JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 1998, **70,** 79–86 NUMBER 1 (JULY)

AVOIDANCE OF 20% CARBON DIOXIDE–ENRICHED AIR WITH HUMANS

C. W. LEJUEZ, JENNIFER O'DONNELL, OLIVER WIRTH, MICHAEL J. ZVOLENSKY, AND GEORG H. EIFERT

WEST VIRGINIA UNIVERSITY

Four college students were exposed to a Sidman avoidance procedure to determine if an avoidance contingency involving 20% carbon dioxide–enriched air (CO_2) would produce and maintain responding. In Phase 1, two conditions (contingent and noncontingent) were conducted each day. These conditions were distinguished by the presence or absence of a blue or green box on a computer screen. In the contingent condition, CO_2 presentations were delivered every 3 s unless a subject pulled a plunger. Each plunger pull postponed CO_2 presentations for 10 s. In the noncontingent condition, CO_2 presentations occurred on the average of every 5 min independent of responding. Following stable responding in Phase 1, condition-correlated stimuli were reversed. In both conditions, plunger response rate was high during the contingent condition and low or zero during the noncontingent condition. Furthermore, subjects avoided most CO_2 presentations. However, CO_2 presentations did not increase verbal reports of fear. Overall, the results from the present study suggest that CO_2 can be used effectively in basic studies of aversive control and in laboratory analogues of response patterns commonly referred to as anxiety.

Key words: anxiety, avoidance, carbon dioxide–enriched air, laboratory analogue, Lindsley plunger pull, self-report, humans

---

Avoidance and escape behavior are important features of response patterns referred to as anxiety (Marks, 1987). In fact, persons who seek treatment for anxiety disorders do so primarily because their avoidance-related behavior disrupts other important aspects of their behavior (Beck & Emery, 1985). Electric shock has often been used as the aversive stimulus in laboratory studies of avoidance and escape with humans (Ader & Tatam, 1961, 1963) and nonhumans (Hineline & Rachlin, 1969; Sidman, 1962). An advantage of shock is that its parameters (e.g., intensity, frequency, duration) can be manipulated easily. It is possible, however, that certain features of shock limit its suitability as an aversive stimulus for developing analogues of the type of responding that is characteristic of individuals diagnosed with an anxiety disorder. For example, the types of bodily responses typically produced by shock differ from those associated with the pattern of behavior known as panic attacks (Barlow, 1988). In particular, shock produces brief and acute peripheral pain, whereas persons with anxiety disorders typically report experiencing abrupt autonomic activity, including respiratory distress, tachycardia, and dizziness (Forsyth & Eifert, 1996).

As an alternative to shock as an aversive stimulus for studies of anxiety-related behavior, researchers have begun to use inhalations of carbon dioxide–enriched air (CO_2) in laboratory examinations of anxiety. CO_2 has been shown to produce reports of autonomic-related sensations that closely resemble those that occur in association with panic attacks. Such reports (or other evidence of particular patterns of autonomic activity) are basic to the definition of anxiety disorders (e.g., Forsyth, Eifert, & Thompson, 1996; Rapee, Brown, Antony, & Barlow, 1992). As with electric shock, researchers can manipulate parameters of CO_2 administration such as duration, concentration, and latency of activation. Various concentrations and durations of CO_2 have been used, ranging from concentrations of 4% to 50% and durations of 5 s to over 15 min, but researchers are increasingly using 20% CO_2 for relatively short durations (e.g., 20 to 25 s) because it can be administered several times throughout individual sessions (Forsyth & Eifert, in press;

The second author is now at the University of Kansas.

We thank Frank Donnelly Jr. and Charles Sicina for technical assistance, and Leo Carlin, Derek Hopko, J. J McDowell, Daniel W. McNeil, Todd Myers, Amy Odum, and David Schaal for commenting on an earlier draft of this manuscript.

Correspondence concerning this article should be addressed to C. W. Lejuez, Department of Psychology, West Virginia University, Morgantown, West Virginia 26506-6040 (E-mail: clejuez@wvu.edu).

Forsyth et al., 1996; Zvolensky, Lejuez, & Eifert, in press).

