Selective processing of threat in children and adolescents with Generalised Anxiety

Disorder

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Abstract

Objectives: Research investigating attentional bias for threat using the modified

Stroop task in younger anxious populations has produced equivocal results. The

present data investigated the replicability of the prototypical adult finding of Mathews

and MacLeod (1985) with patients with Generalised Anxiety Disorder (GAD).

Method: Nineteen patients with GAD and 19 controls completed the modified Stroop

paradigm with threat, depression-related, positive, and neutral words.

Results: The data revealed a selective Stroop interference effect for threat-related

material in the GAD patients, but not in the controls.

Conclusions: The results provide evidence of a robust modified Stroop effect for

threat-related material in children and adolescents with GAD, suggesting that one

reason for the lack of such effects in previous research with younger populations may

have been the use of sub-clinically anxious participants.

Cognitivist approaches to understanding emotional distress/disorder propose that distress is partly maintained by the selective processing of information pertinent to the problems that the individual is distressed about. Such biases in information processing are part of a vicious circle of cognition-emotion relations in which distress leads to bias which itself leads to further distress and so on (e.g. Beck, 1976). Researchers sympathetic to this view have sought to provide empirical support for such assertions through the use of experimental paradigms that assess degrees of biased processing (see Williams et al., 1997, for a review of this literature).

One of the more robust findings in this literature has been a bias in favour of threat-related material in anxious adult participants performing attentional tasks. The prototypical paradigm to investigate this has been a modification of Stroop's (1935) work on colour-naming interference. In the modified version of Stroop's task, participants are asked to name the colours in which words of varying semantic content are written, while trying as best they can to ignore that content. The argument goes that the degree to which the semantic content of a given word interferes with participants' ability to name its colour is an index of how much the content of the word captures participants' attention. In their seminal study on this effect Mathews and MacLeod (1985) found that adult patients with a diagnosis of Generalised Anxiety Disorder (GAD) were slower to colour-name threat-related words compared to neutral words, relative to the performance of healthy controls, therefore suggesting selective attentional processing of threat-related information in the clinical group. Since this initial finding there has been a plethora of studies in the adult literature

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demonstrating selective Stroop interference for mood/problem related material across a range of clinical and sub-clinical presentations (see Williams, Mathews, & MacLeod, 1996 for a review).

More recently, researchers have begun to focus on putative attentional biases for emotional information in younger populations. Here, research using the modified Stroop paradigm has mostly concentrated on children and adolescents with specific fears such as fear of spiders or of injections and has proved somewhat less informative (e.g. Kindt, Bierman, & Brosschot, 1997; Kindt & Brosschot, 1999; Kindt, Brosschot, & Everaerd, 1997). Indeed, Vasey and MacLeod (2001) in a review of this literature have stated "it is difficult to avoid the conclusion that, despite occasionally supportive findings, the modified Stroop task has proven to be a fairly unreliable method of demonstrating attentional bias to feared stimuli in children suffering from specific fears". In contrast to this somewhat murky picture, the one study using a younger population with clinical levels of anxiety, in this case Posttraumatic Stress Disorder (PTSD), revealed a clear Stroop interference effect for threat-related material (Moradi, Taghavi, Neshat-Doost, Yule, & Dalgleish, 1999).

Of course, there are many possible explanations for the inconsistency of the modified Stroop effect in research with child and adolescent populations (see Vasey & MacLeod, 2001, for a discussion of a number of these). However, one of the more prosaic possibilities is that the modified Stroop effect is weak and difficult to replicate because much of the research has been carried out on sub-clinical populations where

levels of anxiety are just not severe enough to produce reliable attentional bias effects. On this point, it is important to note that the modified Stroop effect is less robust in sub-clinical adult populations than it is in adult clinical groups (Williams et al., 1996, 1997).

It is notable in this context that the seminal study by Mathews and MacLeod (1985) on adults with GAD that precipitated research interest with the modified Stroop paradigm has not been repeated with a child and adolescent population. Carrying out such a study with a younger age group would tell us whether the basic adult finding was replicable in such populations, therefore providing an anchor point from which to interpret the more confusing data involving children and adolescents with specific fears.

The present study therefore sought to compare the performance of children and adolescents with a diagnosis of GAD to that of healthy controls on a modified Stroop task involving the colour-naming of threat-related, depression-related, positive, and neutral words. This tested the hypothesis that generally anxious children and adolescents would show a larger selective Stroop interference effect for threat-related material (in comparison to neutral and non-threat-related affective material), relative to healthy controls.

