

Cues for health-related imagery in analogue worriers: a brief report

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Summary—The role of specific cues for eliciting fearful imagery in a sample of analogue worriers was examined. Picture, script and audiotape disease-related cues were presented to 12 nonworriers and 13 analogue worriers who worried about health and disease. In general, the picture and audiotape cues were most anxiety provoking and elicited the most vivid imagery, respectively, although ratings were in the moderate range. Repeated trials of brief imagery had little effect on imagery ratings or estimates of risk for contracting the disease (i.e. worry statements) in the worry group. Disconfirmation of risk for contracting the diseases tended to lessen post-imagery anxiety but only after a series of imagery trials. On the other hand, disconfirming information lessened risk estimation overall. The findings are related to the conceptualization of worry and imagery proposed by Borkovec and Hu (*Behaviour Research and Therapy*, 28, 153-158 1990).

INTRODUCTION

In recent years, Borkovec and colleagues have offered new approaches to the study and conceptualization of the phenomenon of worry. It is generally believed that worry is adaptive to the degree that it involves rehearsal of and preparation for probable aversive events (Barlow, 1988; Mathews, 1990). Worry becomes unadaptive when it involves rehearsal of improbable events, or when it does not result in an effective plan for coping with impending events (Borkovec, Robinson, Pruzinsky & DePree, 1983). Therefore, unadaptive worry has been described as a chain of uncontrollable negative thoughts and images (Borkovec *et al.*, 1983).

Borkovec and colleagues have delineated certain key features through a series of studies with analogue and clinical worriers. First, 'worriers' experience a sense of uncontrollability about their worrying, and difficulty terminating their worry activity (Borkovec *et al.*, 1983; Craske, Rapee, Jackel & Barlow, 1988). Related is the finding that worriers tend to have more negative intrusions during relaxing tasks, when asked to attend to their breathing (Borkovec *et al.*, 1983) or when asked to let their minds wander (Pruzinsky & Borkovec, 1990), in comparison to nonworriers. Second, a short interval of worrying (15 min) increases the number of negative intrusions during a subsequent relaxing task in comparison to a longer 30-min pre-worry interval or no pre-worry at all (Borkovec *et al.*, 1983; York, Borkovec, Vasey & Stern, 1987). Third, worry involves relatively little imaginal activity in comparison to states of non-worry, and particularly so in worriers vs non-worriers (a pattern which normalizes with successful treatment of Generalized Anxiety Disorder) (Borkovec & Hu, 1990; Borkovec & Inz, 1990). In accord, worry episodes are associated with little or no cardiovascular activation for the most part (Borkovec *et al.*, 1983; Borkovec & Hu, 1990). The lack of cardiovascular arousal during worry contrasts with the usual cardiovascular activation during fearful imagery (Lang, 1971). Furthermore, Borkovec and Hu (1990) found that pre-worry conditions lessened the degree of heart rate activation (while increasing subjective fear ratings) during subsequent imagery episodes in contrast to pre-relaxation or pre-neutral conditions.

On the basis of these findings, Borkovec and Hu (1990) speculated that worry is a nonaroused state of cognitive activity ('what if' statements), which protects against (through avoidance) the negative affect of fearful imagery. In turn, worry inhibits habituation or emotional processing of fearful imagery, thereby contributing to the maintenance of fearful imagery and worry. This conceptualization overlaps with Mathews' (1990) notion of cognitive avoidance. Mathews (1990) posits that worry is comprised of (a) persistent negative intrusions (due to processing biases, including a preattentive bias toward threat, a decisional bias to continue to evaluate information with potential threat value, and a bias toward threatening interpretations of ambiguous material); and (b) cognitive avoidance of such intrusions which interferes with emotional processing. In a similar way, Jones and Davey (1990) suggested that worry and anticipatory anxiety about phobic stimuli reflect a *conceptual* rehearsal process, which may serve to maintain and incubate fearfulness.