Although CO_2 inhalation has been shown to produce physiological activity and to increase self-reports of anxiety, it has not been demonstrated that CO_2 reliably produces avoidance or escape. For example, Zvolensky et al. (in press) compared self-report and physiological responses between subjects with or without the option to escape from 21-s presentations of 20% CO_2. Subjects with the escape option showed less physiological arousal and self-reported anxiety compared to subjects without such an option. However, only 20% of the subjects who were given the opportunity to escape exercised that option on any of the presentations (see also de Silva & Rachman, 1984), and no subject exercised the escape option during every CO_2 inhalation. Similar findings have been obtained with panic disorder patients (Sanderson, Rapee, & Barlow, 1989) and nonclinical subjects (Van den Bergh, Vandendriessche, De Broeck, & Van de Woestijne, 1993) in studies employing a low concentration (i.e., 5.5%) of CO_2. Despite elevated physiological responding (e.g., increased heart rate) and self-reported anxiety in response to CO_2, escape behavior rarely occurred. Thus, the effects of CO_2 on operant behavior remain unclear.

Given that CO_2 appears to produce physiological effects and verbal reports that are more like those associated with clinically relevant anxiety phenomena than does shock, it seemed worthwhile to determine whether human subjects would come to engage in behavior whose consequence is avoidance of CO_2 presentations. Specifically, a Sidman (1962) avoidance procedure arranged that CO_2 deliveries would occur every 3 s unless the subject pulled a plunger. Each plunger pull postponed CO_2 presentations for 10 s. In addition, a control condition (i.e., noncontingent) was used to determine whether plunger responses were related to the avoidance contingency. In this condition, CO_2 presentations occurred on the average of every 6 min independent of the subject's behavior. Higher response rates in the contingent condition would suggest that the CO_2 was aversive and would rule out other explanations for responding (e.g., boredom). This control condition, however, does not provide for an entirely equivalent comparison with the contingent condition because the potential frequency of CO_2 presentations is considerably greater in the contingent condition. Although such a comparison may have value, the rate of CO_2 presentations in the noncontingent condition was set at a lower rate to prevent the pairing of plunger responses and CO_2 deliveries, a pairing that was unlikely to occur in the contingent condition. That is, the more frequently CO_2 is presented, the more likely it is that responding will be temporally proximal, which may lead to decreased responding. In addition to operant responding, self-report ratings of fear were obtained to further determine the aversive properties of CO_2.

METHOD

Subjects

Four undergraduates (3 females and 1 male) were recruited through an advertisement at West Virginia University. Subjects earned $4.50 per hour and extra credit for psychology course work. Potential subjects were screened for past or present medical or psychological problems and were excluded if they reported angina, asthma, cardiovascular problems, epilepsy, hypertension, or a history of such problems with immediate family members. Due to reasons unrelated to the present experiment, S4 discontinued participation before the conclusion of Phase 1.

Materials and Apparatus

Sessions were conducted in an experimental room (6 m by 2 m) in the Department of Psychology at West Virginia University. Each subject sat at a desk that supported a 48633SX computer, a laser SVGA color monitor, a mouse, and a keyboard. To the right of the computer was a plunger (Lindsley, 1956) housed in a wooden case (24 cm long, 12 cm high, and 24 cm wide) that was mounted to the desk with two C-clamps. A minimum force of 30 N was necessary to operate the plunger. The experimenters sat in an adjacent room and could view the subject at all times through a one-way mirror.

The key components of the CO_2 apparatus are diagrammed in Figure 1. At all times during experimental sessions, subjects wore a continuous positive pressure C-Pap mask (Vital Signs Inc., Model 9000). The C-Pap mask

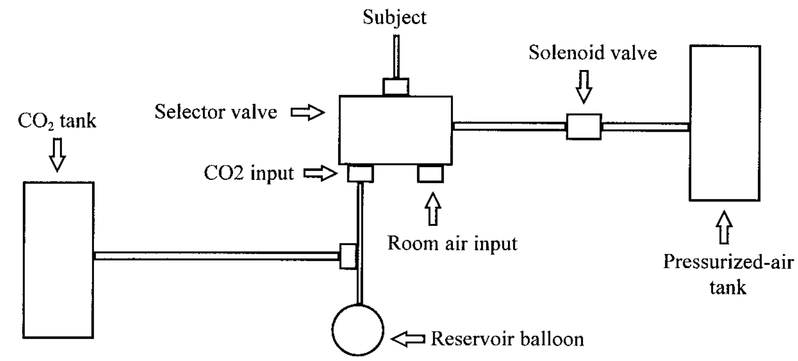

Fig. 1. Key components of the CO_2-enriched air apparatus.

was connected via 1.8-m aerosol tubing to the output port (15 mm) of a four-way two-position (open or closed) spring-return single air-pilot valve, ported as a selector valve with two operable input ports (J-14 Mega valve; Donnelly Co.). The selector valve has a lap spool and sleeve design that requires low air pressure for shifting the two inputs open and closed. For sanitary reasons, the valve was assembled with no lubrication.

