Pergamon

Anxiety Disorders
17 (2003) 335–347

JOURNAL OF Anxiety Disorders

Fear responses to mock magnetic resonance imaging among college students: toward a prototype experiment

F. Dudley McGlynn*, Rhonda Karg, Steven R. Lawyer

Department of Psychology, Thach Hall, Auburn University, Auburn, AL 36849-5214, USA

Received 29 January 2001; received in revised form 26 June 2001; accepted 13 November 2001

Abstract

Two hundred randomly selected student participants (139 females, 61 males) responded initially to questionnaires that quantified variables such as state and trait anxiety, anxiety sensitivity, claustrophobia, and panic/agoraphobia. Later they were informed that a mock magnetic resonance imaging (MRI) procedure was upcoming, and were prompted to provide self-efficacy ratings vis-à-vis completing the procedure. Finally, the participants' behavioral reactions to a mock MRI procedure were characterized; their heart beats were recorded and ratings of fearfulness were acquired. One purpose of the research was simply to tally numbers of participants who responded fearfully in various ways: 7 failed the procedure behaviorally, 7 others completed the procedure but did so fearfully, 17 others completed the procedure but manifested excessive heart-rate responsivity. A second purpose of the research was to "predict" subjects' fear-response categorization psychometrically and/or with self-efficacy ratings: psychometric data related to claustrophobia predicted subjects' fear-response categorization as did self-efficacy ratings. According to these results mock MRI assessment among college students provides a promising context for research on claustrophobia.

Keywords: Magnetic resonance imaging; College students

Nuclear magnetic resonance imaging (MRI) is a means of diagnosing diverse pathologies by photographing electrons in the body. The experience of MRI

* Corresponding author. Tel.: +1-334-844-6472; fax: +1-334-844-4447.
E-mail address: mcglyfd@mail.auburn.edu (F.D. McGlynn).

0887-6185/02/$ – see front matter
PII: S0887-6185(02)00204-9

evaluation usually involves being inserted head-first into a small tunnel-like chamber and remaining motionless for as long as 2 h while a magnetic coil operates outside. Because MRI is non-invasive, reliable, and valid it has become a popular diagnostic procedure (Friday & Kubal, 1990). Problematically, a great many MRI scans are failures due to patients' refusals or premature terminations (see Katz, Wilson, & Frazer, 1994).

Patients who terminate or refuse MRI evaluation do so for a number of reasons, e.g., they are motivated to deny/avoid diagnostic knowledge, to avoid pain from hard surfaces and postures during the procedure (e.g., Flahery & Hoskinson, 1989; Katz et al., 1994). Some reasons for termination and avoidance reported by patients are emblematic of claustrophobia, i.e., being alone, being confined (e.g., Thorp, Owens, Whitehouse, & Dewey, 1990). Estimates concerning the numbers of claustrophobic fear reactions to MRI vary markedly due to differing estimation procedures, including differing definitions of fear itself. However, fear in response to MRI exposure is doubtless commonplace. Quirk, Letendre, Ciottone, and Lingley (1989), for example, found that 28% of 46 MRI patients did not complete a procedure, and that 65% reported having felt at least some anxiety while in the MRI chamber. The relation between MRI participation and claustrophobia is underscored further by reports of cases in which claustrophobia developed after an MRI procedure (Fishbain et al., 1988).

Given the above state-of-affairs research using the MRI context is potentially valuable in at least two ways. First, it can afford empirical generalizations about how to deal with clinical MRI refusal. Some specific suggestions for clinical management of MRI fear are available already (e.g., Melendez & McCrank, 1993) but they are based on uncontrolled case reports or case series and might, therefore, benefit from further validation and refinement using relatively controlled methods. Second, research using the MRI context can yield information toward developing the concept of claustrophobia. A picture of claustrophobia is beginning to take shape in which claustrophobia shares important features with panic disorder (e.g., Craske et al., 1995; Rachman, Levitt, & Lopatka, 1988; Shafran, Booth, & Rachman, 1993) and in which fear of confinement and fear of suffocation are orthogonal dimensions (Valentiner et al., 1996). Problematically, typical research on claustrophobia involves closed rooms or closets inside closed rooms that have various sizes and diverse characteristics (e.g., Rachman & Levitt, 1985). In principle, the MRI context affords standardization as well as a face-valid task for developing the claustrophobia construct.

