ANIMAL PHOBIAS VERSUS CLAUSTROPHOBIAS: EXTEROCEPTIVE VERSUS INTEROCEPTIVE CUES

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Summary—The overall purpose of this investigation was to examine heterogeneity among specific phobias. In particular, the goals were to compare features of fear responding between individuals fearful of claustrophobic situations and individuals fearful of spiders/snakes, and to compare their response to hyperventilation challenges. By so doing, specific predictions were tested in relation to a conceptual model of exteroceptive and interoceptive fear cues. Using a nonclinical sample, 19 subjects with spider/snake phobias, 18 nonphobics, and 9 subjects with claustrophobias were exposed on two separate occasions to a live tarantula or python, a small closet, and a hyperventilation challenge. Dependent measures included subjective anxiety, panic attacks, physical symptoms, cognitive symptoms (or, fear of symptoms) and heart rate. In addition, subjects completed a standardized self-report scale that measures fear of bodily symptoms of arousal. It was found that subjects with claustrophobia reported more physical symptoms and cognitive symptoms than did subjects with snake/spider phobias, in response to their fear-relevant stimulus. In addition, claustrophobic subjects were more fearful of hyperventilation challenges and reported more fear of bodily symptoms, than did snake/spider phobic subjects. Finally, subjects with claustrophobia were as fearful of hyperventilation as they were of their fear-relevant stimulus. Theoretical and empirical implications of these findings are discussed.

Traditional assumptions about the nature of specific phobias have been questionned recently. In particular, the assumption that the various types of specific phobias (e.g. animal phobias, claustrophobias, blood/injury phobias, driving phobias) form an homogenous set, best represented by a singular diagnostic category (i.e. Simple Phobia), has been challenged. That is, specific phobias have been found to diverge significantly in terms of age of onset, sex ratio, family history, comorbidity with other anxiety disorders, pathway to fear acquisition, and physiological and cognitive response profiles. For example, several investigators have noted that animal phobias tend to begin at an earlier age (early childhood), than claustrophobias (early to mid-20s), or height phobias (late childhood to early adolescence) (Curtis, Hill & Lewis, 1990; Marks & Gelder, 1966; Ost, 1987). As further evidence of heterogeneity, blood/injury phobias and injection phobias (which have the strongest family aggregation patterns) have been shown to have a distinct diphasic physiological response pattern that differs from other phobias. It is characterized by initial autonomic acceleration, followed by deceleration in heart rate and blood pressure (Ost, Sterner & Lindahl, 1984; Steptoe & Wardle, 1988). Consequently, blood/injury phobias are effectively treated using a combination of exposure therapy and applied muscle tension designed to counteract decelerative autonomic tendencies (Foulds, Wiedmann, Patterson & Brooks, 1990; Kozak & Miller, 1985; Kozak & Montgomery, 1981; Ost & Sterner, 1987; Ost, Sterner & Fellenius, 1989).

In their reanalysis of the Epidemiological Catchment Area Study data, Curtis *et al.* (1990) identified three main clusters of phobias: an agoraphobia cluster, consisting of being alone, going out of the house alone, crowds, and claustrophobia; a cluster of fears that typically originate in childhood, including fears of animals, storms, and being in water; and a third, less inter-related set of phobias, including fears of tunnels or bridges, and public transportation. Height phobias were separated from the three clusters, given the unusually high proportion of males in the height phobic sample (approx. 60% vs the usual 30–40% proportion). These data lend support to the notion that various types exist within the Simple Phobia category, which may vary in terms of psychopathology and treatment. In accord, there is some evidence to suggest an aggregation within families by class of phobia (Himle, McPhee, Cameron & Curtis, 1988; Liddell & Lyons, 1978). For example, relatives of persons phobic of "natural environment" types of stimuli (such as animals)

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are more likely to have phobias of other "natural environment" stimuli (e.g. thunder, water) than other types of phobias (such as blood/injury).

Related to the issue of heterogeneity among specific phobias is preliminary evidence showing that claustrophobias are more likely to co-occur with uncued/unexpected panic attacks than are other types of specific phobias (Curtis et al., 1990). In addition, claustrophobias share more features in common with Panic Disorder with Agoraphobia (PDA), than do other phobias (Craske, Burton, Zarate & Barlow, submitted; Curtis et al., 1990). For example, Craske et al. (submitted) found that claustrophobias resembled PDA more so than did five other types of phobias (heights, flying, driving, blood/injury, and animals) in terms of three core features. Specifically, claustrophobias entailed more symptoms from the DSM-III-R panic checklist (American Psychiatric Association, 1987), more worry about becoming anxious, panicky or about the bodily symptoms of arousal (i.e. "fear of fear"), and more unpredictability of the fear response. Unfortunately, the study was limited by the flaws and biases inherent in survey methodology. However, Rachman, Levitt and Lopatka (1987, 1988) obtained similar results from direct behavioral assessments. They found that individuals with claustrophobia were frequently concerned about panicking and losing control when exposed to claustrophobic situations. In addition, when compared with persons with PDA, they found that claustrophobic Ss endorsed a higher percentage of panic-symptoms and an equivalent number of occasions on which panic occurred unexpectedly, during behavioral exposure to fear-relevant stimuli. Unfortunately, Rachman et al. (1987, 1988) did not compare claustrophobias with other specific phobias.