Both input ports of the selector valve were fitted with 15-mm plastic PVC inputs. The right input was unattached and fed room air, and the left input was fitted with a 10-cm long section of 15-mm PVC water pipe. At the opposite end of the PVC pipe was a 15-mm plastic T. Attached to one end of the T was a 64-mm stem fitted with tygon tubing (¼ in.). Pressurized CO_2 (60% N_2, 20% CO_2, 20% O_2) was channeled through the tubing and into a 30-L meteorological balloon that was attached to the other end of the T. The balloon served as a reservoir for CO_2. At all times, either room air or CO_2 was delivered through the corresponding input and was provided to the subject through an output port located on the back of the selector valve. This output port was fitted with a 15-mm plastic input and a 5-cm long section of PVC water pipe that was attached to aerosol tubing leading to the C-Pap mask.

The selector valve was affixed to the top of an aluminum chassis (6 cm long, 12 cm wide, and 5 cm high) that housed the solid-state and other electronic components necessary for proper operation. The selector valve was normally open to room air. To provide subject access to CO_2, computer current via the parallel printer port operated a solid-state relay that opened a 24-VDC normally closed three-way poppet-bubble tight solenoid valve (ET-3; Clippard Minimatic) that was mounted on the inside of the chassis to the right of the selector valve (see Dalrymple-Alford, 1992, for a thorough explanation of connecting an apparatus to the parallel printer port and the Turbo Pascal programming code necessary to control the apparatus). The selector valve was connected to the output end of the solenoid valve via tygon tubing (⅛ in.) that was fed through a hole drilled in the top of the chassis. The input end of the solenoid valve was connected to a standard pressurized air tank (minimum pressure of 10 psi) that was used to operate the selector valve. When current was sent to the solenoid valve, pressurized air passed through the opened solenoid to the selector valve. Air pressure switched the selector valve, providing subject access to CO_2. In the absence of current, the closing of the solenoid valve prevented pressurized air from reaching the selector valve, thus returning subject access to room air.

Self-report measures. The Anxiety Sensitivity Index (Reiss, Peterson, Gursky, & McNally, 1986) was administered to each subject prior to the experiment to obtain a sample of responses to questions related to anxiety level. The Anxiety Sensitivity Index is a 16-item questionnaire in which subjects indicate on a 5-point Likert-type scale (0 = *very little* to 4 = *very much*) the degree to which they are concerned about possible aversive consequences of anxiety symptoms. Scores for this measure range from 0 to 64, and have been shown to be moderately correlated (Pearson r = .4) with the level of self-reported anxiety in response to CO_2 (Eke & McNally, 1996). Highscoring individuals were excluded to establish the aversive properties of CO_2. Only individuals who scored in the low or moderate range were selected for participation, because previous research suggests that these subjects would be least reactive. Reports of fear level were obtained using a 9-point Subjective Units of Distress scale (Wolpe, 1958). At the end of each session, the computer monitor displayed the following instruction: ''In relation to the current experiment, please rate your current level of fear from 0 to 8 (0 = *no fear* and 8 = *extreme fear*).''

Procedure

On the first day, subjects completed the Anxiety Sensitivity Index. Subjects then were informed that breathing CO_2 may induce several side effects (e.g., mild chest pain, heart racing, shortness of breath, faintness, dizziness, sweaty palms, increased breathing, or blurred vision). Subjects were also told that the effects of CO_2 are transitory and are not dangerous. This explanation served to inform subjects of the potential aversive consequences of this procedure and to control for expectancy effects across subjects (Forsyth et al., 1996).

After the subject agreed to participate, the following written instructions were read to the subject and were posted in the subject room:

> Every so often, you will receive carbon dioxide-enriched air through the face mask. Use the keyboard to answer the questions on the screen before and after the session. During the session, you can pull the plunger whenever you want. You know you have used the plunger correctly when the box in the middle of the screen flashes. Do not touch anything on the computer screen during the session.