Two hypotheses arise from the conceptualization of worry as an avoidance of fearful imagery. First, exposure to relevant fearful imagery might be expected to elicit cognitive worry activity. Second, successful processing of fearful images might be expected to reduce worry activity. Pruzinsky and Borkovec (1990) addressed the first hypothesis by examining the effect of brief imagery (1- and 3-min audiotaped test-taking scenarios) in groups of worrier and nonworrier undergraduates. However, this brief imagery did not induce worry, as measured by the number of negative thought intrusions during a subsequent relaxation breathing focus task, and by the number of incorrect responses to an anagram task. The authors suggested that either imagery is not a necessary or sufficient cue for worry, or that the selected imagery was insufficiently long, or was irrelevant since not all of the worriers were concerned with test-taking. An additional possibility is that audiotaped scenarios are not the most effective means of eliciting imagery. Clinical anecdote would suggest that worry is elicited by exposure to danger-laden information conveyed through a variety of mediums, including scripted formats (e.g. news items), visual presentations (e.g. film), or dialogue (e.g. stories about 'friends of friends').

The main purpose of this study was to evaluate the efficacy or potency of different cues for eliciting imagery in a group of analogue worriers, while ensuring relevance of the imagery-scenes to their worry activity. The potency of imagery cues was measured in terms of vividness ratings and subjective and cardiovascular distress levels. Also, the effect of imagery-cues upon worry activity was examined by measuring estimates of personal risk. A second purpose was to evaluate the extent to which: (a) repetition of imagery-cues; and (b) provision of disconfirming information, reduce imagery-cue potency and/or reduce estimates of personal risk. It was hypothesized that either repetition of imagery-cues and/or provision of

disconfirming information would contribute to emotional processing of feared imagined scenes (as indicated by decreased potency of imagery cues) and would lessen worry activity (as indicated by lowered estimates of personal risk). This hypothesis was derived from the theory that successful processing of fearful stimuli (imagery included) is dependent upon physiological habituation and cognitive modification of associated danger-laden misconceptions (Foa & Kozak, 1986; Rachman, 1980). These questions were examined in an analogue population of worriers, to provide direction for future research with clinical samples.

METHOD

Subjects

Subjects were students enrolled in introductory psychology classes at the University of California, Los Angeles. They were given course credit in return for experimental participation. In a pilot survey study of 125 undergraduates, 16% ($n = 20$) reported that they worried 'a lot' about their health and often feared or believed that they had some type of serious disease or illness. Seven percent stated additionally that their health concerns interfered with their daily life. Therefore, health-related worries were chosen as the topic of study.

Subjects signed up for a study described as an "investigation of heart rate and estimates of risk in relation to information about diseases". The initial study description possibly led to self-exclusion by persons extremely anxious about health and disease. Study exclusionary criteria included reports of medical diseases or conditions which might place Ss at risk during fearful arousal (cardiac conditions, respiratory conditions, neurological conditions) or which validated their health-related concerns, or which precluded full participation (e.g. severe physical handicaps).

The Medical Screen questionnaire addressed worries about health. Subjects who indicated that they worried a lot about their health and often feared/believed that they had some serious type of disease or illness in the absence of diagnosable conditions, and/or that worrying about illnesses and diseases interfered with their work, family or social life, were assigned to the Worrier group. Subjects who did not answer affirmatively to any of those items were assigned to the Nonworrier group. The final sample consisted of 25 Ss, 13 Worriers and 12 Nonworriers.

The Worrier group included 6 females (46%) and 7 males (54%). The Nonworrier group included 5 females (42%) and 7 males (58%). Chi-square analyses revealed that the sex distributions did not differ between groups. The age range for the entire sample was between 18 and 23 yr.

Stage 1

Design

The purpose of Stage 1 was to examine the potency of different types of cues for eliciting fearful imagery in Worriers and Nonworriers. Three types of cues for disease-imagery were used: audio, picture and script. The order of cue-type was counterbalanced across Ss within each group. Two versions of each type of cue were presented consecutively to obtain an average for each cue-type.