These empirical findings have led to a conceptualization of phobias and PD/PDA that emphasizes fear cues (Craske, 1991). This model suggests that fear reactions are best described in terms of the relative salience of interoceptive and exteroceptive fear cues, ranging from primarily exteroceptive cues (i.e. external objects and situations), to mixed interoceptive (i.e. bodily sensations and images) and exteroceptive cues, to primarily interoceptive cues. Note that since PD/PDA is included in this model, all panic attacks (even "spontaneous attacks") are viewed as cued, even if the cue is not immediately obvious to the individual (as suggested by Barlow, 1988). Furthermore, features of the fear response (e.g. unpredictability, symptoms of anxious arousal, cognitions of danger about arousal symptoms) are attributed to the configuration of fear cues. In other words, it is hypothesized that fears which are primarily interoceptively cued (e.g. PD) are more likely to be unpredictable, and to entail more arousal symptoms, and cognitions of danger about arousal symptoms. Conversely, fears that are primarly exteroceptively cued (e.g. animal phobias) are more likely to be predictable, and to entail less arousal symptoms and danger-cognitions about arousal symptoms. Fears that are triggered by a compound relationship between interoceptive and exteroceptive cues (e.g. PDA and claustrophobias) are likely to have features of both. The description of claustrophobia as a fear of suffocation (e.g. Rachman et al., 1988) is consistent with its placement in the fear-cue model. The purpose of this study was to empirically examine some predictions from this model.

The first goal was to compare claustrophobias and animal phobias in terms of features of fear responding when confronted with fear-relevant stimuli. In particular, cognitions about arousal, arousal symptomatology, and predictability, were examined. These direct comparisons overcame the limitations of the Craske et al. (submitted) and Rachman et al. (1987, 1988) studies described earlier. According to the fear-cue model, it was hypothesized that claustrophobias would entail stronger danger-cognitions about arousal (e.g. fears of losing control), stronger arousal symptomatology, and less predictability than animal phobias, when in the presence of the feared stimulus.

The second goal was to compare the responses of individuals with claustrophobias and animal phobias to interoceptive cues. Interoceptive fear was assessed via hyperventilation challenges, and a standardized self-report measure which addresses fears of bodily symptoms of arousal. Hyperventilation challenges are commonly used to elicit feared interoceptive cues (e.g. Barlow, Craske, Cerny & Klosko, 1989), and have been found to produce stronger fear and symptom reports in individuals with PD/PDA vs nonanxious controls (e.g. van den Hout, 1988). According to the fear-cue model, it was hypothesized that claustrophobic Ss would be more fearful of hyperventilation and report more fear of bodily symptoms than would animal phobic Ss. In

addition, it was hypothesized that claustrophobic Ss would be more fearful of a claustrophobic situation than a hyperventilation challenge.

Individuals with specific phobias relatively rarely seek treatment for their phobic problems, since interference with daily functioning is mostly limited given the circumscribed nature of specific phobias (Barlow, 1988). Specific phobias present at clinical settings most often as additional or secondary problems. In order to maximize sample size and to avoid the confounds from additional diagnostic features, a nonclinical, analog subject sample was recruited in this study as a first step towards evaluating the predictions from the fear-cue model.

METHOD

Study design

A $3 \times 3 \times 2$ study design was employed, consisting of one between-group factor and two within-group factors. The between-group factor (Group) had three levels: claustrophobics, animal phobics, and nonphobic controls. The first within-group factor (Stimulus) also had three levels: closet, snake/spider, and hyperventilation. The second within-group factor (Trial) had two levels; first and second. The sequence of stimulus conditions was counterbalanced among the three groups. In addition, a baseline assessment was conducted as a final phase of the study for the purposes of heart rate measurement (described below). Baseline was conducted at completion of the stimulus conditions in order to measure true baseline levels unconfounded by anticipatory anxiety.

The nonphobic control group provided a baseline for the effects of experimental participation (i.e. exposure to three stimulus conditions). Each phobia group was exposed to the other group's fear-relevant stimulus (i.e. closet or snake/spider) as well as to their own fear-relevant stimulus (i.e. closet or snake/spider) to provide a baseline against which to compare the features of fear responding. A second trial was conducted for each stimulus condition to ensure that responses were not due solely to novelty effects of single-trial exposure.

Subjects

Ss were students enrolled in introductory psychology classes at the University of California, Los Angeles. They were given course credit in return for experimental participation. They signed up for a study described as an investigation of heart rate and subjective response to phobic objects. Therefore, the initial study description did not specify the objects to which Ss would be exposed, although it is possible that highly phobic Ss in general declined to participate, thus serving to bias the sample towards less fearful individuals. Ninety-eight Ss initially entered the study. General exclusionary criteria included reports of medical diseases or conditions which might place Ss at risk during hyperventilation and/or during fearful arousal (e.g. cardiac conditions, respiratory conditions, neurological conditions) or which precluded full participation (e.g. severe physical handicaps). Fifteen Ss were excluded from further study participation due to exclusionary criteria.

Groups

A self-report fear screen was used for initial group assignments, after which study participation was dependent on fear levels during behavioral exposure to the fear-relevant stimulus. The self-report fear screen asked Ss to rate their fear of snakes, spiders, and claustrophobic situations (0 = not at all, 8 = extreme), and the degree to which their fear of each one interfered with their lives or caused distress (0 = not at all, 8 = extreme). Ss who reported a significant fear of snakes or spiders (i.e. 5 or higher on the 0 to 8 point scale) and mild or no fear of claustrophobic situations (i.e. 3 or less on the 0 to 8 point scale) were assigned to the Snake/Spider group ($n = 31$). Conversely, Ss who reported a significant fear of the claustrophobic item (i.e. 5 or higher on the 0 to 8 point scale) and mild or no fear of snakes or spiders (i.e. 3 or less on the 0 to 8 point scale) were assigned to the Claustrophobia group ($n = 16$). Ss who reported mild or no fear (i.e. 3 or less on the 0 to 8 point scale) for both types of phobic stimuli were assigned to the Nonphobic group ($n = 18$). Eighteen Ss were not assigned to any of the three groups, and were not included in the analysis.

In addition, Ss were excluded if they did not meet criteria during the initial behavioral exposure. Specifically, Ss in the Snake/Spider group were excluded if their subjective fear ratings in the

presence of the snake/spider were <4 (i.e. less than moderate); 8 Ss were excluded. Similarly, Ss in the Claustrophobia group were excluded if their subjective fear ratings when exposed to the closet were <4; 5 Ss were excluded. Finally, 4 Snake/Spider Ss and 2 Claustrophobia Ss were excluded for failure to complete the experimental tasks as specified (described below).