The research reported here was prompted by the realization that the context of MRI affords important research opportunities. Two questions were answered. First, what percentages will show various fear responses when randomly selected college students are exposed to a mock MRI procedure? The answer to that question will allow university-based researchers to assess the practicality of a mock MRI approach in their own settings. (Knowing the percentages of students who respond fearfully in various to a mock MRI assessment will also provide for comparisons with related events in clinical MRI settings.) Second, do data from

well-validated questionnaires about claustrophobia predict students' various fear responses during a mock MRI procedure? The answer to that question bears on the extent to which students' fear responses to mock MRI assessment are related conceptually to claustrophobia.

1. Method

1.1. Participants

The participants were 61 male and 139 female college students selected randomly. The mean age of the 200 participants was 19.42 years; 180 of the 200 were Caucasian, 14 were African-American, 1 was Asian; the ethnicity of 5 *S*s was undisclosed. They received modest course credit for participating.

1.2. Apparatus and materials

1.2.1. MRI simulator

The mock MRI chamber is described in detail by Wood and McGlynn (2000). Briefly, it is a full scale re-creation of a GE Signa .5 Tesla MRI apparatus except that it is devoid of magnets and does not produce the sounds of magnetic imaging. A table 18 ft. long, 23 in. wide, and 42 in. from the floor supports a track on which a wheeled platform moves. Ten feet of the track are surrounded by a 22-in. diameter tube that, in turn, is enclosed in a square chamber that has 8-ft. sides. A motor that can be controlled by participants or experimenters moves the platform into and out of the tube. A tape measure is attached to the end of the moving platform and to the fixed table so as to register the distances moved by the platform.

1.2.2. Psychophysiological equipment

Heart-rate was measured via a J & J Instruments Co. (Poulsbo, WA, USA) modular system that included a #P-401 module, a #I-330 interface, and DataTrack software for an IBM Pentium-II computer. Heart beats were recorded from pulse-volume variations beneath an optical densitometer on the pad side of an index finger. Heart rates from 50 to 200 beats per minute were calculated from successive heart periods and were stored at each second. Heart-rate values were held in computer memory then downloaded on a high-density floppy disk.

1.2.3. Psychometric materials

The following questionnaires provided psychometric data: the Claustrophobia Questionnaire (CLQ; Rachman & Taylor, 1993); the Agoraphobic Cognitions Questionnaire (ACQ) and the Body Sensations Questionnaire (BSQ; Chambless, Caputo, Bright, & Gallagher, 1984; Chambless & Gracely, 1989); the State–Trait Anxiety Inventory—State and Trait forms (Spielberger, Gorsuch, & Lushene,

1970); and the Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986). These questionnaires were used because they enjoy at least some psychometric support and are germane potentially to the task of conceptualizing college students' fear during the mock MRI protocol. In addition data from the Fear Survey Schedule-II (FSS-II; Wolpe & Lang, 1977), and from various fear and self-efficacy ratings obtained during the experiment were used as described below.

The CLQ (Rachman & Taylor, 1993) is a 30-item Likert-type instrument on which respondents rate (0–4) their fearfulness when confronted with various situations. The questionnaire provides a total score that quantifies ''claustrophobia,'' as well as two rationally derived, 15-item subscale scores that quantify fear of restriction (CLQ-RS) and fear of suffocation (CLQ-SS). The CLQ has been shown to have internal consistency and test–retest stability coefficients that range from .51 to .68 (Rachman & Taylor, 1993) and to have the properties of discriminant and predictive validity in work with college students who were exposed to a completely dark closet (Radomsky, Teachman, & Rachman, 1997).

