately, doing so would have required a prohibitively large number of subjects (N=180). Although the specific hypotheses being tested did not require the inclusion of the three additional cells, certain questions pertaining to the effects of mood on fear could not be addressed. It is unclear, for example, how mood influences fear in the absence of contextual manipulations. The primary focus of this programme of research was on contrast effects, and thus a decision was made to forego a detailed examination of mood effects.

In addition to the demonstration of contrast effects, three issues were of interest: transience of contrasts, awareness of contrasts, and similarity of target and context. In Experiment 1, contrast effects were no longer evident after a one week period. However, exactly how long the effects last is still unknown. Conducting research on the stability of contrasts is tedious and time-consuming because a within-subjects design cannot be used. Every time an individual is exposed to a feared stimulus, a new context is provided, and subsequent fear ratings are likely to be affected. As a result, subjects can be exposed to the target only once, so a large number of subjects is required to examine contrasts at various time intervals. Perhaps these limitations account for the lack of research on this topic.

The issue of similarity of the context and target stimuli proved to be much more complex than expected. So far, several dimensions of similarity have been ruled out, but the crucial link remains elusive. The examination of similarity of context seems to be a useful next step.

An interesting and unexpected finding is that most individuals were unaware of their own experience of a fear contrast. The use of a post-experimental questionnaire proved to be a sensitive measure of awareness, whereas predicted fear was not. In general, it was enlightening to ask subjects their view of what was happening during the experiment. Not only was this informative, it was also reassuring to know that participants had not determined the purpose of the investigation.

In summary, this research has extended the phenomenon of contrast effects to include fear. It has also established a useful method for controlling the confounding effects of habituation, and has broadened our understanding of the nature and parameters of fear contrasts.

In the first study, most of the participants were women. In Experiment 2, all subjects were female. It is therefore recommended that replication studies include a greater number of males. It is also suggested that future research focus on the linkage between context and target stimuli, and on clarifying the mechanism underlying the impact of mood on contrasts.

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Appendix A

Fear Survey Schedule

Fear Survey Schedule

Please check ( ) the appropriate level of fear for each of the following items:

ITEM	I AM NOT AT ALL FEARFUL OF:	I AM SLIGHTLY FEARFUL OF:	I AM MODERATELY FEARFUL OF:	I AM EXTREMELY FEARFUL OF:	I AM TERRIFIED OF:
SNAKES					
CATS					
BIRDS					
SPIDERS					
WORMS					
DOGS					
INSECTS					
HORSES					
THE DARK					
HEIGHTS					
ENCLOSED SPACES					

Name: ______________________________

Phone Number: _______________________

Best Time to Call: ____________________

Appendix B

Consent Form

Consent Form
Fear Study

We are conducting a research project on factors influencing fear and would welcome your participation. The experiment consists of two 30-minute sessions (1 week apart) during which participants are asked to slowly approach a live, harmless garter snake or spider They are also requested at various points throughout the experiment to predict how much fear they will experience, and to report actual levels of fear. In addition, heart rate recordings are taken using a monitor that clips onto the earlobe.

If you do not wish to participate, or you decide to withdraw from the experiment at any time, you are free to leave without jeopardizing your class standing. However, we hope that you are willing to participate. After completion of the study, participants are given the opportunity to learn the outcome of the research, as well as receive course credit (1/2 credit for each 1/2 hour of participation, or fraction thereof).

All information collected in the course of this study is kept strictly confidential and access to it is restricted to the investigators named below. For further information you may contact Debbie Samsom, Department of Psychology, U.B.C.

If you have any questions about the procedures outlined above, please feel free to ask.

Dr. S. Rachman (Principal Investigator)
Debbie Samsom (Psychology Graduate Student)

I have read the above information, consent to participate in this research, and have received a copy of the consent form.

Signature: ______________________ Date: __________________

Name: ______________________

Appendix C

Similarity Questionnaire

CONQ

Instructions: Please place a slash (/) anywhere along the continuum you feel is appropriate.

To what extent are your fears of spiders and snakes related to each other?

0	100
Not at all related	Completely related

Appendix D

Debriefing Form

Debriefing

The purpose of this experiment is to investigate the way in which different levels of fear interact. There are three groups of subjects involved. In the first group, participants experience an extremely fearful event (e.g., a spider or snake very close by), followed by a moderately fearful event (e.g., a spider or snake further away). Participants in the second group experience a moderate level of fear on both occasions. Finally, those in the third group experience a low level of fear followed by a moderate level of fear. As you can see, the groups differ only in the amount of fear experienced by the participants the first time they encounter the spider or snake. We are predicting that people who are exposed to a high level of fear first, will be less fearful when they face the snake or spider for the second time, compared with the people in the other two groups. Also, we think that people who experience a low level of fear first will experience more fear on the second occasion than those in the other two groups. We expect these findings because of the contrast between the first and second exposure to the feared animal.