Cue types

The stimuli presented information about the symptoms and effects of six rare skin diseases. No information pertaining to actual risk of contracting the skin diseases was provided at this stage:

(a) Scripts: Ss were asked to read two 1-page scripts about skin diseases, for 2 min each. For example:

"Pemphigus vulgaris is a disorder of the skin (which almost always affects the mouth and mucous membranes) that is characterized by large skin blisters that start out as firm and initially tense, but often become flaccid (flabby and lacking firmness). Not infrequently, the blisters are initially boil like, appear elevated from the skin, and contain fluid. These large blisters usually arise on normal appearing skin, and break frequently . . . etc"

(b) Audiotapes: two different skin diseases were described on two 2-min audiotapes by persons dramatizing the role of suffering from the symptoms and effects (1 female and 1 male voice).

(c) Pictures: Ss were shown enlarged, colour, close-up photographs of the visible symptoms of two skin diseases. After a brief inspection of the picture, Ss read a short statement describing the symptoms and effects of the disease (30 sec), and then returned to inspect the picture in detail (90 sec).

In summary, six different skin diseases were described, in three different cue-types. After each cue presentation, Ss were instructed to imagine for 1 min: "You are now to imagine as clearly as you can that you yourself are suffering from the symptoms of the disease just described".

Dependent measures

SUDS. Subjective distress (0-8, from none at all to extremely anxious, visual analog scale) was rated two times: immediately after exposure to the cue (post-cue SUDS) and after imagining (post-imagery SUDS).

Heart rate. 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 signal to a wrist receiver, where data is stored. A built-in event marker enabled designation of experimental phases (baseline, cue exposure, imagining). Heart rate was averaged over 15 sec samples. Heart rate data were analyzed from the imagining phases only.

Imagery. Ability to imagine oneself suffering the disease symptoms was rated using a 0-8 point visual analog scale (0 = not at all, 8 = very strong vividness) immediately after imagining.

Procedure

After a 10-min adaptation to the heart rate equipment, Ss were instructed to sit still for a 2-min baseline recording. Then, Ss were told they would be presented with a series of pictures, scripts and audiotapes, on which they were to concentrate as best as they could. The interval between each cue presentation was at least 1 min. If post-imagery SUDS were 4 or higher, the inter-trial duration continued until anxiety levels reduced, or a maximum of 5 min. Non-health related magazine articles were read between trials to minimize continued rehearsal of disease-imagery.

Stage 2

Design

The purpose of Stage 2 was to examine: (1) the effect of imagery cues upon worry activity; and (2) the effect of (a) repetition of imagery cues and (b) disconfirmation of personal risk, upon cue potency and worry activity. Subjects from the Worrier group were randomly assigned to one of two conditions; Information condition ($n = 7$), and No-information condition ($n = 6$). All Nonworrier subjects received the No-information condition, since pilotting established that their personal risk estimates were generally very low. The most potent cue-type for each S (determined from post-imagery SUDS ratings from Stage 1) was selected for Stage 2. A new version of the cue (i.e. a rare skin disease that had not been depicted previously) was presented on three consecutive occasions to examine the effect of repeated presentation. The results were analyzed using a between-within design, of Group (Nonworrier vs Worrier-Information vs Worrier-No-information) \times Trial (3 trials).

Conditions

Information. Subjects read a short paragraph describing the very low risk for themselves and others of contracting the disease. The information was provided before or after exposure to the stimulus cue, in a counterbalanced order across Ss. For example:

"Lichen planus is a very rare disease, with an incidence ratio of only about 0.00442% of the worldwide population developing the disease each year. About 66.7% of the people affected with Lichen planus will have a spontaneous resolution (find themselves cured) of the disorder within 8–12 months, and the remaining 33.3% of affected individuals often experience resolution sometime thereafter. Thus, treatment intervention is not generally necessary. Also, individuals who are most often affected generally tend to reside in remote, third world geographic locations".

No information. Subjects in this condition were not provided with any information about their risk for contracting the disease described.

Dependent measures

SUDS, heart rate and imagery. Were recorded in the same ways as described for Stage 1.

