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Anxiety-Related Attentional Biases and Their Regulation by Attentional Control

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This study examined the role of self-reported attentional control in regulating attentional biases related to trait anxiety. Simple detection targets were preceded by cues labeling potential target locations as threatening (likely to result in negative feedback) or safe (likely to result in positive feedback). Trait anxious participants showed an early attentional bias favoring the threatening location 250 ms after the cue and a late bias favoring the safe location 500 ms after the cue. The anxiety-related threat bias was moderated by attentional control at the 500-ms delay: Anxious participants with poor attentional control still showed the threat bias, whereas those with good control were better able to shift from the threatening location. Thus, skilled control of voluntary attention may allow anxious persons to limit the impact of threatening information.

One of the most promising findings of recent years concerns anxious persons' attentional biases favoring threatening information. Such biases are important in that attention selectively facilitates the early processing of threat, thereby influencing subsequent cognitive and emotional processes related to anxiety (Mathews, 1990; Wells & Matthews, 1994; Williams, Mathews, & MacLeod, 1996). In addition, attention contributes to many forms of learning and may shape developing cognitive representations from the earliest years (Derryberry & Reed, 1996). Thus, attentional biases appear central to both processing and structural aspects of the anxious personality.

Most research has emphasized the relatively automatic ways in which attention amplifies threat and exacerbates anxiety. However, more voluntary attention is also recruited in the coping strategies that people use to regulate their anxiety. What is needed is a better understanding of the ways in which these automatic and strategic processes work together as the person attempts to cope. In the present article, we approach this goal by viewing anxiety in relation to separate attentional systems involved in relatively automatic orienting and voluntary control processes. We propose that individuals differ not only in anxiety but also in their capacity to use voluntary attention to control orienting. Such an approach affords a distinction between anxious people who are more or less skilled in using voluntary attention in their efforts to cope. This distinction provides a useful perspective on the interplay between automatic and strategic processes and consequent individual differences in anxiety and coping.

Biased Attention in Anxiety

The two most common paradigms used to study anxiety and attention are the emotional Stroop and the dot-probe tasks. In the Stroop task, participants are asked to name the color of a word. If the word is threatening, anxious persons are relatively slow to name its color. Such delays are generally thought to reflect enhanced attention to the threatening word, leading to distraction from the color-naming task (e.g., Williams et al., 1996). In the dot-probe paradigm, a threatening word and a neutral word are simultaneously presented on the screen, followed after 500 ms by a target dot in one of the word's locations. Anxious individuals are relatively fast to detect the target when it appears in the threatening word's location, presumably because their attention has been drawn to the threatening word (MacLeod & Mathews, 1988; Wells & Matthews, 1994)

Findings with the Stroop and dot-probe tasks converge in several ways. For example, both tasks have identified consistent and specific biases in clinical groups but less consistent biases in nonclinically trait anxious people (Sartory, 1998). In addition, both tasks can be modeled in terms of processing along task-relevant and task-irrelevant pathways, with the effects arising because anxious participants allocate attention to irrelevant pathways that convey threat (Williams et al., 1996). Furthermore, both tasks suggest that the attentional distraction is relatively automatic in that it is difficult to control and can even be elicited by subliminal words (Bradley, Mogg, Millar, & White, 1995; Mogg, Bradley, & Williams, 1995).

A third paradigm used to study attention and anxiety is a spatial orienting task (Derryberry & Reed, 1993, 1997). This paradigm differs from the Stroop and dot-probe paradigms in that it uses threatening stimuli that are relevant rather than irrelevant to the task and thus allows more room for strategic or voluntary processes. Participants are engaged in a motivated game where they can gain or lose points depending on their speed in detecting simple circular targets. Before each target appears, a peripheral cue is presented that orients attention to a positive location (e.g., where points can be gained if the response is fast enough) or negative location (where points can be lost if the response is too slow). In

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line with results from the other tasks, neurotic introverts and trait anxious participants show an attentional bias favoring threatening locations where points might be lost (Derryberry & Reed, 1994a, 1997). The bias appears when the target follows the cue by as little as 100 ms, which is consistent with the notion that the bias reflects relatively rapid and automatic attentional shifts. It is important to note that the bias only appears when a negative cue is followed by a target in another location. This suggests a different view of the underlying attentional processes: Rather than facilitating attentional shifts *toward* threatening stimuli, anxiety delays the disengagement of attention *from* threat. Such a view is compatible with both the Stroop and dot-probe results. Difficulty shifting from threatening information would slow color naming when the anxious individual has difficulty shifting from the irrelevant threatening meaning to the relevant color information. In the dot-probe task, the bias favoring threatening locations may often arise from slow reactions to neutral locations due to delays in disengaging from the threatening locations.

The orienting paradigm also provides evidence that anxiety promotes biases favoring "safe" or "relieving" as well as threatening information (Derryberry & Reed, 1993, 1996). In several studies, participants alternated between positive games (where points could be gained for fast responses) and negative games (where points could be lost). The pretarget cues signaled the probable outcome of the subsequent response. On the negative games, *threatening* cues indicated that a target in its location would be "hard" and result in a loss of points 75% of the time. In contrast, the *safe* cues signaled the location of an "easy" target that would result in no loss 75% of the time. Although there were no differences on the positive games, anxious participants showed stronger orienting to both threatening and safe cues on the negative games. These biases were strongest at relatively long (500-ms) delays between the cue and target, suggesting a potential role of voluntary rather than purely automatic processes.

Based on these findings, we have suggested that trait anxious persons are motivated to attend not only to threatening information but also to sources of safety that help them cope with threat (Derryberry & Reed, 1994b, 1996). Effective coping often requires flexible movement of attention among multiple sources of threat and safety. Problems may arise because anxious people have difficulty disengaging from a threat, leading to an escalating anxiety reaction. In other cases, anxious people may have difficulty disengaging from a source of safety, leading to avoidant or dependent reactions. The possibility remains, however, that some individuals may be able to disengage more easily, perhaps through voluntary efforts, and thus take appropriate advantage of both threat- and safety-related information (Derryberry & Rothbart, 1997; Rothbart, Derryberry, & Posner, 1994). In the next section, we develop this idea through a model focusing on separable systems related to involuntary and voluntary attention and consider the role of individual differences in attentional control.

Multiple Attentional Systems

The model is based on the cognitive neuroscience research of Posner and his colleagues (Posner & Petersen, 1990; Posner & Raichle, 1994; Posner & Rothbart, 1998). Rather than viewing attention as a single mechanism, Posner distinguishes several systems related to involuntary and voluntary processes. The *posterior attentional system* is a relatively reactive system that orients the attentional "spotlight" from one location to another. The posterior system consists of subsystems that accomplish orienting through three operations: Attention must first *disengage* from one location, *move* to a new location, and then *engage* the new location.

Once the information is engaged, it is facilitated and transmitted to the *anterior attentional system*. The anterior system is located within frontal regions (anterior cingulate cortex) that are interconnected with limbic and frontal motivational systems. It is viewed as an executive system that carries out more voluntary attentional functions. For example, the anterior system functions to inhibit dominant response tendencies, to inhibit dominant conceptual associations, and to detect erroneous responses. Most important in the present context is the anterior system's function of regulating the posterior orienting system. Such regulation provides voluntary control, guided by expectations and motives, over the allocation of attention in space. For example, the anterior system might help reduce anxiety by enabling the person to disengage from a threat and engage a source of safety.