Consequently, analyses were based on 18 nonphobic controls, 19 Snake/Spider phobia Ss, and 9 Claustrophobia Ss. The average age was 19.8 years (SD = 3.2); groups did not differ significantly in terms of age. Eighteen males and 28 females made up the sample: Nonphobic group, 9 males, 9 females; Snake/Spider phobia group, 8 males, 11 females; and Claustrophobia group, 1 male, 8 females. Although Ss with claustrophobias and snake/spider phobias were fearful during exposures, they mostly reported relatively mild levels of interference with functioning as a result of their fears. The mean interference ratings were 1.9 (i.e. mild) for the Snake/Spider phobia group, and 3.0 (i.e. between mild and moderate) for the Claustrophobia group.

During initial screening, Ss were asked if they had ever experienced unexpected panic attacks (i.e. "sudden rushes of intense fear or dread for no apparent reason"). Four Ss answered affirmatively; 2 from the Nonphobic group and 2 from the Snake/Spider phobia group (none from the Claustrophobia group).

Stimulus conditions

Since the primary goal of this investigation was to compare features of fear responding across groups, it was important for the duration of exposure to the claustrophobia and animal stimuli to be equivalent. Therefore, the stimulus conditions were designed to be fear provocative, and yet also tolerable by fearful Ss for pre-determined durations. Task behavior was monitored (as described in the Procedure section), and Ss who refused to attempt the task or did not complete the task as specified were excluded from further analyses (4 Snake/Spider Ss and 2 Claustrophobia Ss).

Closet. The claustrophobic stimulus was a 2' × 3' × 10' windowless closet, situated inside a small, windowless room. Ss were asked to sit inside the closet, with the door closed, facing the back wall. The lights were turned out and the door of the room closed, while the experimenter waited outside. At no time were Ss locked into the closet or the room. Since ethical considerations prevented us from actually locking Ss into a small room, and since the situations feared by claustrophobic persons range from situations from which escape is difficult (such as elevators and planes) to small rooms from which escape is easy (such as restrooms or attics), an unlocked closet was considered a feasible phobic stimulus. Although fears of the dark may have confounded the phobic stimulus, the lights were turned out in order to minimize the exit (and, hence, safety) cues, available to the S. (No Ss spontaneously reported fearfulness of the dark *per se.*) Ss were instructed to remain in the closet for as long as they could or until the experimenter informed them that the trial was over (in fact, the trial duration was pre-set at 2 min). Relatively high demand instructions were given to encourage Ss to remain for as long as they could, although they had the option of terminating the task prematurely if necessary. High demand was employed in order to minimize escape behavior, since the intention was to compare groups across equal durations of exposure.

Snake/spider. Ss were exposed to either a snake or a spider (Ss from the Snake/Spider group were exposed to the stimulus of which they self-reported being most fearful, while Ss from the Claustrophobia and Nonphobic control groups were exposed to either stimulus in counterbalanced order). The snake was a 3' python. The spider was a Giant Peruvian Tarantula, about 4" in body length. The snake and spider were housed in separate glass tanks, situated at the far end of a 20' room, with the lid open. Ss were asked to approach the snake or spider, reach into the tank, and gently touch the animal with a 5" straw to try to make it move. Ss were instructed to continue this activity for as long as they could, or until the experimenter informed them that the trial was over (the pre-set trial duration was 2 min). The experimenter remained behind the S for the duration of the trial. Actual touching of the snake or spider was not considered feasible given the desired 2 min duration (very few Ss would tolerate touching the animal for that length of time). Furthermore, individuals rarely touch spiders or snakes in the real world, and in cases where the animal has to be moved, an object (such as a broom or stick) is usually used. In addition, since perception of movement increases fearfulness for most Ss, variability in degree of animal movement across Ss was minimized by having all Ss attempt to make the snake or spider move.

Hyperventilation. In this condition, *S*s were asked to breathe fast and deeply, at a rate of around 30 breaths per minute, while in a standing position. The experimenter first modelled the correct breathing rate and depth, and remained a few feet behind the *S* during the trial. The experimenter provided corrective feedback where necessary to ensure that all *S*s hyperventilated at the rate of around 30 breaths per minute. *S*s were informed in advance that they might experience symptoms such as dizziness, lightheadedness, or shortness of breath, and that these symptoms were normally experienced and not dangerous. They were instructed to continue for as long as they could, or until the experimenter informed them that the trial was over (the pre-set trial duration was 1 min). Hyperventilation was not continued for 2 min (the length of the other stimulus conditions) for two reasons. First, unlike the comparison between the snake/spider and closet conditions, the comparability of exposure duration was not as essential in the case of hyperventilation. Second, most *S*s report intense symptomatology after 1 min of hyperventilation.

Trials

Each stimulus condition was repeated two consecutive times for the maximum durations specified above: closet, 2 min; snake/spider, 2 min hyperventilation, 1 min. Length of inter-trial intervals was dependent upon the *S*s level of self-reported anxiety. That is, a new trial was begun when anxiety reached a mild level (i.e. 2 or less on the 0 to 8 point scale).

Dependent variables

Predictability of panic and anxiety during exposure.

(a) After task description and before attempting the task, *S*s rated the level of **expected maximum anxiety** during the task (using the same 0 to 8 point scale).

(b) After completing the task, *S*s rated the level of **maximum anxiety** they experienced (0 to 8). **Accuracy of anxiety prediction** was calculated by subtracting actual maximum anxiety levels from expected maximum anxiety levels.