Estimates of risk. At completion of imagery, Ss rated four risk dimensions, on 0–100 point visual analog scales, where 0 = no chance and 100 = definite. The dimensions were: how likely do you think it is that you currently have this disease; what is the likelihood that you will develop this disease sometime in the future; what is the likelihood that someone you know (family or friend) currently has this disease; and what is the likelihood that someone you know (family or friend) will develop this disease at some time in the future. These estimates were considered to reflect the 'what if' cognitive statements typical of worry activity, and are similar to the kind of measures used in other studies of biases associated with anxious states (e.g. Butler & Mathews, 1987).

Procedure

After obtaining another 2-min baseline recording, and selecting the cue-type to which the S was most fearful in Stage 1, a new version of the cue was presented on three consecutive trials. After completion of the stimulus trials, Ss were debriefed.

RESULTS

Stage 1

What is the potency of different cues for eliciting imagery?

Responses to the two versions of each cue-type were averaged. Means and standard deviations for each dependent measure are presented in Table 1. An initial MANOVA including post-cue SUDS, post-imagery SUDS and heart rate, produced a significant interaction effect for Group [$F(2,30) = 3.32$, $P < 0.05$]. Consequently, univariate analyses were conducted.

Imagery. Imagery vividness ratings did not differ between Worriers and Nonworriers overall. However, the Cue effect was significant; $F(2,46) = 5.04$, $P < 0.01$. Subsequent paired samples *t*-tests showed that the audiotape [$t(24) = -3.12$, $P < 0.01$] led to more vivid imagining than did the script. Neither the picture and audiotape, nor the script and picture, differed from each other. There was no interaction between Group and Cue type.

SUDS. The analysis of post-cue SUDS produced a significant main effect of Group; $F(1,23) = 65.8$, $P < 0.001$. Overall, the Worrier group reported more anxiety to the stimulus cues than the Nonworrier group. Also, the effects of Cue [$F(2,46) = 3.31$, $P < 0.05$] and Group \times Cue [$F(2,46) = 3.47$, $P < 0.05$] were significant. Tests of simple effects showed that the Worrier group reported higher anxiety than the Nonworrier group for each cue-type: script, $F(1,23) = 32.7$, $P < 0.001$; audio, $F(1,23) = 55.0$, $P < 0.001$; and picture, $F(1,23) = 75.9$, $P < 0.001$. The Nonworrier group were equally (minimally) anxious of each cue-type, whereas the picture produced significantly higher anxiety than the script in the Worrier group [$t(12) = -3.62$, $P < 0.01$].

Given the imagery-vividness differences across cue-types, and the correlation between vividness of imagery and post-imagery SUDS ratings ($r = 0.49-0.50$), post-imagery SUDS was analysed using imagery vividness as a covariate. The main effect for Group was the only significant result, $F(1,22) = 56.1$, $P < 0.001$, with the Worrier group reporting more anxiety than the Nonworrier group.

Heart rate. Heart rate values (average baseline subtracted from average imagery heart rate) did not produce significant group, cue-type or interaction effects, with or without imagery vividness as a covariate. [Baseline heart rates did not differ between groups].

Table 1. SUDS levels, imagery ratings and heart rate during imagery, for each cue type, across Worrier and Nonworrier groups

	Script	Audio	Pictorial
Post-cue SUDS			
Worriers	4.00 (1.4)	4.39 (1.0)	4.81 (1.2)
Nonworriers	1.21 (0.9)	1.58 (0.9)	1.21 (0.8)
Imagery vividness ratings			
Worriers	4.19 (1.6)	5.39 (1.3)	4.77 (1.6)
Nonworriers	4.13 (1.1)	4.42 (1.7)	4.38 (1.5)
Post-imagery SUDS			
Worriers	4.35 (1.6)	4.85 (1.5)	4.73 (1.4)
Nonworriers	1.38 (1.0)	1.58 (0.9)	1.42 (0.6)
Absolute heart rate during imagery			
Worriers	68.75 (8.1)	70.61 (9.0)	70.25 (8.5)
Nonworriers	72.65 (8.3)	72.00 (7.7)	73.60 (7.4)
Difference heart rate during imagery			
Worriers	-2.07 (7.1)	-0.21 (8.8)	-0.57 (8.9)
Nonworriers	1.13 (5.0)	0.45 (5.9)	2.08 (6.4)

Stage 2

What is the effect of repeated imagery and corrective information?