Individual Differences in Attention

Several researchers have proposed that the anterior system constitutes an important source of individual differences. In developmental studies, Rothbart and her colleagues proposed that the anterior system underlies a broad dimension of *effortful control* (Derryberry & Rothbart, 1997; Rothbart, Ahadi, & Hershey, 1994; Rothbart, Derryberry, & Posner, 1994). Effortful control is viewed as a self-regulatory dimension in relation to more reactive dimensions of *positive emotionality* and *negative emotionality*. Children high in effortful control may be able to use attention to constrain the overly reactive aspects of positive emotionality and negative emotionality. In adult studies, Derryberry and Rothbart (1988) developed scales to measure the voluntary *attentional focusing* and *attentional shifting* related to anterior system functioning. These scales were positively correlated with one another and negatively correlated with scales measuring fear, frustration, and sadness. This is consistent with the notion that good attentional control helps individuals to cope with threat and other negative stimuli, although the causal influence may run in the other direction.

In recent studies, we have combined the attentional focusing and shifting scales to form a measure of Attentional Control. Factor analyses indicate that the scale measures a general capacity for attentional control, with correlated subfactors related to the abilities (a) to focus attention (e.g., "My concentration is good even if there is music in the room around me"), (b) to shift attention between tasks (e.g., "It is easy for me to read or write while I'm also talking on the phone"), and (c) to flexibly control thought (e.g., "I can become interested in a new topic very quickly when I need to"). The actual scale items are included in the Appendix. The construct of attentional control is more specific than Rothbart's effortful control in that it includes only attention items, apart from more behavioral forms of inhibition. The term *attentional control* has also been used to refer to a coping strategy that allows individuals to avoid depressogenic thought and reaction patterns (Teasdale, Segal, & Williams, 1995). Our use of the term is broader, referring to a general capacity to control attention in relation to positive as well as negative reactions. The measure of attentional control is internally consistent ($\alpha = .88$). It is positively related to indices of positive emotionality such as extraversion ($r = .40$) and inversely related to aspects of negative emotionality such as trait anxiety ($r = -.55$; Derryberry & Reed, 2001).

We are currently attempting to validate the relation between self-reported and actual attentional control by using specific tasks that target the functions of the anterior system. Our initial studies examined the anterior function of inhibiting dominant response tendencies (Derryberry & Reed, 2001). In these studies, we used a Strooplike task in which participants responded with their left and right hands to arrows pointing left and right, respectively, with the arrows appearing in an irrelevant location on the left or right side of the screen. The irrelevant spatial information elicited a dominant (and potentially erroneous) tendency to respond with the hand corresponding to the location of the target. Participants high in trait anxiety showed a greater influence of the irrelevant spatial information, which is consistent with evidence of general distractibility and interference in anxiety (Mathews, May, Mogg, & Eysenck, 1990). However, this was only true for anxious persons with poor attentional control—those with good control were able to limit the irrelevant information and suppress the dominant response tendency.

Experimental Design

The present study aimed to extend the validation of the Attentional Control scale to the anterior function of regulating the posterior orienting system and to examine more closely the voluntary and involuntary processes at work in attention to threat and safety. A spatial orienting task was used in which detection targets appearing on one side of the screen were difficult (i.e., likely to result in negative feedback and thus threatening) and on the other side easy (i.e., likely to result in positive feedback and thus safe). A pretarget cue was used to involuntarily orient attention to either the threatening or safe location, allowing more voluntary processes to promote engagement of that location or disengagement and a shift to the other location.

Each trial began with an arrow cue in the left or right visual field. A blue arrow pointing up indicated that a target in that location would be "easy" and result in positive feedback 75% of the time. A red arrow pointing down indicated that a target would be "hard" and result in negative feedback 75% of the time. The uncued location always carried the opposite (easy/hard) difficulty. For example, a red arrow on the left signaled a probable negative outcome if the target appeared on the left but a positive outcome given a target on the right. Because the cues function predictively, the participant is not responding to the actual outcome but to the anticipated positive or negative outcomes at the two locations. Situations where a future negative outcome is expected are seen as threatening, whereas those where a future positive outcome is expected can be seen as safe.

After a delay of 250 or 500 ms, a detection target requiring a simple keypress appeared in either the cued or uncued location. One second after the response, a feedback signal was presented in the screen's center. A blue arrow pointing up indicated a fast response (positive feedback) and a red arrow pointing down indicated a slow response (negative feedback). Feedback signals were identical in form to the cue arrows that predicted them. To be "fast," a response had to be faster than a criterion based on the participant's median speed, adjusted upward for easy targets and downward for hard targets. Finally, participants alternated through positive games where points were gained and negative games where points were lost.

The design used trait anxiety and attentional control as between-subjects variables. The key within-subject variable was the target location, occurring on either the cued or uncued side of the screen. To the extent that attention is allocated to the cued location, reaction times (RTs) are facilitated at the cued location and/or delayed at the uncued location. Thus, the location variable provides a measure of the strength of orienting elicited by the cue. In addition, the cue difficulty variable (whether it signaled an easy or hard location) allowed an assessment of the strength of orienting to locations where positive or negative feedback was expected. The target delay variable (whether the target followed the cue by 250 or 500 ms) allowed an assessment of changes in the strength of orienting across time. The game variable (whether points could be gained or lost) provided a view of more tonic state effects that might influence the orienting, difficulty, and delay effects.

Predictions

Regarding the influence of trait anxiety, previous research predicted that anxious individuals would show enhanced attention (a stronger orienting effect) compared with low anxious persons given hard (threatening) cues. Because our studies have found this bias to decrease at longer delays (Derryberry & Reed, 1994a), and because others have suggested that such biases are largely automatic (McNally, 1995; Mogg et al., 1995), we predicted that the anxiety-related threat bias would peak at the 250-ms delay. Given our findings that the enhanced orienting involves delays in disengaging from negative cues, we further predicted that anxiety-related differences would appear mainly for uncued targets (i.e., slower responses to targets in safe locations following cues in threatening locations). Finally, our previous work has found enhanced attentional biases on negative games (Derryberry & Reed, 1997), although in some studies effects have appeared on all games (Derryberry & Reed, 2001). In the case of the easy (safe) cues, our studies with similar tasks have found anxious participants to show enhanced attention to safe cues, especially at longer delays. We therefore predicted that anxious individuals would show stronger orienting to safe cues at long (500-ms) delays, resulting in slow responses to targets in uncued locations.

Regarding individual differences in attentional control, the strongest prediction we could make was that the effects of attentional control should be most evident at the long delays. The rationale here was that the voluntary anterior system functions occur relatively late in processing, after the initial posterior orienting effects. Moreover, good attenders may be expected to show a smaller orienting effect. Because the dimension taps flexibility of attention, those with good attention may be fast to disengage and detect targets at uncued locations (i.e., a smaller orienting effect). It is also possible, however, that attentional control may allow strategic adjustments involving specific cues, such as disengagement from threatening but not safe cues.

Of greatest interest are interactions between attentional control and anxiety. One possibility is that high anxiety may interfere with voluntary attention (e.g., the two measures are negatively correlated), leaving attentional control more influential in low anxious individuals. In addition, low anxious people may be skilled at using attention to shift from threatening to safe information, a defensive strategy that allows them to keep anxiety low. Such a finding would be consistent with dot-probe findings interpreted as reflecting avoidant responses in low anxious individuals (Fox, 1993; MacLeod & Mathews, 1988). Alternatively, attentional control may prove most influential in high anxious participants because they are most vulnerable to threat and thus most likely to recruit voluntary control. If so, anxious persons with poor control should show the greatest difficulties disengaging from threatening cues, whereas those with good attention should be better able to shift to safety. This latter prediction is preferred because our previous research has found the interacting effects of attentional control limited to anxious persons (Derryberry & Reed, 2001), and we have yet to find evidence of better avoidance in low anxious persons. In the case of safe cues, we again expected that anxious persons with good control would show the strongest bias. The rationale is that attention to safety may involve a substantial voluntary component, making it particularly open to regulation through attentional control.