We are also interested in determining if these changes in fear are lasting. So we asked all the participants to come back a second time so that we could reassess their fear. Finally, we wanted to see if people's fears of spiders and snakes are connected. In order to check this, we reduced the fear of one animal through exposure and modelling. We then looked at whether this had an effect on their fear of the second animal (i.e., did this fear go down as well?)

Do you have any questions or comments?

Thank you for your participation. It was greatly appreciated. If you have any further questions please feel free to contact Dr. Rachman at

References:

If you would like to read about the latest psychological treatments for anxiety, a recently published paperback is:

Barlow, D.H. & Cerny, J.A. (1988), Psychological Treatments of Panic. New York: Guilford Press.

Appendix E

Tables of Means and Standard Deviations

Means and Standard Deviations for Prediction (Session1)
Group (Hi, Mod, Lo) x Dependency (Independent, Dependent)

Group	Dependency: Dependent *M*	*SD*	Independent *M*	*SD*
High	45.6 (*n*=9)	(11.3)	41.7 (*n*=12)	(15.1)
Moderate	56.9 (*n*=8)	(13.3)	56.9 (*n*=13)	(15.1)
Low	60.8 (*n*=6)	(12.0)	56.9 (*n*=16)	(12.0)

Means and Standard Deviations for Reported Fear (Session1)
Group (Hi, Mod, Lo) x Dependency (Independent, Dependent)

Group	Dependency: Dependent *M*	*SD*	Independent *M*	*SD*
High	35.0 (*n*=9)	(19.4)	37.5 (*n*=12)	(17.9)
Moderate	50.7 (*n*=8)	(16.9)	47.9 (*n*=13)	(19.8)
Low	67.5 (n=6)	(16.9)	60.6 (n=16)	(18.3)

Appendix F

Adjective Questionnaire

AQ

Listed below are some adjectives that people have used to describe **harmless snakes and spiders**. Please read each one, and then indicate on the right hand side of the page if you think it adequately describes one, both, or neither of these animals. There are no right or wrong answers; we want to get an idea of how **you** would describe harmless spiders and snakes. Please circle your response.

	Neither	Spiders	Snakes	Both
Uncontrollable	**N**	**SP**	**SN**	**B**
Disgusting	**N**	**SP**	**SN**	**B**
Creepy	**N**	**SP**	**SN**	**B**
Unpredictable	**N**	**SP**	**SN**	**B**
Ugly	**N**	**SP**	**SN**	**B**
Smooth	**N**	**SP**	**SN**	**B**
Threatening	**N**	**SP**	**SN**	**B**
Quick	**N**	**SP**	**SN**	**B**
Slimy	**N**	**SP**	**SN**	**B**
Cute	**N**	**SP**	**SN**	**B**
Dangerous	**N**	**SP**	**SN**	**B**
Interesting	**N**	**SP**	**SN**	**B**
Sinister	**N**	**SP**	**SN**	**B**
Hairy	**N**	**SP**	**SN**	**B**

Appendix G

Sensations Questionnaire

SQ

Listed below are physical sensations that some people experience when they touch **harmless spiders and snakes**. Please read each one, and then indicate on the right hand side of the page if **you** would experience the sensation if **you** touched a harmless spider or snake in a glass container in our lab here today. If you do not think that you would experience a particular sensation on the list when touching either a spider or a snake, then circle the "N" for "neither".

	Neither	Spiders	Snakes	Both
Heart Palpitation	**N**	**SP**	**SN**	**B**
Tightness in the chest	**N**	**SP**	**SN**	**B**
Shortness of breath	**N**	**SP**	**SN**	**B**
Dizziness	**N**	**SP**	**SN**	**B**
Blurred or distorted vision	**N**	**SP**	**SN**	**B**
Nausea	**N**	**SP**	**SN**	**B**
Butterflies in my stomach	**N**	**SP**	**SN**	**B**
Wobbly or rubber legs	**N**	**SP**	**SN**	**B**
Sweating	**N**	**SP**	**SN**	**B**
Dry mouth	**N**	**SP**	**SN**	**B**
Feeling disoriented or confused	**N**	**SP**	**SN**	**B**
Numbness in my arms or legs	**N**	**SP**	**SN**	**B**
Tingling in my fingertips	**N**	**SP**	**SN**	**B**
Numbness in another part of my body	**N**	**SP**	**SN**	**B**
A knot in my stomach	**N**	**SP**	**SN**	**B**
A lump in my throat	**N**	**SP**	**SN**	**B**
Feeling disconnected from my body	**N**	**SP**	**SN**	**B**

Appendix H

Cognitions Questionnaire

CQ

Listed below are thoughts that some people have when they touch **harmless spiders and snakes**. Please read each one, and then indicate on the right hand side of the page if **you** would have the thought if **you** touched a harmless spider or snake in a glass container in our lab here today. If you do not think that you would have a particular thought on the list when touching either a spider or a snake, then circle the "N" for "neither".