Gas deliveries were 25 s followed by a 65-s rest period. This rest period was used because previous research in our laboratory indicated that the physiological effects of 25-s deliveries of 20% CO_2 last approximately 60 s. During CO_2 presentations and the subsequent rest periods in both conditions, a red box was centered on the screen and plunger pulls were ineffective. Thus, no signal was provided to differentiate the end of a CO_2 presentation and the beginning of the ensuing break period.

Subjects were exposed to two 33-min sessions (i.e., one contingent and one noncontingent) on each day of participation. Before the start of the first daily session, subjects were asked to remove any jewelry (e.g., a watch) or other materials (e.g., a pencil or paper); these were returned at the end of participation each day. Between the two daily sessions, each subject was given a 5-min break, during which he or she could remove the mask and leave the experimental room. After completion of each session, subjects gave their postsession fear ratings.

The first condition presented each day was determined randomly, with the constraint that the same order could not occur on more than 3 consecutive days. In the contingent condition, CO_2 was delivered 3 s after the termination of the previous CO_2 presentation and rest period (i.e., every 93 s) unless the subject pulled the plunger during that 3-s period. Each plunger pull postponed the next scheduled gas delivery for 10 s. In the absence of responding, the subject received as many as 22 CO_2 deliveries. Thus, the rate of gas delivery in the absence of responding (excluding time spent in the rest period) was higher than gas delivery when the subject pulled the plunger. The subject could postpone all gas deliveries by pulling the plunger approximately once every 10 s. In the noncontingent condition, CO_2 deliveries occurred every 3 min, 6 min, or 9 min (selected randomly, with the exception that a given interval could not occur more than three consecutive times) regardless of plunger pulling.

If the subject received more than 70% of the maximum possible CO_2 presentations (at least 16 of 22) in six contingent sessions, the following instructions were provided:

> The only thing that you can do by pulling the plunger is sometimes change the number of times you receive carbon dioxide-enriched air. It is even possible for you to sometimes receive no deliveries of carbon dioxide.

The experiment was divided into two phases. In Phase 1 of the contingent condition, a blue box (15 cm by 15 cm) was centered on the computer screen at all times, except during a CO_2 presentation or a rest period. In the noncontingent condition, a green box was present instead of the blue box. In Phase 2, the colored boxes correlated with each condition were reversed (i.e., a green box was present in the contingent condition, and a blue box was present in the noncontingent condition). Each condition continued until the rate of plunger pulling was stable in both contingent and noncontingent conditions according to visual inspection of trend and variability.

RESULTS

Subjects S1, S2, S3, and S4 completed 30, 32, 42, and 32 sessions, respectively. Figure 2 shows that subjects responded at higher rates in the contingent condition than in the noncontingent condition in both Phases 1 and 2. These results suggest that response rate was determined by the contingency between plunger pulling and postponement of CO_2 delivery (i.e., that CO_2 was aversive). The mean numbers of responses per minute in the contingent and noncontingent conditions, respectively, over the final six sessions of Phases 1 and 2 (averaged across phases) were 26.2 and 0.42 for S1, 9.9 and 0.12 for S2, 46.1 and 25.8 for S3, and 24.9 and 12.3 for S4.

Figure 3 shows that for S1 and S2, most presentations of CO_2 were avoided by the second session of Phase 1. Acquisition of avoidance responding, however, was much slower for S3 and S4. In fact, it was not until after additional instructions were provided to S3 and S4 (in the sixth and seventh pairs of sessions, respectively) that the number of CO_2 presentations decreased. Nevertheless, for the last six sessions of Phase 1, S4 avoided 90% and S3 avoided 75% of scheduled CO_2 presentations. The mean number of CO_2 presentations delivered in the contingent condition over the final six sessions of Phases 1 and 2 (averaged across phases) was 1.3 for S1, 2.4 for S2, 6.7 for S3, and 2.5 for S4. As programmed, the mean number of CO_2 presentations delivered in the noncontingent condition was 5.5 for each subject.

