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ABSTRACT

There is considerable evidence in support of an attentional bias among clinically anxious individuals for threatening stimuli. However, a similar bias is not usually found in non-clinical anxious individuals and neither population has tended to show a response bias for mood-congruent information. We proposed that the measurement of anxiety in normals has previously been flawed due to questionnaires which do not accurately select pathological worry, the cognitive component of anxiety. First, we administered the Penn State Worry Questionnaire and selected only those with the most extreme high and low scores. At the time of testing, these subjects were given a state anxiety measure. From these scores, the high and low state anxiety within trait anxiety subjects were selected. With this selection procedure, we compared all high state anxious individuals to all low state anxious individuals. Our hypothesis was that, we would find significant differences between the high and low state within trait groups in a Directed Forgetting Paradigm. Directed forgetting was observed as a function of state within trait and the valence of the word on recall. Word fragment also showed a directed forgetting effect but no differences were seen for the worry groups. However, a secondary recognition procedure on the completed word fragments showed a bias as a function of worry group. The results are interpreted to suggest that worry has an effect on the availability episodic memory.

INTRODUCTION

Recent studies suggest that not all anxious individuals attend to emotionally valenced information in the same manner. It has been established that those clinically anxious attend to threatening information (Mathews & MacLeod, 1985, 1986; MacLeod, Mathews & Tata, 1986; Mogg, Mathews & Weinman, 1989; Mathews, May, Mogg & Eysenck, 1990; Mathews, Richards & Eysenck, 1989). This anxiety-related bias has typically been seen by tasks which monitor the interference of a stimulus on task performance like the modified Stroop task (Stroop, 1938) and the dot-probe task (MacLeod, et al., 1986; Mogg, et al., 1992). Studies using non-clinical, high trait anxious individuals compared with low trait anxious individuals have shown less consistent evidence. Many studies have found high trait normals to show an attention bias on valenced information (Broadbent & Broadbent, 1988; Ehlers et al., 1988; Eysenck, MacLeod, & Matthews, 1987; MacLeod & Mathews, 1988; MacLeod & Rutherford, 1992; Mogg & Marden, 1990). Others, have not associated anxiety with selective attention to threat (Broadbent et al., 1986; Martin et al.,1991). Martin et al. (1991) compared GAD patients with equally trait anxious normals and found only the clinically anxious to show an attention bias to threatening information.

Despite previous evidence, it seems unlikely that an anxiety-related bias is unique for clinical populations. To account for these inconsistencies, existing studies have considered a distinction between state and trait anxiety each as a possible associative factor of anxiety bias. Findings have been inconclusive in determining the extent to which an attentional bias is associated with transient mood-state or stable personality characteristics (Ehlers et al., 1988; Mathews & MacLeod, 1985; Mogg et al., 1989). It has been suggested that both state and trait anxiety are predictive of attentional bias (Broadbent & Broadbent, 1988) and they are too highly correlated in GAD populations to allow a separation of their roles (MacLeod, 1990). An interactive functioning involving both

state and trait has been shown using non-clinical subjects (MacLeod & Mathews, 1988; MacLeod & Rutherford, 1992). These results were found when the state and trait variables were dissociated. First, subjects were divided into two groups based on their trait anxiety scores, and then each group was tested once when state anxiety was low and again when state anxiety was higher. Individuals with high trait anxiety showed a greater effect of state anxiety on cognitive processing than low trait anxiety individuals.

We maintain an interaction hypothesis but suggest an alternative method for the selection of subjects from their individual state and trait anxiety scores. We first screened subjects with the PSWQ and selected the most extreme scores from each tail for both males and females to include in the experiment. At the time of testing, the STAI-state anxiety measure was administered. From these scores, balanced groups of high state and low state were obtained for both PSWQ groups. These four groups were collapsed into two by combining both high state groups into one and both low state groups into one (see Table I).

This selection process assumes that an individual state anxiety score must be interpreted relative only to its own trait score. For example, a low trait anxious person who is currently state anxious would be just as anxious as a high trait person who has a higher state anxiety score. In other words, a high state score is predictive of state anxiety only if it is high relative to the trait score.