The ACQ (Chambless et al., 1984) is a 17-item Likert-type instrument on which respondents rate (1–5) their fear of the consequences of fearfulness. The questionnaire provides a total score, as well as scores for two rationally-derived 7-item subscales that quantify catastrophic thinking about physical implications of panic (Physical Concerns scale or ACQ-PC) and about social-behavioral consequences of panic (Social/Behavioral Concerns scale or ACQ-SB). Test–retest stabilities for the items of the ACQ range from .56 to .87 (Chambless et al., 1984). The questionnaire has shown construct validity in work with a variety of anxiety-disorder patients including those diagnosed as agoraphobic (e.g., Chambless & Gracely, 1989).

The BSQ (Chambless et al., 1984) is a 17-item Likert-type instrument on which respondents rate (1–5) the severity of concerns over the bodily manifestations of fear. Test–retest stabilities for the items of the BSQ range from .20 to .84. As with the ACQ (above), the BSQ has shown construct validity in work with several categories of anxiety-disorder patients (e.g., Chambless & Gracely, 1989).

The ASI (Reiss et al., 1986) is a 16-item Likert-type instrument on which respondents rate (0–4) the strength of their beliefs that anxiety symptoms will have negative consequences such as illness, embarrassment, and loss of control. Test–retest stabilities for the total score have ranged from .71 to .75 (McNally, 1996). The ASI is used widely in the study of panic phenomena, and has been demonstrably valid in various ways (for a review, see Taylor, 1995).

The State–Trait Anxiety Inventory—Trait form (STAI-T; Spielberger et al., 1970) is a 20-item Likert-type questionnaire on which respondents rate (1–4) how much of the time various anxiety symptoms are present. It is a venerable and relatively well-validated instrument that seeks to quantify the extent to which anxiety is an enduring disposition. Test–retest stabilities for total scores summed over the 20 items have ranged from .65 to .86 (Spielberger, 1983).

The State–Trait Anxiety Inventory—State form (STAI-S; Spielberger et al., 1970) is a 20-item Likert-type questionnaire on which respondents rate (1–4) how

anxious they are at the time of responding. It is a venerable and well-validated instrument that seeks to quantify anxiety as a momentary state. The median among reported test–retest stabilities is .33; relatively low as it should be (Spielberger, 1983).

The Fear Survey Schedule-II—Revised (FSS-II-R; Wolpe & Lang, 1977) is a widely used omnibus questionnaire on which respondents rate (1–7) their fear of 27 objects and situations that are commonly feared. As noted already it was used here in concert with fear and self-efficacy ratings that are described below.

1.3. Procedure

Potential participants were informed of the project by classroom announcements and by posters. Self-selected students ($N = 336$) arrived at a classroom during one of several announced times for participation, responded to the various questionnaires, and arranged for a subsequent session. The questionnaire answers were studied so as to identify and exclude students who reported having a current diagnosis of panic disorder or of an ongoing medical condition. Two hundred and twenty-five students were retained and were contacted by telephone the evening before the second session.

On arrival for the second session, participants were provided with a preview of the events upcoming and were administered the STAI-S. Next the heart-beat sensors were attached, and participants were told that heart beats would be recorded for 6 min. Then they reclined on a cot from which the mock MRI apparatus was not visible, and heart beats at rest were recorded for 6 min.

After resting heart beats had been recorded, participants entered the room that contained the mock imager and the exposure procedure was described. Participants were told they were expected to recline on the table section of the device for 2 min, then to insert themselves completely into the mock imager using a hand-held controller, and remain inside for 5 min. They were told also that they could remove themselves from the mock imager by using the controller either after being informed that the 5 min had elapsed or when they could no longer tolerate the experience. Participants were then afforded opportunity to practice moving the conveyor by operating the hand-held controller.

Participants were asked to respond on a visual analogue scale (0 = ‘‘no fear’’; 100 = ‘‘terror’’) to describe fear intensity at that moment, i.e., before insertion into the mock imager was attempted. They were asked also to rate their self-efficacy for the upcoming task, i.e., their confidence that the task could be completed successfully (0 = ‘‘not confident at all’’; 100 = ‘‘very confident’’). Next participants reclined on the conveyor tray face-up with the head nearest the mock imager. Two minute then elapsed during which heart beats were recorded and, finally, they were asked to insert themselves into the mock imager and remain for up to 5 min.