To summarize, we predicted that an anxiety-related bias favoring threatening cues would be evident at the short delays and a bias favoring safe cues at long delays. Good attentional control would allow anxious participants to reduce the threat bias at long delays and to increase safety bias at long delays. These effects would be most evident given targets in uncued locations that require disengagement and perhaps on the negative games that enhance state anxiety.

Method

Participants

A total of 114 undergraduate students (70 women, 44 men) participated and received extra credit in their introductory psychology class. All were right-handed with normal or corrected vision.

Equipment

The questionnaires and reaction time procedures were presented on a Compaq monitor controlled by a Compaq 486 computer using the Micro Experimental Laboratory (MEL) software (Schneider, 1988). Responses were collected on the computer's keyboard while participants viewed the screen from 50 cm away.

Questionnaires

All participants completed the State–Trait Anxiety Inventory (STAI; Spielberger, 1983), the Extraversion and Neuroticism scales of the Eysenck Personality Questionnaire (Eysenck, Eysenck, & Barrett, 1985), a short version of the Fear of Negative Evaluation Scale (Leary, 1983), and the Attentional Control scale (Derryberry & Reed, 2001). The MEL software presented items in an intermixed, random order.

Groups

Groups representing low and high attentional control were formed on the basis of the median (52.5) of the present sample. Groups representing low and high trait anxiety were split at the STAI median of 37.5. Given the correlation ($r = -.42$) between the two scales, groups were unequal in size. Both groups of low anxious good attenders and high anxious poor attenders consisted of 40 individuals, and groups of low anxious poor attenders and high anxious good attenders consisted of 18 and 16 individuals, respectively. The four groups had the following scores for anxiety and attentional control, respectively: (a) low anxious, low attention (Ms = 33.7 and 49.4); (b) low anxious, high attention (Ms = 32.6 and 58.9); (c) high anxious, low attention (Ms = 45.6 and 46.6); and (d) high anxious, high attention (Ms = 44.7 and 58.1). Thus, anxiety scores are similar within the two low anxious and two high anxious groups, and attention scores are similar within the low attention and high attention groups.

RT Task

The RT task consisted of alternating positive and negative blocks of trials (i.e., games). On positive blocks, participants gained 10 points if their response was accurate and fast but no points if their response was slow (see definitions of *fast* and *slow* below). On negative blocks, participants lost 10 points if their response was slow but no points if their response was fast. Ten points were lost for an inaccurate response, regardless of the block. The score was reset to zero at the start of each game. Scores at the end of each positive game were well above zero, but scores on negative games were well below zero. Participants were instructed that the games would be challenging and that they should see if they could come out above zero at the end of all the games.

Stimuli

The static parts of the display consisted of two black vertical bars (0.16 × 0.64 cm) set against the screen's light gray background. The bars stayed on throughout each game. They marked the location of the cues and targets and were 3.8 cm to the left and right of the screen's center. Each participant's score was presented in black at the screen's center (centered between the two bars). Each digit within the score was approximately 0.6 × 0.9 cm in size. The score was updated after each response (see below) and remained on the screen throughout the trial. Participants were instructed to fixate on the score and not move their eyes.

Each trial began by turning the fixation score off for 200 ms and then back on. Two hundred and fifty ms after the score returned, an arrow cue was superimposed on top of one of the two peripheral bars. The cue arrows measured approximately 0.5 × 1.3 cm with a shaft 0.16 cm wide. The cue arrow served to orient attention to one of the two peripheral locations. Participants were informed that a blue arrow pointing up signaled that a target appearing in that location would be "easy" and result in a fast response about 75% of the time, whereas a target appearing in the uncued location (still marked by the black bar) would be "hard" resulting in a slow response about 75% of the time. A red arrow pointing down indicated that a target in that location would be "hard" (75% slow), whereas a target in the uncued bar's location would be "easy" (75% fast). In addition, participants were informed that the cue arrow would also signal the probable location of the target, with 67% of the targets appearing in the cued location.

After a delay of 250 or 500 ms, a target appeared in the cued or uncued location. The target was a small vertical gray rectangle (0.08 × 0.24 cm) centered within the cue arrow or the bar. Participants were instructed to press the zero key on the number pad as soon as they detected the target. They were also informed that there would be no target on 14% of the trials (i.e., catch trials) and that they should not press a key on these trials. Participants were told that they would lose 10 points for each response on a catch trial and also for each "anticipation" made by pressing before the target appeared.

Five hundred ms after the response (or 1 s following the delay interval on catch trials), the cue and target were removed by reinstating the two black bars, and a feedback signal was presented 1.3 cm below the central score. Feedback consisted of the same arrows used as cues. A blue arrow pointing up signaled a fast response on trials with targets or an accurate nonresponse on catch trials. A red arrow pointing down signaled a slow response or an inappropriate response on catch trials. After a delay of 250 ms, the current score was updated (if it changed). After a randomly selected intertrial interval of 500 or 1,000 ms, the next trial began by removing the feedback signal and blanking the score for 200 ms.

Feedback Computation

At the end of each game, the participant's median RT and standard deviation were computed. These were used to establish cutoffs for fast and slow responses on the next game of the same type (positive or negative). For easy targets, if the RT was less than the median plus (standard deviation × 0.55) the response was treated as *fast*. For hard targets, a RT less than the median plus (standard deviation × 0.55) was treated as *fast*. If RTs equalled or exceeded these cutoffs, the response was treated as *slow*. These adjustments resulted in 65% *fast* responses given easy targets and 62% *slow* responses given hard targets across all participants. To ensure relatively equal feedback on positive and negative games, the cutoffs were computed separately for the two kinds of games. Because RTs tend to be slower at short delays, 12 ms was added to the cutoff for short-delay trials and subtracted on long-delay targets. Participants were informed that the feedback would always be accurate but that the computer would use different cutoffs for the easy and hard targets.

Procedure

Participants were tested individually in a darkened, sound-attenuating room. They first completed the computerized questionnaires. Following the RT instructions, they completed two 28-trial blocks of practice trials, followed by sixteen 42-trial test blocks. The test blocks were presented in two sets of eight, with a 5-min rest in between. The positive and negative games alternated within each set of eight games, beginning with a positive game. Conditions arising from the difficulty, location, and delay variables were randomly selected within each game, with targets occurring twice as often in cued compared with uncued locations.

Each game began with a display informing the participant that it was a positive or negative game and reminding them not to move their eyes. Each game ended with a display showing the score for that game, the number of points lost on catch trials, the number of points lost for anticipations, and the cumulative score across the games of that set. When ready, participants could initiate the next game by pressing a key. To increase their motivation, participants were instructed to record these numbers on a sheet at the end of each game and to show this sheet to the experimenter at the end of the set.

Results

Trials with RTs less than 125 ms (probable anticipations) and greater than 1,000 ms (probable distractions) were excluded from the data analysis. Mean RTs for correct responses and mean percent correct on catch trials are reported in Tables 1 and 2.