We propose that a possible explanation for previous inconsistent findings among non-clinical populations is differences within the selecting questionnaires being administered. In the present study, we used the Penn State Worry Questionnaire for the measurement of trait worry (PSWQ; Meyer et al., 1990). The PSWQ, which measures the cognitive component of anxiety, contains items which refer to maladaptive or pathological aspects of worry. It has been shown to be a discriminate predictor for Generalized Anxiety Disorder (Meyer, et al., 1990). Other questionnaires have not shown

predictive values for GAD and may be correlated with task-oriented constructive worrying (Davey, 1993). We felt that previous inconsistencies found within normal trait anxious individuals could have been caused by the selection of non-pathological worriers.

Table I
Subject criterion of selection and characteristic means

PSWQ within-Trait median split	STAI-state selection score	State-state mean
Low worry	<27 (low)	
	>31 (high)	26 (sd=2.07)
High worry	<35 (low)	42 (sd=6.16)
	>37 (high)	

PSWQ (Penn State Worry Questionnaire)
STAI-state (State-Trait Anxiety Inventory)

Difficulty in suppressing emotional material could account for the pathological worry process. Borkovec, Metzger, and Pruzinski (1986) suggested that high worriers might have more difficulty suppressing emotional material than lower worriers. This would be evidenced by greater difficulty in a directed forgetting task (MacLeod, 1985). This procedure was designed to measure ones ability to forget previously remembered stimuli when told to do so (Bjork, 1972). A series of words is presented in which each is followed by a cue to either "remember" or "forget" the previous word. Following the presentation, various tests are given to determine the degree to which the cue was affective. Results have consistently revealed this effect by the recall or recognition of more remember words than forget words.

In the present study, we first selected high and low PSWQ trait worriers and then identified those with the highest and lowest state scores within each trait, as predicted by the STAI (Spielberger, 1983). By selecting subjects for trait worry level, then for current state within worry, we attempted to maximize the selection for the most accurate definition of current functioning. We used the directed forgetting procedure for the presentation

of threat, neutral and positive words. Recall , word-fragment completion, and secondary recognition tests were given to not only determine the effect of directed forgetting, but the effect of threatening, neutral and positive stimuli. We expected high worriers to have more difficulty in the ability to forget or inhibit valenced stimuli.

METHOD

Subjects

PSWQ scores were received from 450 undergraduates (mean/male= 42.1, sd= 13.7;mean/female= 48.6, sd= 13.1). The 20 most extreme scores from each tail for both males and females were selected of which 58 served as subjects for extra credit. The Ss consisted of 29 low worriers and 29 high worriers and were matched for sex. Based on STAI-state scores received at the time of testing, each group was divided into a low state and high state anxiety group. The four groups were then collapsed into two groups according to state. The state within trait groups were comprised of 23 low (males= 10,females= 13) and 23 high (males= 8, females= 14).

Materials

Ninety words were selected (Porter, 1992) from 292 words which were rated on both emotionality and threateningness. The original words were obtained from previous experiments (Mathews & MacLeod, 1985, 1986; Mathews, Mogg, May, & Eysenck,1989; MacLeod, Mathews, & Tata, 1986; MacLeod & Mathews, 1988; Martin, Williams, and Clark, 1991; Montalvo, Metzger, & Noll, 1989). Twenty-four undergraduate students rated the 292 words for threat/safety on a -10 to +10 scale and an additional twenty-one students rated the same words for emotionality on a 0 to 10 scale. The categories of threat (high emotion; high threat), neutral (low emotion; high safety/low threat), and positive (high emotion; high safety/low threat) were formed from selecting only those words which had a rating at least one standard deviation from the mean. Each

category was comprised of 30 randomly chosen words and did not significantly differ for word length (T=6.6, N=6.5, P=6.6) with an average of 6.6 . The word lists were matched for word frequency according to Kucera & Francis (1967). See Appendix for the word list.

Word-fragments were made for all 90 words with the criterion that at-least one other word other than the target was a possible solution. Solution rates for the target word were obtained from 280 undergraduates . Based on the rates, 60 presentation words were balanced within the three word valences and half of the items within each valence were randomly assigned a "remember" or "forget" cue. The words were presented on a screen from an overhead projector which displayed the word list from a Macintosh SE/30. The 30 remaining words were used as foils in the word-fragment test. The fragment test was randomized across cue ("remember", "forget") , word valence (threat, neutral, positive), and foil words.