	Neither	Spiders	Snakes	Both
I am going to throw up	**N**	**SP**	**SN**	**B**
I am going to pass out	**N**	**SP**	**SN**	**B**
I am going to have a heart attack	**N**	**SP**	**SN**	**B**
The animal will jump at me	**N**	**SP**	**SN**	**B**
I am going to act silly	**N**	**SP**	**SN**	**B**
I am going to lose control	**N**	**SP**	**SN**	**B**
The animal will bite me	**N**	**SP**	**SN**	**B**
I am going to scream	**N**	**SP**	**SN**	**B**
I am going to babble or talk foolishly	**N**	**SP**	**SN**	**B**
The animal will crawl into my clothing	**N**	**SP**	**SN**	**B**
I am going to be paralyzed by fear	**N**	**SP**	**SN**	**B**
I am going to cry	**N**	**SP**	**SN**	**B**

Appendix I

Awareness Questionnaire

AWQ

(1) Do you think that your <u>fear</u> of the second animal was in any way influenced by your experience with the first animal?

YES **NO** (circle one) If "yes", please explain:

____

____

____

(2) Do you think that the amount of fear you <u>predicted</u> you would have of the second animal was in any way influenced by your experience with the first animal?

YES **NO** (circle one) If "yes", please explain:

____

____

____

(3) Do you think that your <u>fear</u> of the second animal was in any way influenced by your <u>mood</u> while you were looking at or handling it?

YES **NO** (circle one) If "yes", please explain:

____

____

____

(4) Do you think that the amount of fear you <u>predicted</u> you would have of the second animal was in any way influenced by your <u>mood state</u>?

YES **NO** (circle one) If "yes", please explain:

____

____

____

Appendix J

Mood Questionnaire

Mood Scale

Instructions: Please place a slash (/) anywhere along the continuum you feel is appropriate. Please indicate how you are feeling right now.

How anxious do you feel?

|____________________________________|

0	100
I am not at all anxious	I am extremely anxious

How sad do you feel?

|____________________________________|

0	100
I am not at all sad	I am extremely sad

How agitated do you feel?

|____________________________________|

0	100
I am not at all agitated	I am extremely agitated

How happy do you feel?

|____________________________________|

0	100
I am not at all happy	I am extremely happy

How relaxed do you feel?

|____________________________________|

0	100
I am not at all relaxed	I am extremely relaxed

How apprehensive do you feel?

|____________________________________|

0	100
I am not at all apprehensive	I am extremely apprehensive

Appendix K

Honesty Questionnaire

M-C Questionnaire

Please answer the following question **honestly**:

Do you think your mood changed when you listened to the music during today's experiment?

YES **NO** (circle one)

Appendix L

Debriefing (2)

Debriefing (2)

There are two purposes to this experiment. The first is to investigate the way in which different levels of fear interact. Two groups of subjects are required to examine this issue. In the first group, participants experience an extremely fearful event (eg. a spider or snake very close by), followed by a moderately fearful event (eg. a spider or snake further away). Participants in the second group experience a low level of fear followed by a moderate level of fear. As you can see, the two groups differ only in the amount of fear experienced by the participants the first time they encounter the spider or snake. We are predicting that people who are exposed to a high level of fear first, will be less fearful when they face the snake or spider for the second time, compared with those exposed to a low level of fear first. We expect this finding because of the contrast between the first and second exposure to the feared animal.

The second purpose of this study is to investigate the effects of mood on fear. Two more groups of subjects are therefore required: One group of subjects who are in a happy mood, and one group who are in a sad mood. We are hypothesizing that a sad mood increases fear and that a happy mood decreases fear.

Do you have any questions or comments?

Thank you for your participation. It was greatly appreciated. If you have any further questions please feel free to contact Dr. Rachman at

References:

If you would like to read about the latest psychological treatments for anxiety, a recently published paperback is:

Barlow, D.H. & Cerny, J.A. (1988), Psychological Treatments of Panic. New York: Guilford Press.