Response rates tracked the switch of condition-correlated discriminative stimuli within the first session of Phase 2 for all subjects. For S1 and S2, whose first session in Phase 2 was the contingent condition, no responding occurred prior to the second or third CO_2 presentation. Following these first few CO_2 presentations, however, rates increased to the level found in the contingent condition in

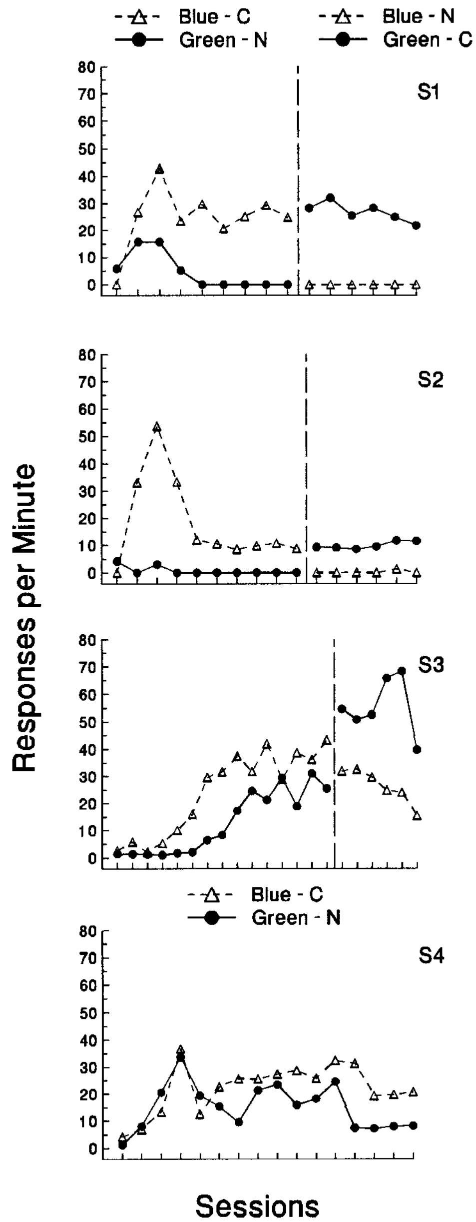

Fig. 2. Responses per minute for each pair of sessions from the contingent and noncontingent conditions. Open triangles represent responding in the presence of a blue box (contingent condition in Phase 1 and noncontingent condition in Phase 2), and closed circles represent responding in the presence of a green box (noncontingent condition in Phase 1 and contingent condition in Phase 2). Additional instructions were provided for S3 and S4 before the sixth and seventh pairs of sessions, respectively. Due to reasons unrelated to the present experiment, S4 discontinued participation before the conclusion of Phase 1.

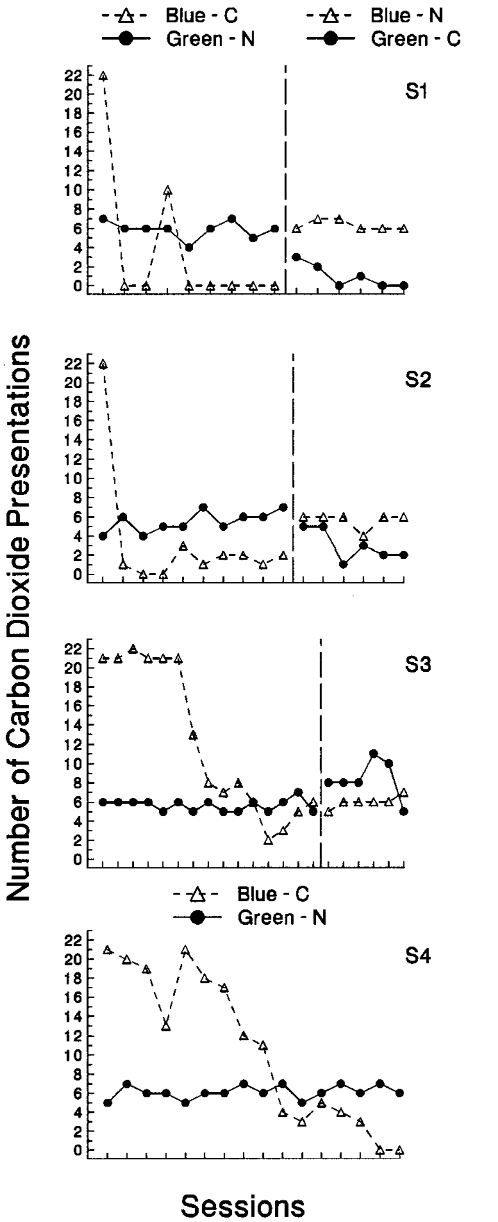

Fig. 3. Number of CO_2 presentations delivered for each pair of sessions from the contingent and noncontingent conditions. Open triangles represent CO_2 presentations in the presence of a blue box (contingent condition in Phase 1 and noncontingent condition in Phase 2), and closed circles represent CO_2 presentations in the presence of a green box (noncontingent condition in Phase 1 and contingent condition in Phase 2). Additional instructions were provided for S3 and S4 before the sixth and seventh pairs of sessions, respectively. Due to reasons unrelated to the present experiment, S4 discontinued participation before the conclusion of Phase 1.