Procedure

Mixed groups of high and low worriers were tested in a classroom setting. Each subject filled out a consent form and the STAI state and trait worry questionnaires. Instructions were given and the presentation began. An asterisk in the center of the screen was seen first and also served as a focal point after every pause. Then a 2-second display of the target word was presented followed by a 1-second duration for the cue ("remember " or "forget") and a 3-second pause.

Following the presentation, recall and word-fragment tests were given in counterbalanced order. After finishing the word-fragment test, the Ss were instructed to review the words which they formed and circle any which they remembered seeing in the presentation. This served as our secondary recognition test.

RESULTS

Subject characteristics

The low and high state within trait groups differed significantly for STAI-

state, $F(1,45)=129.00$ $p<.001$. The PSWQ-trait groups were also significantly different for state, $F(1,45)=29.83$ $p<.001$, with a low worry mean of 30 (sd=3.10) and a high worry mean of 37.9 (sd=5.13).

Directed forgetting effect for recall

The difference between the proportion of remember words recalled and recalled forget words was computed for each type of word, threat, neutral, and positive. This was a measure of directed forgetting. A positive score would indicate that more remember words are recalled than forget words. A trait (2) by state within trait (2) by word type (3) repeated measures ANOVA was performed. There was a significant interaction of state within trait group X word valence $F(2,84)=3.95$ $p<.023$. As can be seen in Figure I., high state worriers obtained a larger directed forgetting effect on neutral words than on either emotional word type. Low state worriers showed a greater directed forgetting effect for emotional words compared to neutral words. There were no other significant interactions or main effects.

FIGURE I
DIRECTED FORGETTING AS A FUNCTION
OF WORD VALENCE FOR RECALL
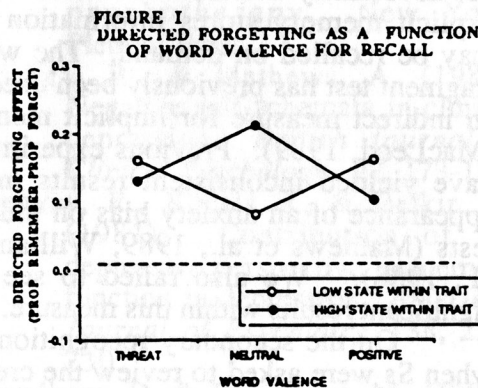
The means listed in Table II indicate that high state within trait worriers recalled as many neutral remember words as emotional remember words and they recalled fewer neutral forget words. Low state within trait worriers recalled fewer neutral remember words and more neutral forget words.
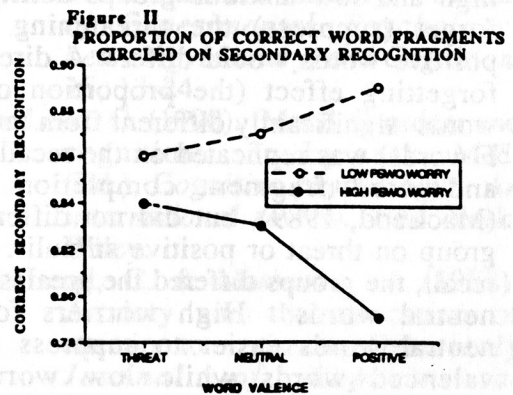
Word Fragment

A trait (2) by state within trait (2) by word valence(3) by cue (2) repeated

measures ANOVA was performed on the proportions of correctly completed word fragments for remember and forget words. The directed forgetting effect was evident in the significant difference between remember and forget word fragments completed $F(1,42)=20.82$ $p<.001$. More remember words (.54) were formed than forget words (.45). There was also a main effect for word valence, $F(2,84)=19.7$ $p<.001$; more threat words (.55) and positive words (.51) were formed followed by neutral (.42). The directed forgetting effect did not differ for state within trait groups and no other interactions involving group were significant.