(c) After task description and before attempting the task, *S*s rated the **likelihood of a panic attack** during the task (0 to 8, where 0 = not at all likely, and 8 = definitely will happen). A panic was defined for *S*s as "a sudden rush of intense fear, accompanied by symptoms such as dizziness, palpitations, racing heart, sweating, shaking, hot and cold flashes, and fears of losing control" in order to minimize unreliability across *S*s in their panic definitions.

(d) After completing the task, *S*s indicated whether a **panic attack** had occurred (yes/no). The frequency of **unexpected panic** attacks was calculated by comparing predictions of likelihood of panicking and occurrence of panic attacks. *S*s who predicted a likelihood of 4 or less, and who subsequently panicked were categorized as unexpected panickers. *S*s who predicted a likelihood of 5 or greater and who subsequently panicked were categorized as expected panickers.

(e) If a panic did occur, the **timing of the panic attack** was classified as one of the following: before beginning the task, immediately upon beginning the task, sometime during the task, or after task completion.

Arousal symptoms and cognitions during exposure. After completing the task, *S*s rated each of the 13 panic symptoms (DSM-III-R; APA, 1987) in terms of the intensity with which they were experienced during the preceding task (0 to 4, where 0 = not at all, and 4 = extremely). The 13 panic symptoms were divided into subscales of physical symptoms (10 items) and cognitive symptoms (3 items). The cognitive symptoms (i.e. fears of losing control, going crazy, and dying) represent fear of panic or sensations of arousal.

Heart rate during exposure. Heart rate was recorded continuously through the use of an ambulatory heart rate monitor (UNIQ Heartwatch). The unit consists of an electrode belt worn around the chest, which transmits the heart rate signals to a wrist receiver, where data is stored. A built-in event marker enables designation of experimental phases. Heart rate was averaged every 15 sec. Heart rate was compared between closet and snake/spider trials, when *S*s were stationary at the point of maximum approach. Heart rate was not measured during the hyperventilation task, given the confound from forced respiratory effort.

Standardized self-report of anxiety sensitivity. Ss completed the Anxiety Sensitivity Index (Reiss, Peterson, Gursky, & McNally, 1986) which assesses belief in harm from the physical sensations of anxiety. It has good reliability and discriminant validity, and distinguishes between clinical and nonclinical panickers and nonanxious controls (e.g. Peterson & Heilbronner, 1987; Donnell & McNally, 1989).

Procedure

Following medical and fear screening, the experimental procedures were described to eligible Ss. After reading and signing the informed consent statement, the heartwatch monitor was attached to allow time for adaptation. Ss then completed the Anxiety Sensitivity Index. After determining the counterbalancing sequence for Stimulus Conditions, the six exposure trials were conducted. Behavior was rated in order to determine suitability for inclusion in data analysis. Therefore, the duration of actual endurance was recorded for each trial. Also, failure to adhere to task specifications was rated (0 = completed, 1 = incomplete, and 2 = refused) as another indicator of behavioral avoidance. For example, if Ss removed their hand from the glass tank for any portion of the 2 min exposure to the snake or spider, adherence was coded as 1. As described earlier, Ss who failed to complete the task for the specified duration or in the ways described were excluded from data analysis ($n = 6$). After conducting the stimulus trials, Ss were asked to sit quietly, and still for 5 min, in order to obtain baseline heart rate values. Finally, Ss were debriefed.

RESULTS

Initial group differences

Given the disproportionate ratio of females to males in the Claustrophobia group, a series of ANOVAs were conducted to determine if males and females differed on the dependent variables across stimulus conditions. Gender did not yield significant main effects or interaction effects (Gender × Stimulus) with any of the dependent variables. Therefore, gender was not used as a co-variate in subsequent analyses. A 1-min recording of heart rate in the interval between study instructions and exposure trials indicated that the groups did not differ significantly in anticipatory heart rate: Snake/Spider 76.2 bpm, Claustrophobia 73.2 bpm, and Nonphobic 69.3 bpm.

Analytical approach

A 3 × 3 × 2 between-within repeated measures ANOVA approach was used to analyze each of the following variables: maximum anxiety; accuracy of anxiety prediction (predicted maximum anxiety minus actual maximum anxiety); sum of physical symptom ratings; and sum of cognitive symptom ratings. A 3 × 2 × 2 ANOVA was used to analyze heart rate (stimulus heart rate minus baseline heart rate). Significant interaction effects were followed by simple main effects, which in turn were followed by pairwise comparisons for between-group differences, and orthogonal contrasts for within-group differences. Given the smaller number for the Claustrophobia group, variances were compared between groups using Greenhouse–Geisser tests. Degrees of freedom were corrected in order to reduce inflation in Type 1 error if the variances were significantly different. Report of panic attacks was analyzed using chi-square tests.

Maximum anxiety

Means and standard deviations for maximum anxiety are presented in Fig. 1. The Group × Stimulus × Trial interaction was significant, $F(4,78) = 2.9$, $P < 0.05$, as were the Group × Stimulus $F(4,78) = 17.5$, $P < 0.001$, and the Group × Trial $F(2,39) = 6.9$, $P < 0.01$ interactions.