Phase 1. As such, response rate in that session was similar to the rates in sessions during the previous phase, with all CO_2 presentations occurring within the first 8 min of the session. Neither subject responded in the subsequent session of the noncontingent condition. For S3, who received the noncontingent condition as the first session of Phase 2, adjustment to the change in condition-correlated stimulus color did not occur until the following session of the contingent condition. Similar to S1 and S2, S3's rapid adjustment in the following contingent condition could be attributed to the repeated CO_2 presentations at the onset of the session due to the initial absence of responding. As discussed above, S4 was not exposed to Phase 2.

Preexperimental questionnaire scores were low for each subject. Anxiety Sensitivity Index scores were 16 for S1, 13 for S2, 13 for S3, and 9 for S4. In general, fear ratings were low for all subjects, with no subject giving a rating greater than 4. The mean fear ratings in contingent and noncontingent conditions over the final six sessions of Phases 1 and 2 (averaged across phases), respectively, were 1.0 and 1.0 for S1, 0.4 and 2.0 for S2, 0.3 and 0.3 for S3, and 0 and 0.2 for S4.

DISCUSSION

The development and maintenance of avoidance responding in the present study suggest that 25-s inhalations of 20% CO_2 can function as an aversive stimulus for humans. In the final six sessions of each condition, 3 of 4 subjects consistently avoided CO_2 presentations. The other subject avoided over two thirds of 22 possible CO_2 presentations. For each subject, plunger pulling in the contingent condition occurred at a consistent rate and was higher than in the noncontingent condition. These results suggest that responding in the contingent condition was due to the avoidance contingency rather than to other factors (e.g., boredom).

Considering that subjects reliably avoided CO_2, it is surprising that previous research has not found escape from CO_2. Because it seems unlikely that avoidance and escape are functionally different (cf. Barlow, 1988), one possible explanation is the focus of the previous studies. For example, these studies examined differences in physiological responding and self-report ratings of fear depending on whether or not subjects had an escape option, even if that option was not exercised. As a result, actual escape was not of primary concern. Furthermore, two studies used a much lower concentration of CO_2 (5.5%), and subjects were asked not to use their escape option unless necessary (Sanderson et al., 1989; Van den Bergh et al., 1993). Thus, subjects may have endured the CO_2 because of the low concentration of CO_2 and also because of implicit instructional control. This proposition could not be tested, however, because CO_2 was provided continually throughout an entire session and not as discrete presentations.

Concerning low postsession anxiety ratings, this result may have reflected a "relief" response, rather than a response to the presentations of CO_2 during the session, or even the cumulative subjective effects of the session. Low postsession anxiety ratings also may have been due to the low preexperimental anxiety level of subjects, indexed by their low scores on the preexperimental questionnaire. As support for this hypothesis, previous research in our laboratory has shown that subjects with low preexperimental anxiety scores provide low postsession anxiety ratings, whereas subjects with high preexperimental anxiety scores provide high postsession anxiety ratings. Thus, if the present study had used subjects with higher scores on the preexperimental questionnaire, higher postsession fear ratings might have been obtained.

Even though CO_2 reliably produced avoidance responding in the present study, there are certain limitations of using CO_2 in the laboratory. First, using a preset duration and concentration of CO_2 does not guarantee consistency in the amount of CO_2 that is inhaled from presentation to presentation (i.e., subjects may alter their breathing pattern during CO_2 presentations). Second, the use of CO_2 may require certain modifications in standardized procedures for administering aversive stimuli. For example, although the design of the present experiment is based on a free-operant procedure, safety and ethical constraints require a rest period between CO_2 presentations. Thus, CO_2 cannot be used in the same manner as in studies that use shock and point loss as aversive stimuli, for which a recovery period is not required (Ader & Tatam, 1961, 1963; Weiner, 1969). Similar comparisons might be attained, however, with methodological modifications such as the use of a discrete-trials procedure or the implementation of blackout periods with shock or point loss. Nevertheless, despite the methodological constraints associated with using CO_2 as an aversive event, the results from the present study suggest that CO_2 can be used effectively in basic studies of aversive control and in laboratory analogues of response patterns referred to as anxiety.