The cue-types selected were 7 pictures, 5 audiotapes and 1 script for the Worrier group, and 6 scripts, 3 audiotapes and 3 pictures for the Nonworrier group. Since an initial multivariate analysis yielded a significant main effect for Group [$F(2,16) = 5.5, P < 0.02$], univariate analyses were performed: Group (Worriers/Information vs Worriers/No-information vs Nonworriers) \times Trial (first, second or third repetition). Means and standard deviations for the dependent variables are presented in Table 2.

Imagery. An analysis of imagery vividness ratings did not yield significant Group or Trial effects.

SUDS. For post-cue SUDS ratings, the Group \times Trial effect [$F(4,44) = 4.29, P < 0.01$], as well Group [$F(2,22) = 22.3, P < 0.001$] and Trial [$F(2,44) = 5.42, P < 0.01$] effects were significant. Tests of simple effects showed that the groups differed significantly at each trial of exposure: first trial, $F(2,22) = 30.3, P < 0.001$; second trial, $F(2,22) = 19.4, P < 0.001$; and third trial, $F(2,22) = 8.2, P < 0.01$. Scheffe tests showed that Worrier-Information and Worrier-No-information groups reported more anxiety than the Nonworrier group, without differing significantly from each other, for the first and second trials of cue exposure. Only the Worrier-No-information group differed from the Nonworrier group at the third trial. Analysis of within-group trends showed that post-cue SUDS did not change across trials for the Nonworrier group. Post-cue SUDS reduced significantly from the first and second trials to the third trial in the Worrier-Information group. Also, post-cue SUDS reduced from the second to the third trial in the Worrier-No-information group.

Imagery ratings were used as covariates in the analysis of post-imagery SUDS, given the moderately strong correlations between imagery vividness and post-imagery SUDS (0.31–0.46). The only significant effect was for Group, $F(2,22) = 23.5, P < 0.001$. The pattern of group differences was the same as for post-cue SUDS. However, post-imagery SUDS ratings did not reduce significantly over trials in any group.

Heart rate. There were no significant effects, with or without covarying imagery vividness.

Risk estimates. Since an initial multivariate analysis including each risk dimension yielded a significant Group effect [$F(2,21) = 5.8, P < 0.01$], univariate analyses were conducted. Analyses of 'risk for self currently' and 'risk for self in the

Table 2. SUDS levels, imagery ratings and heart rate during imagery, across Worriers given disconfirming information or no information and Nonworriers

	Trial 1	Trial 2	Trial 3
Post-cue SUDS			
Worriers/No-info	4.25 (1.0)	4.63 (1.9)	3.88 (1.9)
Worriers/Info	4.40 (1.1)	3.60 (0.6)	2.40 (1.1)
Nonworriers	1.17 (0.9)	1.25 (0.9)	1.42 (0.9)
Imagery vividness ratings			
Worriers/No-info	4.63 (1.8)	4.38 (2.1)	4.38 (2.1)
Worriers/Info	4.00 (3.1)	4.00 (1.7)	3.80 (1.9)
Nonworriers	4.17 (1.4)	4.00 (1.4)	4.42 (1.4)
Post-imagery SUDS			
Worriers/No-info	4.75 (1.7)	4.63 (1.8)	4.50 (1.9)
Worriers/Info	3.60 (1.8)	3.20 (1.1)	2.60 (1.1)
Nonworriers	1.50 (0.8)	1.33 (0.8)	1.42 (0.8)
Absolute heart rate during imagery			
Worriers/No-info	68.90 (9.5)	68.40 (11.6)	67.60 (9.9)
Worriers/Info	69.00 (6.1)	66.17 (2.8)	68.50 (4.8)
Nonworriers	71.64 (8.9)	72.82 (9.5)	74.18 (9.8)
Difference heart rate during imagery			
Worriers/No-info	-0.50 (3.1)	-1.00 (5.1)	-1.80 (2.9)
Worriers/Info	-1.67 (11.3)	-4.50 (8.0)	-2.17 (10.0)
Nonworriers	-2.00 (3.5)	-0.82 (2.4)	-0.55 (3.6)