Method

Nineteen child and adolescent patients with a diagnosis of Generalized Anxiety Disorder (GAD) were recruited from a variety of sources including hospital outpatients' and inpatients' services in the UK. The selection criterion for the patient group was a primary diagnosis of GAD in the absence of a comorbid diagnosis of Major Depressive Disorder according to the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) (American Psychiatric Association, 1994) criteria, with no evidence of psychosis or organic brain damage. This sample included 9 girls and 10 boys, with a mean age of 13.47 years ($\underline{SD}$ = 3.23). The diagnosis was determined in a clinical assessment by psychiatrists and psychologists before the patients were introduced to the experimenters. Consensual diagnosis by all members of the clinical team was a requirement for selection. Diagnosticians had no access to self-report data prior to diagnosis. A symptom checklist from the DSM-IV, completed by the diagnostic team, was used in the assessments.

The control group comprised 19 children and adolescents (11 girls and 8 boys) with a mean age of 14.50 years ($\underline{SD}$ = 1.01) recruited from London schools who had never experienced GAD or any other psychiatric disorder according to parents and teachers.

The 2 groups were comparable with respect to sex, age, vocabulary level and reading ability (see Results section). The primary language of all participants was English.

Materials and measures

The Depression Self-Rating Scale (DSRS; Birleson, 1981)

The Depression Self-Rating Scale was developed by Birleson (1981) to measure depression in childhood. Its 18 items cover the major areas of mood disturbance. The content validity, internal consistency, and stability of the DSRS have been found to be satisfactory (Birleson, 1981).

The Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds & Richmond, 1978)

The RCMAS, a revision of the Children's Manifest Anxiety Scale, was designed to assess the presence or absence of a variety of anxiety-related symptoms. The RCMAS consists of 37 item, of which 28 items measure anxiety and the remaining 9 comprise a lie scale. Research has shown that the reliability of the RCMAS is high (Reynolds & Richmond; 1978).

The British Picture Vocabulary Scale (BPVS; Dunn, Whetton & Pintilie, 1982)

The BPVS was developed to measure a participant's receptive (hearing) vocabulary for standard English for participants who have grown up in a standard English speaking environment (Dunn et al., 1982).

The Wechsler Objective Reading Dimensions (WORD, Basic Reading; Rust, Golombok & Trickey, 1993)

The Basic Reading test of the Wechsler Objective Reading Dimensions is an individually administered scale designed for assessing decoding and word-reading ability of children and adolescents. Data on the internal consistency, test-retest stability and inter-scorer reliability of WORD scores show that it has sound psychometric properties. Accumulated data from studies of WORD indicate that the WORD subtests are valid (Rust et al., 1993).

The modified Stroop task:

Sixty words were used as verbal stimuli in the modified Stroop paradigm. These consisted of 12 words from each of 5 word categories: happy (e.g. pleased, kindness, smile, excited, brilliant), categorised neutral (e.g. sheep, donkey, gorilla, parrot, duck), depression-related (e.g. lonely, friendless, crying, miserable), threat-related (e.g. terrified, dark, ghost, petrified), and trauma-related (e.g. injured, emergency, hospital, blood, bandage). The words were selected from a source of words produced by 231 primary and secondary school pupils (Neshat Doost, Moradi, Taghavi, Yule & Dalgleish, 1999). All of the 5 categories were matched for length and frequency according to this source. Each of the words had been produced as an

associate of the category cue. For example, the word "sheep" had been generated by the pupils as an exemplar of an animal. The words were then further independently categorised by 4 adult raters. There was unanimous agreement differentiating the words involved in all of the categories except for the threat and trauma word types which were confusable. These two word types were therefore combined into a single threat-related category for all analyses in the present study.

Each word was presented to participants twice, once in each of 2 colours chosen at random from the 4 colours: green, yellow, red, and blue. The words were presented via an IBM PC (Thinkpad 755C TF1) portable computer with a 26.41cm. active-matrix TFT colour LCD screen using locally written software. An adjustable voice key was used to register a verbal colour-naming response and to record the colour-naming latencies (RT). The voice key connected to an adjustable head microphone (Bandridge EH620, Dynamic Headsets) worn by the participant. Colour-naming accuracy was recorded on line by the experimenter using a locally constructed button box.

Procedure

In order to carry out the modified Stroop task, participants sat 50 cm. from the computer screen. There were 18 practice Stroop trials using uncategorised neutral words. The 120 stimulus words were then presented in a new fully random order for each participant. The presentation time for each word was 1.7 seconds. The inter-trial interval was 2.0 seconds. The participant was asked to ignore the content of the word

and say out loud the colour into the microphone as quickly as possible. Following the Stroop task, participants completed the mood, reading and vocabulary measures.

<div align="center">Results</div>

<u>Participant Characteristics</u>

The two groups were comparable on age, vocabulary level as indicated by BPVS scores, reading ability as indicated by WORD scores, $\underline{t}$s (36) < 1.30, $\underline{p}$s > .20, and gender, $Chi^2 = 0.42$, ns. The anxious patients obtained significantly higher scores on the RCMAS and on the DSRS, $\underline{t}$s > 3.72, $\underline{p}$s < .001 (see Table 1).