The three groups were compared within each stimulus condition, for each trial separately. In the first trial, the groups differed significantly for each stimulus condition: snake/spider, $F(2,40) = 67.7$, $P < 0.001$; closet, $F(2,40) = 95.2$, $P < 0.001$; and hyperventilation, $F(2,40) = 14.7$, $P < 0.001$. The groups were compared using Scheffe pairwise comparisons. In the snake/spider condition, the Snake/Spider group reported higher anxiety than the Claustrophobia group, which in turn reported higher anxiety than Nonphobic controls. In the closet condition, the Claustrophobia group were more anxious than the Snake/Spider group, who in turn were more anxious than nonphobic
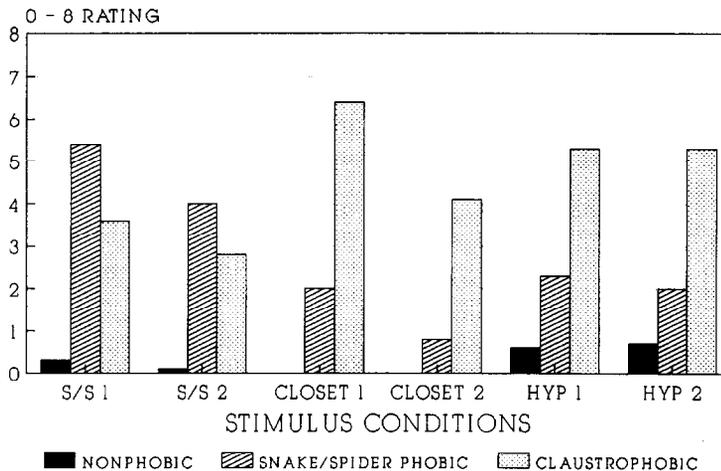
Fig. 1. Maximum anxiety during exposure to snake/spider (S/S), closet, and hyperventilation (HYP) trials across Claustrophobia, Snake/Spider, and Nonphobia groups.

controls. In the hyperventilation condition, the Claustrophobia group were more anxious than the Snake/Spider group who in turn were more anxious than Nonphobic controls.

Very similar patterns emerged in the second trial. The groups differed significantly for each stimulus condition: snake/spider, $F(2,39) = 26.5$, $P < 0.001$; closet $F(2,39) = 41.5$, $P < 0.001$; and hyperventilation $F(2,39) = 17.5$, $P < 0.001$. In the snake/spider condition, the Snake/Spider and Claustrophobia groups were more anxious than Nonphobic controls, but not significantly different from each other. In the closet condition, the Claustrophobia group was more anxious than the Snake/Spider and Nonphobic groups, which did not differ from each other. The same pattern occurred in the hyperventilation condition.

Also, anxiety levels were compared across the three stimulus conditions within each group, using orthogonal contrasts. Nonphobics' anxiety ratings did not differ across the three stimulus conditions in either trial. In both trials, the Snake/Spider group were significantly more anxious in the snake/spider vs hyperventilation condition, and were equally anxious in the hyperventilation and closet conditions. In both trials, the Claustrophobia group were significantly more anxious in the hyperventilation vs the snake/spider condition, and were equally anxious in the hyperventilation and closet conditions.

Anxiety predictability

The Group × Stimulus × Trial interaction effect was significant, $F(4,78) = 3.5$, $P < 0.05$, as was the Group × Trial effect $F(2,39) = 5.1$, $P < 0.05$. However, simple effects analyses of between-group differences were not significant: the groups did not differ significantly from each other within any of the stimulus conditions, in either the first or second trial.

Arousal symptoms and cognitions

A multivariate $3 \times 3 \times 2$ ANOVA was performed, for sum of physical symptom ratings (maximum = 40) and sum of cognitive symptom ratings (maximum = 12). Pooled variance estimates were used in the analysis of cognitive symptoms since the Nonphobic group reported no cognitive symptoms under any stimulus condition. The multivariate 3-way interaction was significant, $F(8,152) = 3.1$, $P < 0.01$. In subsequent univariate analyses, only cognitive symptoms produced a significant 3-way interaction, $F(4,78) = 5.7$, $P < 0.001$. However, univariate Group × Stimulus interactions were significant for both physical and cognitive symptom ratings: $F(4,78) = 7.4$, $P < 0.001$, and $F(4,78) = 9.2$, $P < 0.001$, respectively. Means are presented in Figs 2 and 3.

For **physical symptoms**, simple effects analyses of between-group differences in the first trial showed that the groups differed significantly for each stimulus condition: snake/spider, $F(2,40) = 18.5$, $P < 0.001$; closet, $F(2,40) = 50.4$, $P < 0.001$; and hyperventilation, $F(2,40) = 9.6$,
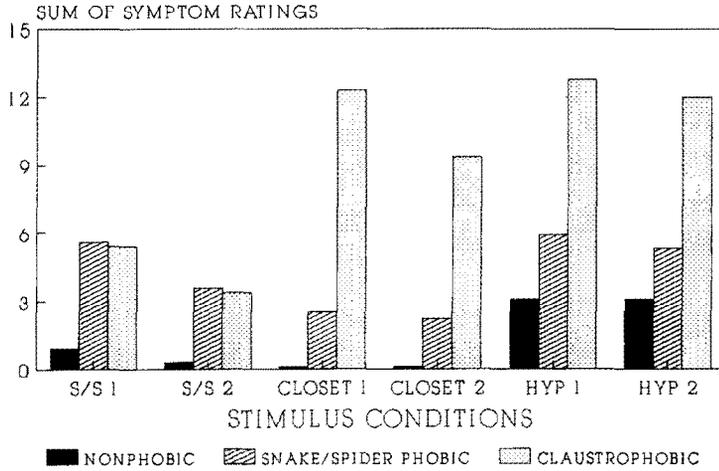
SUM OF SYMPTOM RATINGS

Fig. 2. Physical symptoms during exposure to snake/spider (S/S), closet, and hyperventilation (HYP) trials
across Claustrophobia, Snake/Spider, and Nonphobia groups.

$P < 0.001$. In the snake/spider condition, Scheffe pairwise comparisons showed that the Snake/Spider and Claustrophobia groups reported more physical symptomatology than did nonphobic controls, but did not differ from each other. In the closet condition, the Claustrophobia group reported more physical symptomatology than did the Snake/Spider group which in turn reported more than did Nonphobic Ss. In the hyperventilation condition, the Claustrophobia group reported more physical symptomatology than did either the Snake/Spider or Nonphobic groups, which did not differ from each other.

Almost the same patterns were observed for the second trial. The exception was that the Claustrophobia group reported more physical symptomatology than did either the Snake/Spider or Nonphobic groups (which did not differ from each other), in the closet condition.