RT Data

The RTs were analyzed through an analysis of variance (ANOVA) that included anxiety and attentional control as between-subjects factors, and game (positive, negative), cue difficulty (easy, hard), target delay (250, 500 ms), and target location (cued, uncued) as within-subject factors. Before describing the personality effects, we briefly describe the underlying effects characterizing performance in this task. Responses were generally faster on negative (M = 290 ms) than positive (M = 306 ms) games, $F(1, 110) = 36.0$, $p < .001$. An *alerting effect*, representing a buildup in general alertness (Posner, 1978), was evident in the faster RTs at long (M = 292 ms) than at short (M = 313 ms) delays, $F(1, 110) = 232.3$, $p < .001$. Most important, the attentional effect (i.e., cue-elicited orienting) was evident in the faster RTs for targets in cued (M = 291 ms) than for uncued (M = 315 ms) locations, $F(1, 110) = 92.2$, $p < .001$.

The size of the attentional or orienting effect can be viewed in terms of the difference between the faster RTs to targets in cued (i.e., attended) and slower RTs to targets in uncued locations. The resulting orienting effect (uncued − cued target RTs) was stronger for easy (mean orienting effect = 26 ms) than for hard (M = 21 ms) cues, $F(1, 110) = 8.8$, $p < .004$. Orienting was also stronger at short (M = 36 ms) than at long (M = 13 ms) delays, $F(1, 110) = 93.1$, $p < .001$. These effects indicate that at short delays, orienting was particularly strong at the cued location, but at long delays participants tended to shift some attention toward the uncued location. This may reflect a strategy allowing attention to better cover both potential target locations. However, the tendency to shift from the cued to the uncued location at long delays was greater for hard than for easy cues: Cue Difficulty × Delay × Location, $F(1, 110) = 11.9$, $p < .001$. At short delays, orienting effects were identical for easy and hard cues (M = 36 ms), but at long delays orienting was stronger for easy (M = 19 ms) than for

Table 1
Mean Reaction Times (in Milliseconds) on Correct Trials for the Four Groups

Type of trial	Low anxiety, low attention: Cued	Low anxiety, low attention: Uncued	Low anxiety, high attention: Cued	Low anxiety, high attention: Uncued	High anxiety, low attention: Cued	High anxiety, low attention: Uncued	High anxiety, high attention: Cued	High anxiety, high attention: Uncued
Positive games								
Easy cues, short delay	288	320	296	334	306	340	301	337
Hard cues, short delay	292	325	299	333	301	346	300	343
Easy cues, long delay	280	287	291	309	294	313	282	317
Hard cues, long delay	284	282	292	300	294	308	292	297
Negative games								
Easy cues, short delay	284	323	291	325	300	336	296	329
Hard cues, short delay	289	322	294	318	296	330	295	333
Easy cues, long delay	274	288	281	295	290	304	281	302
Hard cues, long delay	280	283	281	290	288	305	289	293

hard ($M = 7$ ms) cues. This greater decrease in orienting for hard cues may reflect some strategic avoidance of the hard in favor of the easy location as the delay lengthens. Finally, the Cue Difficulty × Delay × Location × Game interaction was significant, $F(1, 110) = 4.4$, $p < .04$. Analyses of simple interactions found the tendency to shift from negative cues at the long delays (i.e., the Cue Difficulty × Delay × Location interaction) to be reliable on positive, $F(1, 110) = 12.6$, $p < .001$, but not negative ($p < .31$) games.

Neither personality variable showed a main effect: $F(1, 110) = 1.51$, $p = .22$ for anxiety, and $F(1, 110) = 0.06$, $p = .81$ for attentional control. However, they entered into three interactions. The first was not predicted and involved Attentional Control × Game × Location, $F(1, 110) = 4.4$, $p < .04$. The orienting effect was stronger on positive games for good (mean orienting effect = 27 ms) than for poor attenders ($M = 23$ ms) and weaker on negative games for good ($M = 22$ ms) than for poor ($M = 25$ ms) attenders.

Of greater interest were interactions involving the cue difficulty variable. Our predictions concerning anxiety involved stronger orienting to threatening (hard) cues at short delays and safe (easy) cues at long delays. These effects were reflected in an Anxiety × Cue Difficulty × Delay × Location interaction, $F(1, 110) = 4.2$, $p < .05$. Given our pattern of predictions, we performed a series of planned comparisons focusing on the Anxiety × Location interaction (i.e., the influence of anxiety on strength of orienting) for the four combinations of cues and delays. Consistent with predictions, the Anxiety × Location effect was significant for hard cues at short delays, $F(1, 110) = 8.1$, $p < .01$. As can be seen on the left side of the left panel in Figure 1, the orienting effect (reflected in the slope of the line between cued and uncued locations) is larger for anxious (mean orienting effect = 40 ms) than low anxious ($M = 31$ ms) groups. A second comparison, focused on hard cues at long delays (right side of left panel) indicated that even though attention remains stronger in anxious participants, the difference is no longer significant at the long delays, $F(1, 110) = 3.5$, $p < .10$. These two findings are in line with the prediction of an early, anxiety-related bias favoring threatening cues. A third comparison (left side of right panel) showed no anxiety-related differences given easy cues at short delays, $F(1, 110) = 0.05$, $p < .98$. The last comparison, of easy cues at long delays (right side of right panel), revealed stronger orienting in high (mean orienting effect = 23 ms) than in low ($M = 13$ ms) anxious groups, $F(1, 110) = 8.1$, $p < .01$. These two findings are consistent with the prediction of an anxiety-related bias favoring safe locations at long delays. Thus, high anxiety is accompanied by stronger orienting to threatening cues at short delays and to safe cues at long delays.

We also predicted that these anxiety-related effects would be influenced by attentional control. The Attentional Control × Anxiety × Cue Difficulty × Delay × Location interaction was significant, $F(1, 110) = 6.2$, $p < .02$. Given the prediction that good attentional control would allow anxious participants to reduce the threat bias and enhance the safety bias at long delays, we performed planned comparisons of the Attention × Anxiety × Location interaction for the four cue and delay combinations. This set of comparisons should also be sensitive to avoidant tendencies in low anxious individuals. As predicted, the three-way interaction was significant for hard cues at long delays, $F(1, 110) = 9.1$, $p < .01$. As evident in the bottom left panel of Figure 2, the orienting effect given hard cues at long delays was reduced in anxious individuals with high attentional control ($M = 5$ ms) compared with anxious persons with low attentional control ($M = 16$ ms). Given hard cues at short delays, however, the Anxiety × Location effect did not depend on attentional control (upper left panel of Figure 2), $F(1, 110) = 0.03$, $p < .87$. These findings support the prediction that disengaging and shifting from threatening cues would be easier for anxious participants with good rather than poor attentional control, particularly at long delays required for anterior system participation. Given easy cues at short delays (upper right panel of Figure 2), there was no effect of attentional control (or anxiety), $F(1, 110) = 0.80$, $p < .38$. Given easy cues at long delays (lower right panel of Figure 2), the Anxiety × Location effect did not depend on attentional control, $F(1, 110) = 0.81$, $p < .38$. This last finding fails to support the prediction that good attention would enhance the anxiety-related bias favoring safe cues. Instead, anxious participants showed stronger orienting to easy cues at long delays regardless of attentional control. Also note that in contrast