Participants exited the mock imager by operating the controller after 5 min at full insertion or, in some cases, sooner. They then responded to a visual analogue

scale (0 = ''no fear''; 100 = ''terror'') to describe, retrospectively, what their greatest fear had been during the insertion. Finally, the heart-beat sensors were removed and participants completed the STAI-S to characterize their anxiety at the end of the experiment. The procedure was repeated until 200 data sets were available.

2. Results

As noted earlier we were interested in answering two questions. What percentages of college students will show fear responses related to the mock MRI experience? This question was answered by defining several fear-response categories then tallying the number (percentage) of the 200 students assigned to each. Is there psychometric support for thinking of mock MRI fear/avoidance among college students as conceptually related to claustrophobia and/or panic? This question was answered by using data from the various questionnaires to predict participants' assignments to the various fear-response categories.

2.1. Percentages of fearful subjects

According to the orthodox three-channel fear concept (e.g., Lang, 1968) fear can be measured via overt behavior, via self-reporting, and via physiological arousal. Guided by the three-channel concept we formed three categories of fear response to the mock MRI apparatus: behavioral failure due to premature exit or refusal to enter; completion with self-reported fear; and completion with heart-rate responsivity. Fearless completion formed a fourth category.

The category of behavioral failure due to premature exit or refusal to enter was the most straightforward. Seven of the 200 participants (3.5%) were behavioral failures; 4 exited the apparatus before 5 min had elapsed; 3 refused to enter.

The category of completion with self-reported fear was formed arbitrarily by including participants who completed the insertion but who provided retrospective fear ratings of 70 or higher on the 100-point visual analogue scale. Seven of the 200 subjects (3.5%) met the arbitrary criterion.

The category of completion with heart-rate responsivity was formed in the following way. Each participant's heart rate was recorded in beats-per-minute values during 10–30-s intervals of the successful 5-min insertion. The resting heart rate from each of the 200 participants (taken from the last minute of the 6-min resting heart-rate recording period) was subtracted from his or her 10 heart rates during insertion. Thus, there were 200 heart-rate difference scores for each of 10–30-s intervals. The means and standard deviations of the difference scores for each 30-s interval were calculated and participants were identified whose heart rate exceeded 2 S.D.s above the mean for at least 1 of the 10 intervals. Seventeen of the 200 participants (8.5%) were placed in the category of completion with heart-rate responsivity.

Table 1
Means (and standard deviations) for anticipatory fear, retrospective fear, and self-efficacy and means (and standard deviations) for maximum heart-rate difference scores across fear categories

Fear category	*n*	Anticipatory fear ratings (0–100)	Retrospective fear ratings (0–100)	Maximum heart-rate difference scores	Self-efficacy ratings (0–100)
Behavioral failure	7	61.67 (25.03)	86.25 (24.28)	1.20 (25.74)	53.33 (36.29)
Completion with fear	7	55.00 (16.58)	80.00 (9.13)	2.01 (29.56)	75.00 (19.58)
Completion with heart-rate response	17	22.47 (21.24)	14.12 (21.74)	36.02 (22.11)	90.88 (20.40)
Fearless completion	169	19.76 (21.61)	17.45 (18.40)	−1.08 (17.57)	90.30 (16.66)

No participant showed both criterional fear and criterional heart-rate responsivity. Thus, 31 students (15.5%) were classified as having shown some variety of three-channel fear. The remaining 169 (84.5%) were classified as having shown fearless completion.

Table 1 shows for participants in each of the four categories: the mean anticipatory-fear rating before insertion, the mean retrospective rating of maximum fear during insertion, and the mean of the maximum heart-rate difference scores (arrived at by finding the average of the participants' largest heart-rate difference scores across the 10–30-s intervals). Table 1 also shows the mean self-efficacy rating for the participants in each category.

2.2. *Psychometric characterization*

As just noted 15.5% of the 200 students showed fear in one way or another. To what extent does fear in response to the mock MRI examination among college students contact the concept of claustrophobia and/or panic? This question was answered initially by two logistic regression analyses in which the 31 participants in the three fear categories were aggregated into one cohort and the 169 participants in the fearless completion category constituted another.