Orthogonal contrasts among stimulus conditions showed that the Nonphobic group reported more physical symptomatology in the hyperventilation vs closet condition in trial 1, and vs either the snake/spider or the closet condition in trial 2. The Snake/Spider group reported more physical symptomatology in the hyperventilation vs closet condition in both trials, with ratings for the snake/spider condition falling midway without differing significantly from the other conditions. The Claustrophobia group reported more physical symptomatology in the hyperventilation vs snake/spider condition in both trials, with ratings for the closet condition falling midway without differing significantly from the other conditions.
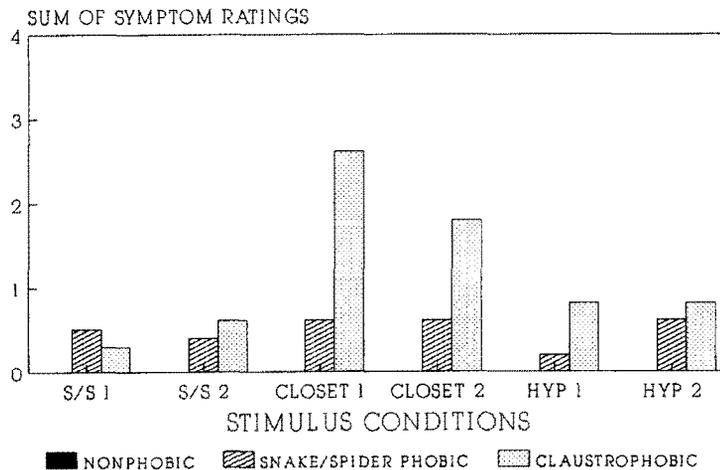
SUM OF SYMPTOM RATINGS

Fig. 3. Cognitive symptoms during exposure to snake/spider (S/S), closet, and hyperventilation (HYP)
trials across Claustrophobia, Snake/Spider, and Nonphobia groups.

For **cognitive symptoms**, simple effects analyses of between-group differences were restricted to the Claustrophobia and Snake/Spider groups, since the Nonphobic group reported no cognitive symptoms under any condition. The groups differed significantly in the first, $F(1,23) = 17.8$, $P < 0.001$, and second trial, $F(1,23) = 15.19$, $P < 0.02$ of the closet condition. The Claustrophobia group reported more cognitive symptomatology than did the Snake/Spider group. The groups did not differ significantly in the other two conditions.

Orthogonal contrasts among stimulus conditions showed very mild cognitive symptomatology for the Snake/Spider group, which did not differ across stimulus conditions. In the first trial, the Claustrophobia group reported more cognitive symptomatology in the closet vs hyperventilation condition, which in turn entailed more cognitive symptomatology than the snake/spider condition. However, these contrasts were not significant in the second trial.

Panic predictability

The report of panic attacks was compared across groups for each trial of exposure for each stimulus condition, using chi-square tests. The chi-square values were significant for the first trial, $\chi^2(2) = 8.9$, $P < 0.05$, and second trial, $\chi^2(2) = 9.7$, $P < 0.01$, of the closet condition. In both trials, a higher proportion of the Claustrophobia group reported panicking. Percentages are presented in Fig. 4.

All of the panics by Claustrophobia group Ss in the closet were expected. All of the remaining attacks were unexpected.

With the exception of 1 S in the Claustrophobia group whose panic occurred immediately upon entering the closet, every other panic was described as occurring at some time during the exposure (vs immediately).

Heart rate

Heart difference scores were analyzed by subtracting the average baseline heart rate score from average heart rates during the exposure trials. In the $3 \times 2 \times 2$ ANOVA, the only significant effect was for Group, $F(2,35) = 3.5$, $P < 0.05$. Means and standard deviations are presented in Table 1. Overall, the Snake/Spider group had higher heart rates than did Nonphobic controls, but did not differ from the Claustrophobia group. Also, the groups did not differ in terms of baseline heart rate values.

Heart rate difference scores were correlated with the sum physical and cognitive symptom scores. Correlation coefficients were not significant in any stimulus condition for either the Nonphobic or the Snake/Spider groups. The only correlation to reach statistical significance in the Claustrophobia group was between heart rate and report of cognitive symptoms in the closet condition ($r = 0.92$), in contrast to the very weak correlation between heart rate and report of physical symptoms in
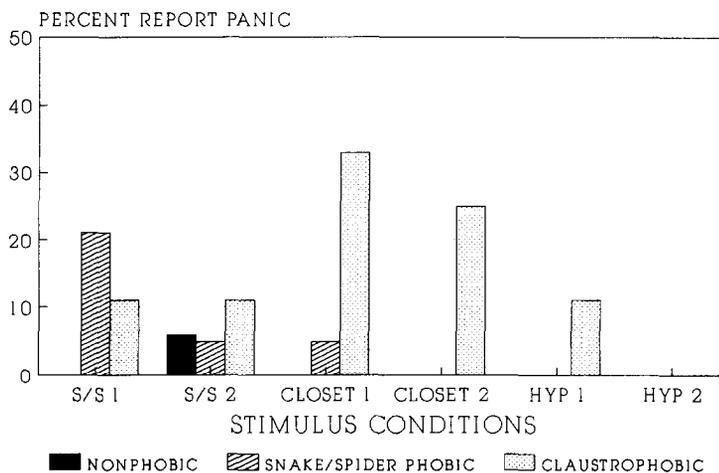

Fig. 4. Percentage of Claustrophobia, Snake/Spider, and Nonphobia Ss who panic during exposure to snake/spider (S/S), closet, and hyperventilation (HYP) trials.