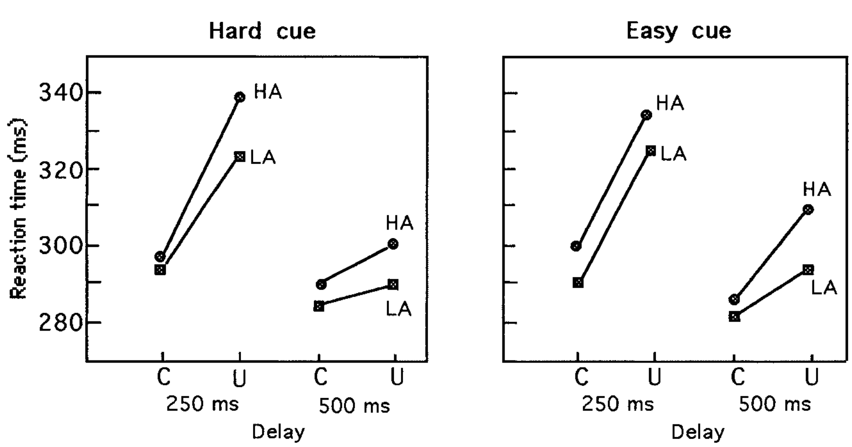

Figure 1. Anxiety × Target Location interactions for hard cues at 250-ms delays (left side of left panel) and for easy cues at 500-ms delays (right side of right panel). Extent of orienting is reflected in the faster reaction times to targets in cued (C) locations than in uncued (U) locations. LA = low anxiety; HA = high anxiety.

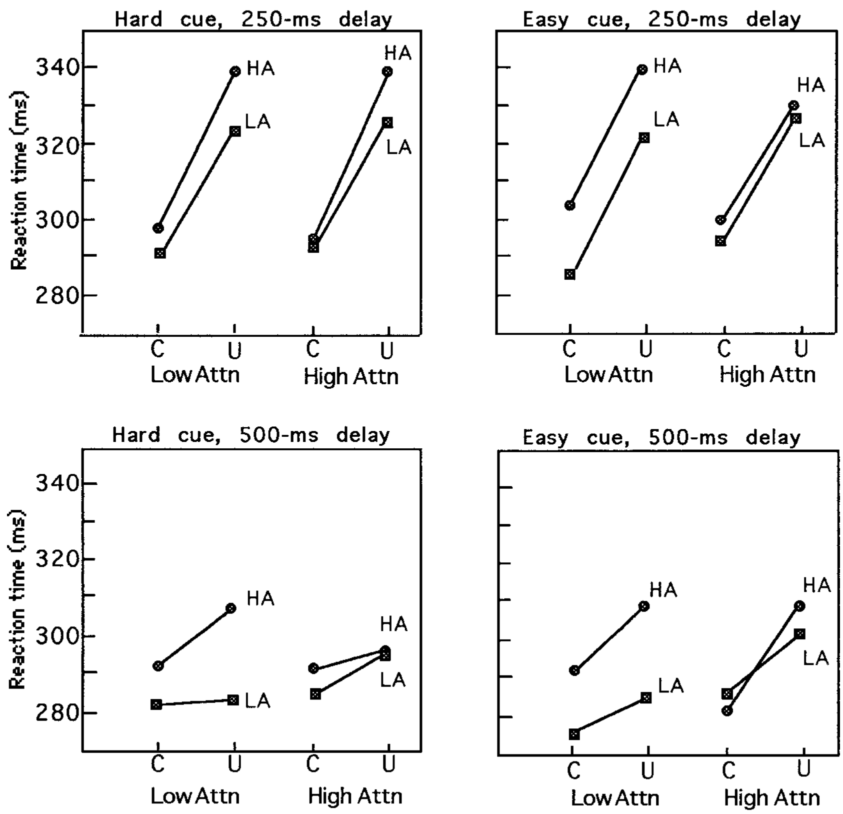

Figure 2. Anxiety × Attentional Control × Target Location interactions for hard cues at short delays (upper left), for hard cues at long delays (lower left), for easy cues at short delays (upper right), and for easy cues at long delays (lower right). C = cued location; U = uncued location; HA = high anxiety; LA = low anxiety; Low Attn = low attentional control; High Attn = high attentional control.

to the prediction of enhanced effects on negative games, these effects were present on positive as well as negative games.

Of additional interest was whether the attentional bias would involve movement toward or a shift away from the cues. We performed a planned comparison of the Anxiety × Attention × Cue Difficulty × Delay interaction at cued and uncued target locations. The interaction was reliable for uncued, $F(1, 110) = 5.9$, $p < .02$, but not cued ($p < .28$) locations. Because uncued targets require attentional shifts from the cued location, this suggests that anxiety regulates the ease with which attention is disengaged from a cued to an uncued location.

One difficulty in interpreting effects related to anxiety involves possible contributions of depression, which is highly correlated with anxiety and tapped by most anxiety scales. Therefore, we repeated our ANOVAs using two subscales that measure the anxious and depressive components of the STAI (Bieling, Antony, & Swinson, 1998). The five-way interaction involving attentional control replicated for the Anxiety subscale, $F(1, 110) = 4.66$, $p < .03$, and was of the same basic form but nonsignificant for the Depression subscale, $F(1, 110) = 1.95$, $p < .17$. These analyses suggest that the effect is primarily related to anxiety and not just depression.

Another difficulty arises from the use of correlated anxiety and attentional control measures ($r = -.42$ in this sample), which may lead to exaggerated ANOVA interactions if dichotomous groups are formed through median splits (Maxwell & Delaney, 1993). To check the ANOVA results, we performed a multiple regression analysis that avoided dichotomous measures. Following Aiken and West's (1991) recommendations, the anxiety and attentional control measures were centered (i.e., transformed to deviation scores) and used to predict the orienting effect (uncued − cued target RTs) given easy and hard cues at long delays. Consistent with the ANOVA, the Attentional Control × Anxiety interaction was not significant for the easy cues, indicating again that attention did not influence the anxiety-related bias favoring safe cues. Also consistent with the ANOVA, the attentional Control × Anxiety interaction was significant for the hard cues, $F(1, 110) = 2.9$, $p < .005$. We then performed an analysis of simple slopes focused one standard deviation above and below the STAI mean, running separate regressions on the cued and uncued targets. No attentional differences were evident for targets in cued locations ($p < .67$), whereas targets in uncued locations showed a significant attentional effect for anxious, $F(1, 110) = 2.1$, $p < .05$, but not low anxious ($p < .35$) participants. The regression thus replicates the ANOVA and demonstrates that the interaction is not a spurious by-product of median splits on correlated factors. It also reinforces the conclusion that the attentional control effect in anxious participants primarily involves uncued locations and thus disengagement.

Accuracy Data

The accuracy data (mean proportion correct) were analyzed with an ANOVA that included anxiety and attentional control as between-subjects factors, and game (positive, negative) and cue difficulty (easy, hard) as within-subjects factors (see Table 2). The delay and location factors were not included because the accuracy was measured only on catch trials, which involved no target. There were not enough errors of omission on targeted trials to analyze. The only significant finding was a main effect of cue difficulty, $F(1, 110) = 4.6$, $p < .05$. Accuracy (i.e., correctly withholding the response in the absence of a target) was greater following hard (mean proportion correct = .83) than following easy cues (M = .81). This may reflect enhanced response inhibition given the more threatening cues. The absence of interactions with anxiety or attentional control indicates that the RT findings were not contaminated by strategies that trade off speed for accuracy.