Table 2 shows the means and standard deviations of the several predictor variables as calculated for the fearful versus the non-fearful participants as well as results for *t*-tests between data for fearful versus non-fearful participants. For the first regression analysis the raw scores that produced the tabled means were used to "predict" each participant's category assignment. Table 3 summarizes the results from the logistic regression analyses. The Hosmer and Lemeshow goodness-of-fit test (Hosmer & Lemeshow, 1989) showed that the model based on the ACQ-PC, ACQ-SB, ASI, BSQ, CLQ-RS, CLQ-SS, self-efficacy, pre-exposure STAI-S scores and STAI-T scores predicted fear versus non-fear categorization fairly well, $\chi^2(8, N = 191) = 4.9820$, $P = .7595$. However, the only component of the model that unilaterally afforded significant category prediction based on raw scores was that of self-efficacy rating with a beta-weight of −.0247

Table 2
Mean self-report scale scores for fearful and non-fearful participants

Scale	Mean	S.D.	*N*	*t*	*P*
ACQ-PC					
Non-fearful	8.86	1.76	168	1.735	.084
Fearful	9.64	4.20	31		
ACQ-SB					
Non-fearful	12.35	4.29	168	.523	.602
Fearful	12.80	4.94	30		
ACQ-Total					
Non-fearful	21.17	5.27	169	1.081	.281
Fearful	22.38	8.04	31		
Age					
Non-fearful	19.46	1.85	169	−.620	.536
Fearful	19.71	1.55	31		
ASI					
Non-fearful	15.79	7.55	169	−.186	.853
Fearful	15.51	8.04	31		
BSQ					
Non-fearful	34.59	10.99	169	−.634	.527
Fearful	33.23	10.92	31		
CLQ-RS					
Non-fearful	26.64	13.50	168	1.411	.160
Fearful	30.36	13.19	31		
CLQ-SS					
Non-fearful	12.16	8.54	169	1.137	.257
Fearful	14.10	9.50	31		
CLQ-Total					
Non-fearful	38.65	20.85	169	1.434	.153
Fearful	44.45	19.92	31		
Pre-exposure STAI-T					
Non-fearful	19.29	21.24	169	5.096	0**
Fearful	39.26	29.55	28		
Pre-exposure STAI-S					
Non-fearful	33.05	9.40	166	1.464	.145
Fearful	35.87	11.31	30		
Post-exposure STAI-S					
Non-fearful	29.14	8.49	166	3.781	0**
Fearful	36.52	14.93	29		
Self-efficacy rating					
Non-fearful	90.48	16.53	169	−4.061	0**
Fearful	75.16	30.48	31		
STAI-T					
Non-fearful	38.99	9.33	168	.988	.324
Fearful	40.87	11.63	31		

Note: *t*-test analyses test the differences in scores between fearful and non-fearful participants.
** $P < .001$.

Table 3
Logistic regression functions of self-report measures for fear versus non-fear classification

Scale	Beta	Wald	*df*	*P*	exp(*B*)
ACQ-PC	.0918	.8976	1	.8911	1.0961
ACQ-SB	.0090	.0188	1	.3434	1.0090
ASI	−.0102	.0497	1	.8235	.9898
BSQ	−.0303	.9156	1	.3386	.9701
CLQ-RS	.0008	.0011	1	.9738	1.0008
CLQ-SS	.0193	.2161	1	.6420	1.0195
FSS–fear of suffocating	−.0464	.0864	1	.7688	.9547
FSS–fear of small places	.0979	.3198	1	.5717	1.1028
Pre-exposure STAI-S	.0038	.0220	1	.8821	1.0002
Self-efficacy rating	−.0235	5.6248	1	.0177*	.9747
STAI-T	.0002	0	1	.9944	1.0002

* $P < .05$.

($P = .0106$). For each additional point of self-efficacy the odds ratio of being classified as fearful decreased by 3%.