REFERENCES

Ader, R., & Tatam, R. (1961). Free-operant avoidance conditioning in human subjects. *Journal of the Experimental Analysis of Behavior, 4,* 275–276.

Ader, R., & Tatam, R. (1963). Free-operant avoidance conditioning in individual and paired human subjects. *Journal of the Experimental Analysis of Behavior, 6,* 357–359.

Barlow, D. H. (1988). *Anxiety and its disorders.* New York: Guilford.

Beck, A. T., & Emery, G. (1985). *Anxiety disorders and phobias: A cognitive perspective.* New York: Basic Books.

Dalrymple-Alford, E. C. (1992). Response-key input via the IBM PC/XT/AT's parallel printer port. *Behavior Research Methods, Instruments, and Computers, 24,* 78–79.

de Silva, P., & Rachman, S. (1984). Does escape behavior strengthen agoraphobic avoidance? A preliminary study. *Behaviour Research and Therapy, 22,* 87–91.

Eke, M., & McNally, R. J. (1996). Anxiety sensitivity, suffocation fear, trait anxiety, and breath-holding duration as predictors of response to carbon dioxide challenge. *Behaviour Research and Therapy, 304,* 603–607.

Forsyth, J. P., & Eifert, G. H. (1996). Systemic alarms in fear conditioning. I: A reappraisal of what is being conditioned. *Behavior Therapy, 27,* 441–462.

Forsyth, J. P., & Eifert, G. H. (in press). Response intensity in content-specific fear conditioning comparing 20% vs. 13% CO_2-enriched air as unconditioned stimuli. *Journal of Abnormal Psychology.*

Forsyth, J. P., Eifert, G. H., & Thompson, R. N. (1996). Systemic alarms in fear conditioning. II: An experimental methodology using 20% carbon dioxide inhalation as an unconditioned stimulus. *Behavior Therapy, 27,* 391–415.

Hineline, P. N., & Rachlin, H. (1969). Escape and avoidance of shock by pigeons pecking a key. *Journal of the Experimental Analysis of Behavior, 12,* 533–538.

Lindsley, O. (1956). Operant conditioning methods applied to research in chronic schizophrenia. *Psychiatric Research Reports, 5,* 118–139.

Marks, I. M. (1987). *Fears, phobias, and rituals.* New York: Oxford University Press.

Rapee, R., Brown, T. A., Antony, M. M., & Barlow, D. H. (1992). Response to hyperventilation and inhalation of 5.5% carbon dioxide-enriched air across the DSM-III-R anxiety disorders. *Journal of Abnormal Psychology, 101,* 538–552.

Reiss, S., Peterson, R. A., Gursky, D. M., & McNally, R. J.

(1986). Anxiety sensitivity, anxiety frequency, and the prediction of fearfulness. *Behaviour Research and Therapy, 24,* 1–8.

Sanderson, W. C., Rapee, R. M., & Barlow, D. H. (1989). The influence of illusion of control on panic attacks induced by 5.5% carbon dioxide enriched air. *Archives of General Psychiatry, 46,* 157–162.

Sidman, M. (1962). Classical avoidance without a warning stimulus. *Journal of the Experimental Analysis of Behavior, 5,* 97–104.

Van den Bergh, O., Vandendriessche, F., De Broeck, K., & Van de Woestijne, K. P. (1993). Predictability and perceived control during 5.5% CO_2-enriched air inhalation in high and low anxious subjects. *Journal of Anxiety Disorders, 7,* 61–73.

Weiner, H. (1969). Conditioning history and the control of human avoidance and escape responding. *Journal of the Experimental Analysis of Behavior, 12,* 1039–1043.

Wolpe, J. (1958). *Psychotherapy by reciprocal inhibition.* Stanford, CA: Stanford University Press.

Zvolensky, M. J., Lejuez, C. W., & Eifert, G. H. (in press). The role of control in anxious responding: An experimental test using repeated administrations of 20% CO_2-enriched air. *Behavior Therapy.*

Received November 11, 1997
Final acceptance March 24, 1998