Discussion

This study provides evidence of several attentional biases related to trait anxiety. Anxious individuals showed stronger orienting than low anxious individuals given hard (threatening) cues at short delays and easy (safe) cues at long delays. These orienting effects involved slow responses to uncued targets, suggesting delays in disengaging from the cues rather than biases toward the cues. In addition, the anxiety-related threat bias depended on individual differences in attentional control: Anxious persons with poor attention remained slow in disengaging from threat at long delays, whereas those with good attention were better in shifting away.

Before discussing these findings, one prediction that found no support was that the anxiety-related effects would be stronger on negative games. We have found effects limited to negative games in some studies (Derryberry & Reed, 1997), but our previous studies with attentional control, like the present study, found effects on positive as well as negative games. This may be at odds with models proposing that anxiety-related processes are enabled in contexts involving potential punishment but not potential reward (Gray, 1987). The null finding is difficult to interpret, however, because the game manipulation (gaining as opposed to losing points) may not always be potent enough to overcome the participant's general interpretation and emotional state arising from the experimental context. Specifically, anxious persons may view the experiment as threatening, perhaps because of the difficulty of the task or their uncertainty concerning their performance. Occurring on positive as well as negative games, this general state may obscure more subtle motivational influences related to the games. In addition, the present study used cues that were physically identical to the predicted feedback signals; this emphasis on the feedback rather than the gaining or losing of points may have obscured the game-related motives. Until we know more about the ways in which attentional control influences interpretative processes in anxiety, we can only conclude that anxiety-related effects are not limited to negative incentive conditions.

Another concern involves the possibility that the general findings reflect appetitive rather than defensive motives. Rather than signaling potential threat and safety, the cues may elicit appetitive states related to reward (given easy cues) and frustration (given hard cues). This is possible, but the results would be difficult to explain given existing theories and research. We know of no theory that predicts stronger appetitive motives in anxious people, and we have never found biases favoring rewarding or frustrating cues in anxious people. Along somewhat related lines, one might suggest that it is depression rather than anxiety that underlies our results because the two traits co-occur and are measured by the STAI. If one argues for an appetitive interpretation, however, most theories of depression predict weaker appetitive motivation in the anxious groups, which was not found. In addition, our analysis showing the effect to be more closely related to the STAI Anxiety than the Depression subscale supports the importance of defensive motivation. Therefore, the simplest interpretation is that the results reflect the influence of trait anxiety in defensive contexts involving threat and safety.

Anxiety-Related Attentional Biases

The present study replicated many previous findings of stronger orienting to threat in anxious persons. Although other paradigms use personally meaningful verbal stimuli that are irrelevant to the task, the present paradigm used simple nonverbal stimuli that were highly relevant. The convergence across tasks suggests that the threat bias is a general phenomenon. In addition, the present findings provide further evidence that the bias is not limited to clinically anxious individuals; it can also be found in people with high trait anxiety. This supports the notion of a general personality dimension representing sensitivity to threat, with those at the high end most vulnerable to clinical problems (e.g., Clark, Watson, & Mineka, 1994; Zinbarg & Barlow, 1996).

The use of a spatial orienting task provided several clarifications regarding the nature of the threat bias. Manipulating the delay between the cue and target showed that the bias appears early, within 250 ms following a threatening stimulus. Such speed is

Table 2
Mean Percentage Correct on Catch Trials for Each of the Four Groups

Type of trial	Low anxiety, low attention	Low anxiety, high attention	High anxiety, low attention	High anxiety, high attention
Positive games				
Easy cues	79	80	85	81
Hard cues	81	88	87	82
Negative games				
Easy cues	79	82	87	78
Hard cues	82	84	84	80

consistent with proposals that the anxiety-related bias reflects a relatively automatic, reflexive adjustment of attention. Manipulating the target location showed that the bias appears when a threatening cue is followed by a target in the uncued location. This runs counter to models suggesting an anxiety-related bias *toward* threatening stimuli, suggesting instead a bias involving problems in disengaging *from* such stimuli. Note also that anxious participants showed delays (rather than facilitation) in shifting from an easy cue to a hard target, which argues further against a bias involving movement toward threat. In general, these findings argue against a highly automatic bias related to anxiety. We return to this issue in more detail after discussing the safety-related bias and the influence of attentional control.

Although the threat-related biases are often emphasized, anxious participants also showed stronger orienting to safe locations at long delays. It is important to note that this bias appeared only when a safe location was cued and was not a case of shifting from a cued threatening location to a safe location (which depended on attentional control). Converging evidence is scarce, although panic patients have been found to show a recognition bias for safe as compared with neutral faces, a bias that may depend on attentional processes during encoding (Lundh, Thulin, Czyzykow, & Ost, 1998). Individuals prone to anxiety (i.e., with "actual–ought" self-discrepancies) also show enhanced memory for the absence as well as the presence of a negative outcome (Higgins & Tykocinski, 1992). The absence of a negative outcome often involves a feeling of relief or safety.

On the basis of earlier findings, we have suggested that this bias reflects the functional importance of safety to anxious persons. If anxiety arises from a defensive system or motivational state, it makes sense for the system to facilitate not only threat information but also safety information crucial to coping with the threat (Derryberry & Reed, 1996). Anticipatory attention to safety may help the person to plan different coping options and to be prepared for things that might go wrong. Within a threatening situation, attention to safety may help the person attenuate their anxiety, enabling them to remain in and learn from the environment. Although generally adaptive, it remains possible that a concern with safety may contribute to problematic avoidance behaviors. Rachman (1984) noted that agoraphobics often strive to counter their anxiety by establishing strong safety signals (e.g., sitting close to an exit) and that excessive dependency on another person can represent an exclusive source of safety. Similar biases favoring safety may contribute to childhood problems such as separation and avoidant disorders (Derryberry & Reed, 1994b).

The strategic nature of safety information suggests that attention to safety may be less automatic and more voluntary than the threat bias. Consistent with this idea, the safety bias appeared only at the 500-ms delay, whereas the threat bias peaked at the 250-ms delay. This sequence is consistent with a recent stage model proposed by Beck and Clark (1997): A relatively early and automatic stage of *immediate preparation* emphasizes primary threat appraisal, and a subsequent stage of *secondary elaboration* involves slow, effortful processing concerned with safety and other information related to secondary coping appraisals. A similar idea, with a different time course, has been proposed by Bradley, Mogg, White, Groom and de Bono (1999) in a study of general anxiety disorder. In addition to the usual attentional bias favoring threatening faces, they found a bias favoring happy faces that only emerged in the second half of the study, which they interpreted as strategic. Although more research is clearly needed, the finding of enhanced attention to safety as well as threat is important in suggesting that anxiety-related biases should not be approached simply in terms of their (negative) valence. Instead, the biases are best viewed in light of their functional and complementary importance to defensive motivation.

Anxiety's Modulation by Attentional Control

The primary goal of this study was to examine the contribution of individual differences in attentional control. We predicted that good control, assumed to reflect voluntary capacities of the anterior attentional system, would allow anxious individuals to constrain their threat-related bias at long delays. As predicted, all anxious participants showed the bias at short delays, but those with good control were better able to reduce it at long delays. This general pattern replicates that found in our studies of response inhibition, in which anxious good attenders were better able than anxious poor attenders to inhibit dominant response codes. These findings warn against viewing processing biases as common to all anxious persons: Their magnitude and time course depends on another personality dimension involving the capacity to voluntarily control attention.