As another approach to psychometric characterization of participants in the three-channel fear category, a second logistic regression was done. First, the middle third of raw scores on each predictior variable in the model were deleted and the remaining scores were classified as simply being ''high'' (upper third) or ''low'' (lower third). Next, these high versus low classifications for each predictor variable were entered into separate logistic regressions in which the criterion variable was a classification of either three-channel fear ($N = 31$) or successful completion ($N = 169$). High versus low score-categorization on the Claustrophobia Questionnaire—Total score (CLQ-Total) predicted fear classifications significantly with a beta-weight of 1.4091 ($P = .02$). Moving from the low to high category on the CLQ-Total increased the odds ratio of being classified as fearful by 309%. High versus low categorization of self-efficacy ratings also predicted fear classifications significantly with a beta-weight of −.9544 ($P = .02$). Moving from the low to the high category of self-efficacy ratings decreased the odds ratio of being classified as fearful by 62%.

Separate logistic regression analyses were conducted in which raw scores on each psychometric variable (summarized in Table 2) were used to predict the 31 fearful participants' fear-category assignment, i.e., whether the participant was assigned to the category of completion with self-reported fear, completion with heart-rate responsivity, or behavioral failure. Self-efficacy ratings predicted assignment to behavioral failure ($P = .001$) and assignment to completion with self-reported fear ($P = .03$) with beta-weights of −.1139 and −.0260, respectively. Raw scores on two psychometric instruments also predicted assignment to the category of behavioral failure. One of these instruments was the Physical Concerns subscale of the Agoraphobia Cognitions Questionnaire (ACQ-PC) with a beta-weight of .2716 ($P = .02$). The other was the Restriction subscale of the Claustrophobia Questionnaire (CLQ-RS) with a beta-weight of .0995 ($P = .02$).

As a final approach to characterizing psychometrically the fear of mock imaging produced in the experiment a forward, stepwise multiple regression analysis was performed in which the criterion variable was participants' retrospective ratings of maximum fear immediately after exiting the imager (above), and the predictor variables were those included in the complete model (above). A three-variable model accounted for 42% of the variance in immediate post-exit fear ratings. The three variables in the model were self-efficacy rating ($r = -.56$, $t = 7.49$, $P = 0$), and raw scores for the CLQ-Total ($r = .30$, $t = 4.83$, $P = 0$) and the pre-insertion STAI-S measure ($r = .13$, $t = 2.2$, $P = .03$).

3. Discussion

Given the definitions used, 3.5% of our 200 participants were behaviorally fearful, another 3.5% reported experiencing criterional fear, and another 8.5% manifested cardiac responsivity that presumably was related to fear. To some extent the definitions were arbitrary; probably the percentages of fearful students would vary with different definitions. Probably also the percentages of fearful students would be increased by using longer durations of confinement, by reproducing the noises created by moving magnets, by producing heat inside the chamber. Furthermore, such changes would increase the objective similarity of the laboratory and clinical MRI procedures, thus augmenting the external validity of empirical generalizations produced with the laboratory arrangement (cf. Abramson & Seligman, 1977). Researchers who have access mainly to college-student participants can use our percentage figures and take note of these related considerations while contemplating research based on a mock MRI assessment.

As is clear from our introductory narrative, estimates of fear-related events during actual MRI assessment are both vague and variable. Thus, comparisons of the present results with events in clinic settings are not straightforward. There are no clinic data on MRI-related cardiac responsivity; hence the 7% incidence of behavioral or self-reported fear is the basis for comparison. Seemingly, therefore, incidence of fear-related events in our laboratory was well below the incidence of such events in radiology settings, e.g., the 65% incidence of patients who reported "some anxiety" in the Quirck et al. (1989) study noted earlier. One of the storied criticisms of research with college students is that inclusion criteria have been too liberal; that too many students have been chosen and they were insufficiently fearful to stand as surrogates for clinically anxious patients (Bernstein & Paul, 1971; Cooper, Furst, & Bridger, 1969). The mock MRI approach might afford defense against those sorts of criticisms. Researchers who wish to make use of college-student participants can take note of this set of issues as well.

The CLQ has performed well in research to date; sufficiently well that a failure to predict fear behavior here would challenge the validity of our laboratory

arrangement, not that of the questionnaire. In particular, McIsaac et al. (1998) acquired scores on the CLQ from each of 80 medical outpatients scheduled for a first-time MRI assessment. They then performed the indicated clinical MRI assessment and, afterward, acquired ratings of subjective anxiety during the scan. Total scores on the CLQ accounted for 26% of the variance in anxiety ratings (see also Radomsky et al., 1997).