Table II
Proportion of recalled words

	Remember			Forget		
	T	N	P	T	N	P
Low State In Trait	.37	.25	.37	.21	.17	.21
High State In Trait	.37	.34	.36	.24	.12	.25

T=Threat
N=Neutral
P=Positive

Figure II
PROPORTION OF CORRECT WORD FRAGMENTS
CIRCLED ON SECONDARY RECOGNITION

Secondary recognition

The proportion of correctly completed word fragments which were circled was analyzed by a trait (2) by state within trait (2) by word type (3) by cue (2) repeated measures ANOVA . Circled words showed no significant interactions

or main effects of state within trait. However, there was a significant interaction for PSWQ trait-group X word valence $F(2,84)=3,80$ $p< .026$ (see Figure II.). High trait worriers were always less able than low trait worriers to correctly recognize items they had completed on the word-fragment test, particularly when the words were positive. Also, main effects for cue $F(1,42)=30.22$ $p<.001$ (remember= .40 ; forget = .28) and word valence $F(2,84)= 23.25$ $p<.001$ (T= .40, N= .27, P= .35) reached significance.

DISCUSSION

Pathological worry differs from adaptive or coping processes of worry by the extent to which worrisome thoughts are uncontrollable and intrusive (Borkovec et al., 1983). By defining a current worry status through the identification of pathological worry and state worry, we predicted that an anxiety bias would be found in a directed forgetting procedure. Previous failings at finding an anxiety bias in normal populations could possibly be due to questionnaires which measure content-related and adaptive worry and fail to accurately use current state data.

Due to the intrusiveness of worrisome thoughts, we expected that high and low anxious groups ability to forget (suppress) the threatening and positive words would differ. A directed forgetting effect (the proportion of R words significantly different from that of F words) was replicated on the recall test and word fragment completion test (MacLeod, 1989), but did not differ for group on threat or positive stimuli . On recall, the groups differed the greatest for neutral words. High worriers found neutral words easier to suppress than valenced words while low worriers suppressed the valenced words more than the neutral. Since neither group differed in the suppression of threat compared to positive words, an emotionality hypothesis may account for the results (Martin et al., 1991; Mogg & Marden, 1990). This suggests that any word, if containing emotional content, can interfere with cognitive processing. Therefore, both threat and positive words, being equal in emotionality, would require similar processing and hence, produce similar interference.

In the past, studies with anxious individuals have not demonstrated a recall bias of semantic memory using recall or recognition (Mathews & MacLeod, 1985; Mathews et al., 1989; Mogg et al., 1987; Mogg et al., 1989; Watts et al., 1986). Cognitive avoidance (Foa & Kozak, 1986; Mogg et al., 1987) has been suggested to account for the absence of recall bias and apparent absence of cognitive elaboration for anxiety-congruent information. Typically, only an attentional bias to threatening information is found and only consistently for clinically anxious individuals and not normals. Our data suggests a recall bias to emotionally valenced stimuli for normal subjects.

Because a recall bias is typically not found, it has been proposed that implicit memory, but not explicit memory, is a factor in the revealing of such cognitive biases in GAD's for threatening information. Implicit memory is considered to hold information which is not necessarily available for recall while explicit memory stores information that may be recalled on demand. The word-fragment test has previously been used as an indirect measure for implicit memory (MacLeod, 1989). Previous experiments have yielded inconsistent results in the appearance of an anxiety bias on indirect tests (Mathews et al., 1989; Williams et al., 1988). We also failed to see any significant results within this measure.

On the secondary recognition test when Ss were asked to review the created words from the word-fragments formed and circle those in which they remembered seeing in the presentation, the results showed no significance involving state worry. However, a significant interaction of the PSWQ trait group X valence was present. Both groups did not differ for threat or neutral words but did for positive words. Overall, high worriers recognized fewer words than did the low worriers, but particularly when those words were positive .

The circling results show that a recognition bias is present only when asked to recognize items completed on the indirect word fragment completion test. This suggests an effect of worry on episodic memory. Worriers had more difficulty retrieving their knowledge that a positive word had been seen. This is similar to the difficulty exhibited by depressed subjects, who also have difficulty with positive information (Bradley & Mathews, 1983; Breslow, Kocsis, & Belkin, 1981; Derry & Kuiper, 1981; Mathews & Bradley, 1983; McDowell, 1984).

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