It is unfortunate that there have been few studies of conceptually related personality variables that may interact with anxiety. Some studies have focused on *repressors*, who report low anxiety but score high on defensiveness and are usually thought to use attention to block negative affect. Repressors have shown avoidant biases on the Stroop (Myers & McKenna, 1996) and dot-probe (Fox, 1993) tasks, but these findings have been difficult to replicate (e.g., Brosschot, de Ruiter, & Kindt, 1999). It is worth noting that attentional control shows no relationship to conventional measures of repression. Other studies have examined *monitoring*, a style of coping in which the person seeks out information regarding threat. Adolescents high in state anxiety and low in monitoring show avoidant dot-probe patterns (Vasey & Schippell, 1997), but adult studies have found no effects of monitoring (Muris, Merckelbach, & de Jongh, 1995).

The shifts from threatening to safe cues in anxious good attenders may be construed as a form of attentional avoidance. In fact, the anxious good attenders approximate the sequential pattern of vigilance (at short delays) and avoidance (at long delays) suggested to exist in anxiety (e.g., Amir, Foa, & Coles, 1998). This may seem problematic in that avoidance is often viewed as maladaptive because it limits learning about the threat. However, there are probably different forms of attentional avoidance whose adaptiveness depends on the situation. Using terms from animal research, the shift from threatening to safe locations constitutes an attentional form of *active avoidance*. Active avoidance of threat is adaptive in many coping situations, as long as it allows the person to take appropriate advantage of safety signals and gain more information about how to cope. Even though they are anxious, those with good attention may be better able to disengage the threat and engage safety, allowing them to remain in and learn from the stressful situation. In contrast, anxious people with poor attention may become overwhelmed by the threat and end up having to rely on more drastic forms of avoidance such as escaping (i.e., leaving) or passively avoiding (i.e., not approaching) the situation.

In contrast to predictions, good attentional control did not enhance the safety bias favoring easy cues. One explanation is that the safety bias evident in anxious participants arose too late to be influenced by the equally late voluntary attentional effects and that such an interaction would appear given a longer delay. A more interesting possibility is that attentional control was not enhanced because anxious participants did not feel threatened following a safe cue. It is thus possible that anxious individuals may enhance attentional control primarily under acute defensive conditions, as when attention is drawn to a threatening cue. Such an effect would be important in illustrating one way in which a defensive motivational process might recruit a voluntary attentional process.

Underlying Mechanisms

A third goal of our study was to consider underlying attentional mechanisms related to the posterior and anterior attentional systems. As in our previous work, the differences in orienting appeared when targets appeared in uncued locations. This suggests that anxiety-related biases do not involve posterior system functions of moving attention toward a threatening (or safe) stimulus. The initial movement to the cue appears relatively automatic and similar across individuals. The anxiety-related bias arises once the threat has been engaged, leading to delays in shifting away. Such delays may reflect a suppression of the disengage operation or a facilitation of the engage operation. As a whole, our research is most consistent with a model in which anxiety enhances the engagement of already-attended threatening stimuli. A rapid deepening of engagement would be adaptive in facilitating important information but make it difficult to reflexively disengage to other stimuli. At longer delays, the anterior system related to attentional control can send a voluntary signal that facilitates the posterior system's capacity to disengage. This may be accomplished by direct activation of the disengage operation and/or a suppression of the engage operation. More research is needed, but a model in which the engage operation is involuntarily enhanced by anxiety and then voluntarily suppressed via attentional control provides the simplest account for the experimental interactions between these variables as well as their negative correlation in the general population.

Clinical Implications

A final and important issue involves the extent to which our findings generalize to clinical anxiety. There is little doubt in the case of the threat bias, which has been found in diverse anxiety disorders (e.g., generalized anxiety, social phobias, physical phobias). Nevertheless, future research is needed to characterize differences in the bias's size, time course, and other parameters across different clinical and nonclinical groups. The generalizability of the safely bias is less clear, although the strongest evidence of such a bias has been found in agoraphobics (Rachman, 1984) and panic patients (Lundh et al., 1998). It makes sense that an overemphasis on safety and avoidance may contribute to and help maintain anxious symptoms because inappropriate avoidance often constrains the learning of new coping skills.

Perhaps most interesting are the clinical implications of attentional control. To the extent that good attentional control serves protective functions, anxious individuals with poor control should be most vulnerable to clinical disorders. As emphasized above, difficulties in disengaging from threat will limit their use of safety information and thus their capacity to cope. At the same time, the delayed disengagement promotes prolonged attention to threat, which in turn amplifies the threat and increases the probability of self-focused, ruminative, or catastrophic forms of thought (Derryberry & Reed, 1997). Although anxious people with good control may be less susceptible to clinical problems, their vulnerability may still increase when prolonged stress or coping efforts deplete their attentional resources (Williams et al., 1996). In addition, good attentional control may at times contribute to anxiety, as when effortful attention facilitates an essentially maladaptive coping strategy (e.g., efforts to control an uncontrollable situation).

In regard to prevention and treatment, attentional differences may indicate different therapeutic approaches. Several cognitive therapies suggest that people with poor attention may benefit from initial training aimed at strengthening attentional control (Teasdale et al., 1995; Wells & Matthews, 1994). It is interesting that biological treatments are increasingly using anti-anxiety medications thought to facilitate frontal, attention-related mechanisms (e.g., monoaminergic drugs) as opposed to earlier drugs that impair attention (e.g., benzodiazepines). In the case of anxious clients with good control, initial emphasis may need to focus on their strategic use of attention, including the conceptual and motivational processes that govern their efforts. Finally, it should be noted that attentional differences are likely to be relevant to additional disorders beyond anxiety, such as those involving depression or impulsivity.

References

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions.* Newbury Park, CA: Sage.

Amir, N., Foa, E. B., & Coles, M. E. (1998). Automatic activation and strategic avoidance of threat-relevant information in social phobia. *Journal of Abnormal Psychology, 107,* 285–290.

Beck, A. T., & Clark, D. A. (1997). An information processing model of anxiety: Automatic and strategic processes. *Behavioural Research and Therapy, 35,* 49–58.

Bieling, P. J., Antony, M. M., & Swinson, R. P. (1998). The State–Trait Anxiety Inventory, Trait version: Structure and content re-examined. *Behaviour Research and Therapy, 36,* 777–788.

Bradley, B. P., Mogg, K., Millar, N., & White, J. (1995). Selective processing of negative information: Effects of clinical anxiety, concurrent depression, and awareness. *Journal of Abnormal Psychology, 104,* 532–536.

Bradley, B. P., Mogg, K., White, J., Groom, C., & de Bono, J. (1999). Attentional bias for emotional faces in generalized anxiety disorder. *British Journal of Clinical Psychology, 38,* 267–278.

Brosschot, J. F., de Ruiter, C., & Kindt, M. (1999). Processing bias in anxious subjects and repressors, measured by emotional Stroop interference and attentional allocation. *Personality and Individual Differences, 26,* 777–793.

Clark, L. A., Watson, D., & Mineka, S. (1994). Temperament, personality, and the mood and anxiety disorders. *Journal of Abnormal Psychology, 103,* 103–116.

Derryberry, D., & Reed, M. A. (1993, July). *Visual attention and temperament: Orienting to hope, relief, fear, and frustration cues.* Paper presented at the meeting of the International Society for the Study of Individual Differences, Baltimore, MD.

Derryberry, D., & Reed, M. A. (1994a). Temperament and attention: Orienting toward and away from positive and negative signals. *Journal of Personality and Social Psychology, 66,* 1128–1139.