The CLQ figured into three significant predictions in the research reported here. High versus low categorization of the total score on the CLQ served to predict a participant's assignment to the category of fearless completion versus some variety of three-channel fear. Total raw scores on the CLQ were included in a three-variable model that predicted retrospective ratings of fear during the mock procedure. The CLQ-RS afforded prediction of a participant's assignment to the category of behavioral failure. Hence, there is non-trivial support for the idea that events in the mock MRI procedure are related psychometrically to the construct of claustrophobia. (Findings such as those for the ACQ-PC and for the STAI-S Anxiety scale are of potential interest also, but discussion is withheld pending additional research.)

Self-efficacy ratings predicted assignment to the category of behavioral failure, and to the category of completion with self-reported fear. In general, self-efficacy ratings are important when one is trying to predict the persistence and vigor of self-change efforts among people who are faced with behavioral tasks that are difficult and adaptively significant (Bandura, 1977). The ''self-efficacy'' ratings reported here are little more than predictions of success vis-à-vis a somewhat arbitrary laboratory performance. Clearly, therefore, the data here add little to the literature on self-efficacy per se. However, the participants were able to predict their reactions to an upcoming mock MRI assessment with some accuracy. Practically, therefore, such ''self-efficacy'' ratings can be used to identify likely-to-be-fearful research participants early-on, and to forestall the laborious assessment of a great many students as was undertaken here.

Wood and McGlynn (2000) described the first experiment in which college-student participants were exposed to our mock MRI assessment. The experiment showed that 9% of 615 undergraduate respondents to the FSS-II reported *very much fear* or *terror* in relation to small spaces, and that participants selected from among those respondents could be used to study factors that affect the ''return of fear'' (Rachman, 1989) after fear reduction among seemingly claustrophobic college students. The research reported here adds that 15.5% of 200 different, randomly selected college students displayed fear behavior during a mock MRI assessment and that some fear behavior was related psychometrically to the construct of claustrophobia. Taken together the experiments show that fear of mock MRI assessment among college students allows for research that is both feasible and theoretically meaningful. Some research directions and methodological considerations related to research based on mock MRI assessment are described in the earlier paper.

References

Abramson, L. Y., & Seligman, M. E. P. (1977). Modeling psychopathology in the laboratory: history and rationale. In: J. D. Maser & M. E. P. Seligman (Eds.), *Psychopathology: experimental models* (pp. 1–26). San Francisco, CA: Freeman.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, *84*, 191–215.

Bernstein, D. A., & Paul, G. L. (1971). Some comments on therapy analogue research with small animal phobics. *Journal of Behavior Therapy and Experimental Psychiatry*, *2*, 225–238.

Chambless, D. L., Caputo, G. C., Bright, P., & Gallagher, R. (1984). Assessment of fear in agoraphobics: the Body Sensations Questionnaire and the Agoraphobic Cognitions Questionnaire. *Journal of Consulting and Clinical Psychology*, *52*, 1090–1097.

Chambless, D. L., & Gracely, E. D. (1989). Fear of fear and the anxiety disorders. *Cognitive Therapy and Research*, *13*, 9–20.

Cooper, A., Furst, J. B., & Bridger, W. H. (1969). A brief commentary on the usefulness of studying fears of snakes. *Journal of Abnormal Psychology*, *74*, 413–414.

Craske, M. G., Mohlman, J., Yi, J., Glover, D., & Valeri, S. (1995). Treatment of claustrophobia and of snake/spider phobias: fear of arousal and fear of context. *Behaviour Research and Therapy*, *33*, 197–203.

Fishbain, D. A., Goldberg, M., Labbe, E., Zacher, D., Steele-Rosomoff, R., & Rosomoff, H. (1988). Long-term claustrophobia following magnetic resonance imaging. *American Journal of Psychiatry*, *145*, 1038–1039.