Table 3. Estimates of risk for self and others currently and in the future (0–100 point scales) across Worriers given disconfirming information or no information and Nonworriers

	Trial 1	Trial 2	Trial 3
Current risk for self			
Worriers/No-info	2.86 (4.9)	2.86 (7.6)	2.86 (7.6)
Worriers/Info	4.00 (8.9)	0.00 (0.0)	0.00 (0.0)
Nonworriers	3.33 (6.5)	4.17 (6.7)	3.33 (4.9)
Future risk for self			
Worriers/No-info	14.29 (7.9)	12.86 (9.5)	8.57 (6.9)
Worriers/Info	10.00 (14.1)	8.00 (11.0)	6.00 (8.9)
Nonworriers	5.00 (8.0)	6.67 (6.5)	6.67 (6.5)
Current risk for significant others			
Worriers/No-info	21.43 (21.9)	12.86 (12.5)	10.00 (15.3)
Worriers/Info	2.00 (4.5)	4.00 (8.9)	4.00 (8.9)
Nonworriers	3.33 (4.9)	5.83 (5.2)	7.50 (7.5)
Future risk for significant others			
Worriers/No-info	34.29 (18.1)	27.14 (12.5)	21.23 (17.7)
Worriers/Info	14.00 (15.2)	8.00 (11.0)	4.00 (5.5)
Nonworriers	6.67 (6.5)	6.67 (6.5)	8.33 (8.4)

future' did not yield any significant effects. A significant Group \times Trial interaction emerged from the analyses of 'risk for others currently' [$F(4,42) = 3.7, P < 0.02$]. Tests of simple effects showed that the groups differed in their estimates of current risk for others in the first trial only, $F(2,21) = 5.5, P < 0.02$, at which time the Worrier-No-Information group had higher estimates than the Nonworrier or Worrier-Information groups. Analyses of within-group changes showed that risk estimates increased from the first to the third trial within the Nonworrier group, whereas they did not change significantly over time for the Worrier groups (the trend for decreasing averages was countered by a high degree of within-group variability).

The Group \times Trial interaction was significant for 'risk for others in the future', $F(4,42) = 3.2, P < 0.03$. Tests of simple effects showed that the groups differed in the first trial [$F(2,21) = 10.6, P < 0.001$], second trial [$F(2,21) = 11.2, P < 0.001$] and third trial [$F(2,21) = 4.13, P < 0.05$]. Further analysis of the group differences at each trial showed that the Worrier-No-information group had higher risk estimates than did either the Worrier-Information or Nonworrier groups, who did not differ significantly from each other, in the first and second trials. No pair of groups differed at the third trial. Estimates did not change significantly across trials within any group. Means and standard deviations for estimate ratings are shown in Table 3.

DISCUSSION

The main objective of this study was to examine imagery cues for worriers. The effectiveness of different cues was measured via imagery vividness, and by subjective (post-imagery anxiety) and physiological (heart rate) indices of anxiety. The finding that worriers rated the cues and their imagery as more anxiety provoking than did nonworriers demonstrated the relevance of these cues for this particular sample of worriers. On the other hand, anxiety levels were moderate in severity only, possibly due to the analogue nature of this sample. Interestingly, despite being less anxious, Nonworriers rated their imagery as vividly as did Worriers. Overall, post-imagery anxiety and imagery vividness ratings were moderately correlated ($r = 0.31-0.46$).