Derryberry, D., & Reed, M. A. (1994b). Temperament and the self-organization of personality. *Development and Psychopathology, 6,* 653–676.

Derryberry, D., & Reed, M. A. (1996). Regulatory processes and the development of cognitive representations. *Development and Psychopathology, 8,* 215–234.

Derryberry, D., & Reed, M. A. (1997). Motivational and attentional components of personality. In G. Matthews (Ed.), *Cognitive science perspectives on personality and emotion* (pp. 443–473). Amsterdam, the Netherlands: Elsevier.

Derryberry, D., & Reed, M. A. (2001). *Attentional control, trait anxiety, and the regulation of irrelevant response information.* Manuscript in review.

Derryberry, D., & Rothbart, M. K. (1988). Affect, arousal, and attention as components of temperament. *Journal of Personality and Social Psychology, 55,* 958–966.

Derryberry, D., & Rothbart, M. K. (1997). Reactive and effortful processes in the organization of temperament. *Development and Psychopathology, 9,* 633–652.

Eysenck, S. B. J., Eysenck, H. J., & Barrett, P. (1985). A revised version of the Psychoticism Scale. *Personality and Individual Differences, 6,* 21–29.

Fox, E. (1993). Allocation of visual attention and anxiety. *Cognition and Emotion, 7,* 207–215.

Gray, J. A. (1987). *The psychology of fear and stress* (2nd ed.). New York: McGraw-Hill.

Higgins, E. T., & Tykocinski, O. (1992). Self-discrepancies and biographical memory: Personality and cognition at the level of psychological situation. *Personality and Social Psychology Bulletin, 18,* 527–535.

Leary, M. R. (1983). A brief version of the Fear of Negative Evaluation Scale. *Personality and Social Psychology Bulletin, 9,* 371–375.

Lundh, L., Thulin, U., Czyzykow, S., & Ost, L. (1998). Recognition bias for safe faces in panic disorder with agoraphobia. *Behaviour Research and Therapy, 36,* 323–337.

MacLeod, C., & Mathews, A. (1988). Anxiety and the allocation of attention to threat. *Quarterly Journal of Experimental Psychology, 40,* 653–670.

Mathews, A. (1990). Why worry? The cognitive function of anxiety. *Behavioral Research and Therapy, 28,* 455–468.

Mathews, A., May, J., Mogg, K., & Eysenck, M. (1990). Attentional bias in anxiety: Selective search or defective filtering? *Journal of Abnormal Psychology, 99,* 166–173.

Maxwell, S. E., & Delaney, H. D. (1993). Bivariate median splits and spurious statistical significance. *Psychological Bulletin, 113,* 181–190.

McNally, R. J. (1995). Automaticity and the anxiety disorders. *Behaviour Research & Therapy, 33,* 747–754.

Mogg, K., Bradley, B. P., & Williams, R. (1995). Attentional bias in anxiety and depression: The role of awareness. *British Journal of Clinical Psychology, 34,* 17–36.

Muris, P., Merckelbach, H., & de Jongh, A. (1995). Colour-naming of dentist-related words: Role of coping style, dental anxiety, and trait anxiety. *Personality and Individual Differences, 18,* 685–688.

Myers, L. B., & McKenna, F. P. (1996). The colour naming of socially threatening words. *Personality and Individual Differences, 20,* 801–803.

Posner, M. I. (1978). *Chronometric explorations of mind.* Hillsdale, NJ: Erlbaum.

Posner, M. I., & Petersen, S. E. (1990). The attention system of the human brain. *Annual Review of Neuroscience, 13,* 25–42.

Posner, M. I., & Raichle, M. E. (1994). *Images of mind.* New York: Scientific American Library.

Posner, M. I., & Rothbart, M. K. (1998). Attention, self-regulation and consciousness. *Philosophical Transactions of the Royal Society of London B, 353,* 1915–1927.

Rachman, S. (1984). Agoraphobia—A safety-signal perspective. *Behaviour Research and Therapy, 22,* 59–70.

Rothbart, M. K., Ahadi, S. A., & Hershey, K. L. (1994). Temperament and social behavior in childhood. *Merrill-Palmer Quarterly, 40,* 21–39.

Rothbart, M. K., Derryberry, D., & Posner, M. I. (1994). A psychobiological approach to the development of temperament. In J. E. Bates & T. D. Wachs (Eds.), *Temperament: Individual differences at the interface of biology and behavior* (pp. 83–116). Washington, DC: American Psychological Association.

Sartory, G. (1998). Disorder-specificity of attentional dysregulation in anxiety. In E. Sanavio (Ed.), *Behavior and cognitive therapy today: Essays in honor of Hans J. Eysenck* (pp. 241–247). Oxford: Anonima Romana.

Schneider, W. (1988). Micro Experimental Laboratory: An integrated system for IBM PC compatibles. *Behavioral Research Methods, Instruments, & Computers, 20,* 206–217.

Spielberger, C. D. (1983). *Manual of the State–Trait Anxiety Inventory, Form Y.* Palo Alto, CA: Consulting Psychologists Press.

Teasdale, J. D., Segal, Z., & Williams, J. M. G. (1995). How does cognitive therapy prevent depressive relapse and why should attentional control (mindfulness) training help? *Behaviour Research and Therapy, 33,* 25–39.

Vasey, M. W., & Schippell, P. (1997, April). *Trait anxiety, state anxiety and coping style as determinants of adolescents' threat-related attentional biases.* Paper presented at the meeting of the Society for Research in Child Development. Washington, DC.

Wells, A., & Matthews, G. (1994). *Attention and emotion: A clinical perspective.* Hillsdale, NJ: Erlbaum.

Williams, J. M. G., Mathews, A., & MacLeod, C. (1996). The emotional Stroop task and psychopathology. *Psychological Bulletin, 120,* 3–24.

Zinbarg, R. E., & Barlow, D. H. (1996). Structure of anxiety and the anxiety disorders: A hierarchial model. *Journal of Abnormal Psychology, 105,* 181–193.

(*Appendix follows*)

Appendix

Items of the Attentional Control Scale

Items are scored on a 4-point scale (1 = *almost never*; 2 = *sometimes*; 3 = *often*; 4 = *always*). R = reverse-scored item.

It's very hard for me to concentrate on a difficult task when there are noises around. (R)

When I need to concentrate and solve a problem, I have trouble focusing my attention. (R)

When I am working hard on something, I still get distracted by events around me. (R)

My concentration is good even if there is music in the room around me.

When concentrating, I can focus my attention so that I become unaware of what's going on in the room around me.

When I am reading or studying, I am easily distracted if there are people talking in the same room. (R)

When trying to focus my attention on something, I have difficulty blocking out distracting thoughts. (R)

I have a hard time concentrating when I'm excited about something. (R)

When concentrating I ignore feelings of hunger or thirst.

I can quickly switch from one task to another.

It takes me a while to get really involved in a new task. (R)

It is difficult for me to coordinate my attention between the listening and writing required when taking notes during lectures. (R)

I can become interested in a new topic very quickly when I need to.

It is easy for me to read or write while I'm also talking on the phone.

I have trouble carrying on two conversations at once. (R)

I have a hard time coming up with new ideas quickly. (R)

After being interrupted or distracted, I can easily shift my attention back to what I was doing before.

When a distracting thought comes to mind, it is easy for me to shift my attention away from it.

It is easy for me to alternate between two different tasks.

It is hard for me to break from one way of thinking about something and look at it from another point of view. (R)

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