Flahery, J. A., & Hoskinson, K. (1989). Emotional distress during magnetic resonance imaging. *New England Journal of Medicine*, *320*, 467–468.

Friday, P., & Kubal, W. (1990). Magnetic resonance imaging: improved pain tolerance utilizing medical hypnosis. *American Journal of Clinical Hypnosis*, *2*, 80–84.

Hosmer, D. W., & Lemeshow, S. (1989). *Applied logistic regression*. New York: Wiley.

Katz, R. C., Wilson, L., & Frazer, N. (1994). Anxiety and its determinants in patients undergoing magnetic resonance imaging. *Journal of Behavior Therapy and Experimental Psychiatry*, *25*, 131–134.

Lang, P. J. (1968). Fear reduction and fear behavior. In: J. Schlein (Ed.), *Research in psychotherapy* (pp. 90–103). Washington, DC: American Psychological Association.

McIsaac, H. K., Thordarson, D. S., Shafran, R., Rachman, S., & Poole, G. (1998). Claustrophobia and the magnetic resonance imaging procedure. *Journal of Behavioral Medicine*, *21*, 255–268.

McNally, R. (1996). Anxiety sensitivity is distinguishable from trait anxiety. In: R. M. Rapee (Ed.), *Current controversies in the anxiety disorders*. New York: Guilford Press.

Melendez, J. C., & McCrank, E. (1993). Anxiety-related reactions associated with magnetic resonance imaging examinations. *Journal of the American Medical Association*, *270*, 745–747.

Quirk, M. E., Letendre, A. J., Ciottone, R. A., & Lingley, J. F. (1989). Anxiety in patients undergoing MR imaging. *Radiology*, *170*, 463–466.

Rachman, S. J. (1989). The return of fear: review and prospect. *Clinical Psychology Review*, *9*, 147–168.

Rachman, S., & Levitt, K. (1985). Panics and their consequences. *Behaviour Research and Therapy*, *23*, 585–600.

Rachman, S., Levitt, K., & Lopatka, C. (1988). Experimental analyses of panic—III: claustrophobic subjects. *Behaviour Research and Therapy*, *26*, 41–52.

Rachman, S., & Taylor, S. (1993). Analyses of claustrophobia. *Journal of Anxiety Disorders*, *7*, 281–291.

Radomsky, A. S., Teachman, B. A., & Rachman, S. (1997, June). *The predictive validity of the Claustrophobia Questionnaire (CLQ)*. Poster presented at the annual convention of the Canadian Psychological Association, Toronto.

Reiss, S., Peterson, R. A., Gursky, D. M., & McNally, R. (1986). Anxiety sensitivity, anxiety frequency, and the prediction of fearfulness. *Behaviour Research and Therapy*, *24*, 1–8.

Shafran, R., Booth, R., & Rachman, S. (1993). The reduction of claustrophobia—II: cognitive analyses. *Behaviour Research and Therapy*, *31*, 75–85.

Spielberger, C., Gorsuch, A., & Lushene, R. (1970). *The State–Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Spielberger, C. D. (1983). *Manual for the State–Trait Anxiety Inventory*. Palo Alto, CA: Mind Garden, Inc.

Taylor, S. (1995). Anxiety sensitivity: theoretical perspectives and recent findings. *Behavior Research and Therapy*, *33*, 243–258.

Thorp, D., Owens, R. G., Whitehouse, G., & Dewey, M. E. (1990). Subjective experiences of magnetic resonance imaging. *Clinical Radiology*, *41*, 276–278.

Valentiner, D. P., Telch, M. J., Petruzzi, D. C., & Bolte, M. C. (1996). Cognitive mechanisms in claustrophobia: an examination of Reiss and McNally's expectancy model and Bandura's self-efficacy theory. *Cognitive Therapy and Research*, *20*, 593–612.

Wolpe J., & Lang, P. J. (1977). *Manual for the Fear Survey Schedule* (Revised). San Diego, CA: Educational and Industrial Testing Service.

Wood, B. S., & McGlynn, F. D. (2000). Research on post-treatment return of claustrophobic fear, arousal, and avoidance using mock diagnostic imaging. *Behavior Modification*, *24*, 379–394.