Table 1. Heart rate and heart rate difference scores across groups and conditions

	Nonphobic $n = 18$	Snake/spider phobic $n = 19$	Claustrophobic $n = 9$
Absolute heart rate			
Snake/spider			
Trial 1	75.7 (10.7)	87.6 (13.7)	79.6 (9.3)
Trial 2	75.9 (10.3)	85.9 (12.2)	80.1 (9.6)
Closet			
Trial 1	72.5 (8.1)	82.3 (12.4)	82.2 (17.6)
Trial 2	72.1 (8.8)	83.5 (12.6)	79.1 (10.5)
Baseline	66.4 (8.6)	72.2 (10.8)	71.3 (5.6)
Difference heart rate			
Snake/spider			
Trial 1	9.3 (6.0)	15.7 (11.4)	9.0 (4.7)
Trial 2	9.5 (6.2)	14.3 (8.8)	9.5 (4.8)
Closet			
Trial 1	6.1 (6.0)	10.5 (6.5)	11.6 (15.8)
Trial 2	5.7 (5.4)	11.3 (7.1)	8.5 (6.9)

the same condition $(r = 0.05)$. Correlations between heart rate difference scores and the report of the specific physical sympton of "palpitations or racing heart" were not significant in any group under any condition.

Standardized self-report of anxiety sensitivity

The three groups differed significantly in terms of Anxiety Sensitivity Index scores; $F(2,43) = 6.3$, $P < 0.01$. The group means were: Nonphobic 19.8, Snake/Spider 22.9, and Claustrophobia 32.9. Scheffe tests showed that the Claustrophobia group reported higher anxiety sensitivity than did Nonphobics, but did not differ significantly from the Snake/Spider group.

In addition, Pearson correlation coefficients were calculated between Anxiety Sensitivity Index scores and the various dependent measures of interest. Anxiety Sensitivity scores correlated significantly with maximum levels of anxiety experienced in relation to the closet $(r = 0.60$ and $0.52)$ and hyperventilation $(r = 0.63$ and $0.54)$ conditions. In addition, Anxiety Sensitivity scores correlated significantly with physical symptom ratings for each trial of every stimulus condition (coefficients ranged from 0.43 to 0.54). Anxiety Sensitivity scores correlated significantly with cognitive symptom ratings for the first trial of hyperventilation only $(r = 0.42)$. Correlation coefficients were not significant between anxiety sensitivity and the report of panic, heart rate difference scores, or baseline heart rate values.

DISCUSSION

The results of this investigation can be summarized as follows. First, the Claustrophobia group reported considerably more physical symptomatology overall, and especially in relation to the fear-relevant stimulus (i.e. the closet condition), in comparison to the S̲ ̲ake/Spider and Nonphobic groups. Indeed, the Claustrophobia group reported as intense physical symptomatology in response to the snake/spider stimulus condition as did the Snake/Spider group, even though they were less anxious than the Snake/Spider group, at least on the first trial of exposure. Furthermore, while the Claustrophobia group reported more intense physical symptomatology, the Snake/Spider group evidenced the highest heart rate during exposures. The lack of correlation between heart rate responsivity and the report of physical symptomatology in general, or in relation to the heart rate symptom in particular, is consistent with these findings. If it can be assumed that heart rate is at least a partially valid indicator of level of autonomic arousal, this pattern of findings highlights the discordance between reporting of physical symptomatology and experience of physical arousal. Furthermore, the strength of the correlations between physical symptom ratings and scores on the Anxiety Sensitivity Index lend support to the notion that the report of physical symptomatology relates more to fear of bodily symptoms of arousal than to intensity of actual arousal.

Second, the Claustrophobia group reported more cognitive fears (i.e. fears of losing control, going crazy, or dying) than did either of the other groups. However, unlike their report of intense physical symptomatology across all conditions, the cognitive symptoms emerged only with respect to the closet condition, and only significantly so in the first trial of exposure. Worries about

panicking and losing control were almost nonexistent in the other conditions, as they were for the Snake/Spider group in general. The Nonphobic group reported no cognitive fears at all.

Third, the evidence regarding predictability of anxiety and panic was unclear. Accuracy with which the intensity of anxiety was predicted did not differ across the three groups. Although the Claustrophobia group reported more panic attacks than did the other groups ($n = 5$), they predicted that their panic attacks were likely to occur when placed in the closet. In other words, their closet-panics were expected. In contrast, the panic attacks experienced by the Snake/Spider and Nonphobic groups ($n = 7$) were unexpected, as were the attacks by Ss from the Claustrophobic group in the snake/spider and hyperventilation conditions ($n = 3$). Furthermore, with the exception of one claustrophobic panic attack that occurred immediately upon entering the closet, the remaining attacks were reportedly delayed, or occurred "sometime during the trial". In other words, the five panic attacks in the Snake/Spider group when confronted with their fear-relevant stimulus were unexpected and delayed. This result is consistent with other evidence suggesting that unexpected fear responses extend beyond the domain of PD to specific phobias (Craske et al., submitted; Rachman et al., 1987, 1988). However, the pattern of results is inconsistent with the predictions from the fear-cue model. It was postulated that unexpected fear/panic is related to unpredictable fear cues, that interoceptive cues are more unpredictable than are exteroceptive cues, and that claustrophobias entail more interoceptive cues than do animal phobias (Craske, 1991). On the other hand, it is conceivable that the unexpected panics reported by Ss in the Snake/Spider group were triggered by unexpected changes in the stimulus configuration (e.g. movement of the snake or spider). Furthermore, it is conceivable that more unexpected panics would have occurred in the claustrophobic situation if escape had been perceived as being more difficult. That is, fears of suffocation and other bodily symptoms of arousal that could trigger unexpected panic attacks may become more salient under external conditions that are perceived as being more threatening. Further investigation of the relationship between intensity of exteroceptive contexts and interoceptive cues is warranted.

Overall, these results support two of the predictions from the fear-cue model. That is, persons with fears of claustrophobic situations report more physical symptomatology, and more cognitive fears than persons with fears of animals. In addition, the Claustrophobia group were clearly more anxious of hyperventilation challenges than the Snake/Spider group. In contrast to predictions, the Claustrophobia group was as anxious about hyperventilating as about being in the closet, even in the second trial of exposure. As noted above, the perceived ease of escape from the closet may have mitigated anxiety levels, in comparison to more trapped claustrophobic situations, such as elevators.