<div align="center">INSERT TABLE 1 ABOUT HERE</div>

<u>Modified Stroop performance</u>

Colour naming latency data were excluded from the analyses for trials on which participants made colour naming errors or when the latencies of participants were less than 100msec or more than 2sec. Responses of less than 100msec may be caused by movements of the microphone and responses of more than 2 sec. are historically recognised as outliers as they are more than 3 standard deviations longer than the slowest mean latency of the participants (e.g. Moradi et al., 1999). The mean numbers of colour naming errors were 3.57% ($\underline{SD} = 5.10$) and 1.04% ($\underline{SD} = 0.79$) for patients and controls, respectively, with the patient group making significantly more errors, $\underline{t}$ (36) = 2.4, $\underline{p} < 0.05$.

The mean latencies to colour-name each type of word are shown in Figure 1. These data were analysed using a mixed model analysis of variance (ANOVA) to observe any effects due to Group (2: control vs. anxious) as a between-participants variable and Word Type (4: threat, depression, positive, categorised neutral) as a within-participants variable. The data violated assumptions of sphericity, Mauchly's $\underline{W} = .15$, $\underline{p} < .01$, and so Huynh-Feldt corrected analyses are reported here. The results revealed significant main effects of Word Type $\underline{F}$ (1.50, 54.10) = 3.52, $\underline{p} < 0.05$, and of Group, $\underline{F}$ (1, 36)=12.57, $\underline{p} < .01$. There was also a significant interaction between Group and Word Type, $\underline{F}$ (1.50, 54.10) = 3.90, $\underline{p} < 0.05$.

INSERT FIGURE 1 ABOUT HERE

Simple contrasts compared each of the emotional word types with the neutral word type across groups. The results revealed an interaction of Group by Word Type for threat versus neutral words, $\underline{F}$ (1,36) = 6.10, $\underline{p} < .02$, but no such interaction for either depression-related versus neutral words, $\underline{F}$ (1,36) = 2.98, $\underline{p} = .09$, or for positive versus neutral words, $\underline{F} < 1$. Simple paired comparisons were performed for the threat-neutral interaction. These revealed that anxious participants were significantly slower to colour-name threat words, compared to neutral words, $\underline{t}$ (18) = 2.57, $\underline{p} < .02$, but that this effect was not significant in the controls, $\underline{t} < 1$.

Discussion:

The present study sought to examine the replicability in a child and adolescent population of Mathews and MacLeod's (1985) seminal finding in adults of selective interference on the modified Stroop task for threat-related material in patients with a diagnosis of Generalised Anxiety Disorder (GAD). The data revealed a clear threat-related interference effect in child and adolescents with GAD that was not present for positive or depression-related emotional material.

This finding suggests that child and adolescent patients with GAD exhibit a processing bias for threatening information in a similar way to adults with the comparable diagnosis. It also raises the possibility that previous failures to find bias effects in younger adult populations using this methodology may have been due to sampling differences across the studies, with studies using sub-clinical or analogue populations demonstrating less robust effects (see Vasey & MacLeod, 2001, for a discussion).

While this is a plausible account of the extant literature, there of course remain other possible explanations for the equivocal nature of the modified Stroop data in younger anxious participants. For instance, the effect seems to be stronger in studies that have used a card format of the Stroop task, where all of the stimuli are blocked together, as opposed to a one-word-at-a-time format, as demonstrated by Kindt, Bierman and Brosschot (1997). On that point, it is important to note that the present study utilised the supposedly weaker single trial format and still found a strong effect.

Another potential explanation for the mixed findings concerns the ages of the different samples, with the effect being stronger in older participants, such as those in the present study. However, again the findings are not clear cut with strong effects also being reported for anxious children as young as 4-5 years of age e.g.(Martin, Horder, & Jones, 1995).

In summary, the present study demonstrates clear selective Stroop interference effects for threat-related material in children and adolescents with GAD, relative to controls. This finding replicates the work in adults of Mathews and MacLeod (1985) and adds strength to claims that such bias effects are only robust in clinical groups among the younger population.

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Table 1. The means and standard deviations (SD) of age in years, reading and vocabulary scores, and mood measures of the participants

	Anxious		Controls	
	Mean	SD	Mean	SD
Age[a]	13.47	3.23	14.50	1.01
BPVS	95.16	21.45	92.79	19.80
WORD	97.32	22.27	97.68	16.51
RCMAS***	19.26	4.84	9.05	5.80
DSRS***	14.63	5.90	8.68	3.71
Ratio (F:M)	9:10		11:8	

Note

BPVS = British Picture Vocabulary Scale, WORD = Wechsler Objective Reading Dimensions, RCMAS = Revised Children's Manifest Anxiety Scale, DSRS = Depression Self-Rating Scale.

a = t-test for unequal variances used.

*** = t-tests revealed scores to be significantly different at $p < 0.001$.

Figure 1

Graph of Stroop colour-naming latencies in milliseconds (ms) across the two groups

for the four word types. Error bars are 1 standard deviation above the mean.