The results showed some uncoupling between the different measures of cue potency. On average, the pictures were rated as most anxiety provoking, and the audiotapes of persons describing their symptoms led to the most vivid imagery ratings. Audiotapes produced the highest post-imagery anxiety levels for approximately half of the Worriers, as did pictures for the other half. The three cues did not differ in terms of heart rate during imagery. Again, these findings must be interpreted within the context of only moderate degrees of imagery vividness and anxiety. For example, heart rate may have been elevated under more intense anxiety conditions (Foa & Kozak, 1986). Nevertheless, the results suggest the value of selecting individually tailored imagery cues when conducting future research in this area.

The effects of repeated cue/imagery exposure and disconfirming information were examined in this context of moderate anxiety. Overall, measures of imagery were relatively unaffected by either trial repetition or disconfirmation of risk. That is, imagery vividness, post-imagery anxiety and heart rate tended to remain the same across the three trials of exposure, and regardless of whether disconfirmation was provided or not. However, in an interactive way, disconfirmation influenced post-imagery anxiety by the third trial of exposure. In contrast, anxiety to the cue itself decreased over trials in both worry groups (with and without disconfirmation). Habituation may occur more readily to external cues than to internal imagery representations.

Worry activity was measured via judgements of risk, since risk judgements represent 'what if' statements. In general, Worriers' risk estimates remained stable over trials (the mean reduction was countered by high within-group variability). This pattern differed from the Nonworriers, whose slight but significant trend for increasing estimates of "risk for others" was suggestive of a sensitization effect. Disconfirmation tended to lessen Worriers' estimates of risk, so that the Worrier group given disconfirmation estimated risk in the same range as the Nonworrier group, while Worriers not given information tended to make higher estimates, particularly in reference to future risk for others, and particularly in the first two trials of exposure. However, group differences on this particular estimate disappeared by the third trial, due to slight increases in risk for Nonworriers and reductions in risk for Worriers.

To some extent, these results are consistent with emotional processing theory (Foa & Kozak, 1986; Rachman, 1980) which suggests that fear or anxiety diminish through repeated exposure to feared stimuli (the cue-imagery trials in this case) and changes in beliefs (the disconfirming information in this case). That is, post-imagery anxiety reduced over repeated trials of exposure and disconfirmation. Although three repetitions of exposure was insufficient for complex anxiety reduction in this study, it is possible that longer exposure trials may have lessened anxiety, even in the absence of disconfirming

information. It might be argued, however, that since heart rate was not elevated during imagery, fear networks were not adequately accessed, thereby precluding proper emotional processing (Foa & Kozak, 1986).

Assuming that some degree of emotional processing did take place, however, the results are less clear with respect to Borkovec and Hu's (1990) prediction that emotional processing of feared imagery in turn lessens worry activity. Although indicators of worry activity (i.e. risk estimates) decreased, the decreases did not parallel reductions in post-imagery anxiety. The worry group given disconfirmation gave significantly lower risk estimates in the first two exposure trials, even though their anxiety about the imagery was comparable to that of the worry group not given disconfirmation. It was not until the third trial that the disconfirmation group rated imagery as less anxiety provoking.

Alternatively, the estimates of risk may not have measured worry activity satisfactorily. Limitations to the use of reported risk as an index of worry activity include demand biases. Also, the estimates were very divergent, ranging from 0 to 50% in the worry group that was not given disconfirmation. In addition, the estimates that showed an inflation effect in worriers concerned risk for others vs self. In contrast, Butler and Mathews (1987) found that anxious *S*s tend to overestimate risk more so in relation to themselves than others. The reason for this discrepancy is unclear. Finally, cross-study comparison would be facilitated by using the same measures of worry activity as described by Borkovec and colleagues (i.e. number of negative intrusions during relaxing tasks, or performance interference).

Another problem with this study was that the study design did not assess the causal influence of imagery upon risk estimates, since risk was not estimated in the absence of imagery. That is, it is not clear whether elevated risk estimates were a function of imagery exposure, or an enduring characteristic of the worry group, or both. Finally, replication with larger sample sizes and with clinical samples is warranted. For all these reasons, Borkovec and Hu's (1990) theory awaits further examination.

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