On the other hand, the Claustrophobia group panicked more often in the closet than during hyperventilation. The report of panic may relate to physical and cognitive symptom profiles. That is, even though the Claustrophobia group reported equally intense physical symptomatology during hyperventilating and closet exposure, cognitive fears of losing control, and so on, were limited to the closet condition. As has been suggested by others (e.g. Rapee, Ancis & Barlow, 1988), it seems that the experience of panic attacks is dependent on cognitive fears in addition to physical symptomatology.

Nevertheless, the Claustrophobia group was highly anxious in relation to hyperventilating. Furthermore, as was predicted, the animal phobic group showed very little anxiety in reponse to hyperventilating; by the second hyperventilation trial, they were no more anxious than the control group. This result suggests that persons with fears of claustrophobic situations are more fearful of interoceptive cues than are persons with fears of snakes/spiders. Results from the Anxiety Sensitivity Index support this conclusion since the Claustrophobia group attained the highest scores on this measure of fear of bodily arousal symptoms. In fact, their mean score approached scores obtained from patients with PD (e.g. Rapee et al., 1988), whereas the Snake/Spider group did not differ from Nonphobic controls on this measure. Importantly, the Claustrophobic group's fear of interoceptive cues cannot be attributed to a previous learning history of panic attacks, since, according to the initial screen, none had ever experienced an uncued panic attack.

In conclusion, the results lend support to the notion that individuals with claustrophobias are more responsive to interoceptive cues than are individuals with snake/spider phobias. This result was not due to novelty of single-trial exposure, since group differences were mostly maintained

on the second trial of hyperventilating. Also, Anxiety Sensitivity Index scores reflect relatively stable group differences. Together, the results from this investigation support the hypothesis that features of fear responding are functionally related to fear cues; that the Claustrophobia group reported more physical symptomatology and cognitive fears due to a stronger salience of interoceptive cues.

Before considering the theoretical and empirical implications of these findings, it is important to consider potential weaknesses that may limit the validity of the results. First, the phobic groups were drawn from an analog population, and therefore the extent to which the findings generalize to more fearful persons seeking help for their specific phobias warrants attention. As described, the phobics in this study reported only mild to moderate interference or distress as a function of their fears. On the other hand, interference ratings were very similar to ratings surveyed from a clinical sample who reported significant fears of animals (interference rating = 1.2 vs 1.9 in this study) and closed-in situations (rating = 3.6 vs 3.0 in this study) (Craske *et al.*, submitted). Moreover, fear ratings during exposure in this study were comparable with the average fearfulness reported by the clinical sample who feared animals (fear rating = 5.9 vs 5.4 in this study) and closed-in situations (fear rating = 6.0 vs 6.4 in this study). In addition, the average number of symptoms endorsed in this study was almost identical to the number of symptoms endorsed by the clinical sample: the Snake/Spider group endorsed 3.7 symptoms on average in comparison to 3.5 symptoms by the clinical sample who feared animals, and the Claustrophobia group endorsed 7.3 symptoms on average in comparison to 7.4 by the clinical sample who feared closed-in situations. Finally, symptom data from this study are comparable with data collected during interviewing of patients seeking help specifically for simple phobias at the Center for Stress and Anxiety Disorders, Albany, New York (unpublished raw data). The average symptom endorsement ratio for a group of 35 clients principally diagnosed with Simple Phobias (mixed types of phobias) was 42.9% (range 14.3–77.1%) in comparison to an average of 56.4% (range = 11.1–100%) for the Claustrophobia group and 29.5% (range = 0–94.7%) for the Snake/Spider group in this study. Although the comparisons are not direct, given the different methods of data collection (surveys and interviews of the clinical sample vs *in vivo* measurement in the analog sample), the similarities between the current data set using an analog population and data obtained from clinical samples is suggestive of some degree of generalizability. Nevertheless, replication of this study with patients seeking help primarily for their specific phobias is warranted.

Second, an improvement in study design might be to include a condition in which interoceptive and exteroceptive cues are combined, such as hyperventilating in the presence of the fear-relevant stimulus. This comparison would enable further exploration of the role of interoceptive cues for specific phobias. Third, although heart rate is a commonly used index of autonomic arousal, more thorough investigation of the relationship between symptom reporting and physiological arousal warrants more extensive physiological measurement. Fourth, measurement of trait anxiety levels may have contributed to the current set of results, since it is conceivable that individuals with claustrophobias are more anxious in general than individuals with snake/spider phobias. Barlow (1988) has suggested that heightened trait anxiety is associated with fearfulness of interoceptive cues, since such cues are more available as a function of heightened autonomic arousal and self-focussing of attention in general. Therefore, the group differences in symptom profiles and anxiety sensitivity could be attributable to trait anxiety levels. On the other hand, others have argued that trait anxiety and anxiety sensitivity are independent factors (e.g. McNally, 1990). That is, group differences may emerge even after controlling for trait anxiety levels. Finally, matching of stimulus conditions in terms of actual task requirements may be important. In this study, *S*s were asked to attempt to make the snake/spider move whereas they simply sat passively during exposure to the closet. The degree of task involvement in the snake/spider condition may have limited attention to interoceptive cues.

One theoretical implication from these findings is that since specific phobias seem to be much more heterogeneous than was originally thought, they may entail distinct mechanisms of fear acquisition, maintenance, and reduction. The possibility of specific pathways to fear acquisition across different phobias has been investigated to some extent already (e.g. Ost, 1991). Furthermore, the results provide further evidence of a linkage between claustrophobias and PDA. An important empirical implication is the possibility that treatments for claustrophobia may benefit from the

inclusion of procedures that address fears of interoceptive cues specifically, such as those developed for the treatment of panic disorder (Barlow *et al.*, 1989).

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