The Impact of Anxiety on Memory for Details in Spider Phobics

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SUMMARY
According to the attentional narrowing account of emotional memory, physiological arousal results in attention being directed towards central rather than peripheral characteristics of the situation. Consequently, memory for central details would be relatively good, whereas memory for peripheral information would be impaired. The present experiment sought to test this attentional narrowing hypothesis under highly stressful conditions. Spider phobics and low-fear controls were confronted with a large live spider, eliciting high levels of emotion in the phobic group. Afterwards, subjects’ memory for the experimental situation was tested. On a cued recall test, phobics displayed a poor memory for peripheral detail information relative to control subjects. There were no differences between phobics and controls with respect to central detail information. Thus, the present data provide partial support for the attentional narrowing account of emotional memory.

The question of how emotional events are remembered has intrigued many researchers. Christianson (1992) noted that the type of information that is involved in memory testing should be taken into account in emotion and memory research. Following Easterbrook’s (1959) cue-utilization hypothesis, Christianson (1992) argued that physiological arousal experienced during a traumatic event causes attentional narrowing. This, in turn, would result in hyperattention for information reflecting the gist of the traumatic event (central details) and hypoattention for irrelevant (peripheral) information. Due to such differential encoding, memory for central details of the emotional situation would be relatively good, whereas memory for peripheral details would be relatively poor.

There is empirical evidence to support Christianson’s attentional narrowing hypothesis. Field studies examining the memory of witnesses for robberies (Christianson and Hübînette, 1993), or that of college students for idiosyncratic situations, provide support for the attentional narrowing account of emotional memory.
emotional events (Christianson and Loftus, 1990; Wessel and Merckelbach, 1994) suggest that central information is, indeed, better remembered than peripheral information. There are, however, a number of serious limitations to this type of research. To begin with, in these studies retrospective emotionality ratings were related to central and peripheral detail memory. Yet, such retrospective reports do not always accurately reflect original emotion (Neisser and Harsch, 1992). Therefore, such a retrospective procedure may yield imprecise and, as a result, mixed findings (see also, Wessel and Merckelbach, 1994). A second problem with these studies is the circularity implicated by their correlational approach. Especially in the case of questionnaire studies, it is quite possible that subjects classify remembered details as central for no other reason than that these details are remembered (Wessel and Merckelbach, 1994).

Laboratory studies do not suffer from the problems inherent in retrospective reporting. That is, emotionality can be manipulated and detail information can be a priori defined. The results of laboratory studies testing the attentional narrowing hypothesis indicate that, compared to neutral slides, emotional slides render a better memory for central details and a poorer memory for peripheral details (Burke, Heuer and Reisberg, 1992; Christianson and Loftus, 1987, 1991; but see Heuer and Reisberg, 1990). However, this type of research has been heavily criticized (e.g., Terr, 1994; Yuille and Tollestrup, 1992). For example, Yuille and Tollestrup (1992) argued that laboratory experiments involve normal, healthy subjects, acting as uninvolved bystanders in events of low impact. These authors maintained that the results obtained under laboratory conditions cannot be generalized to genuine traumatic situations.

In sum, field studies on memory for highly emotional events may suffer from retrospective and report biases, whereas experimental studies may not be generalized to real-life situations. Of course, ethical considerations make it impossible to expose normal, healthy subjects to highly emotional and traumatizing events. Confronting phobic patients with the object of their fear (e.g., a spider in case of a spider phobia) results in acute and high levels of fear. This, then, may provide an approach to elucidate the effects of intense emotion on memory for details.

The present study explored this possibility. Central and peripheral detail memory was tested in spider phobics and low-fear controls after confrontation with a large live spider. This approach has two advantages over the usual methods for studying emotional memory in the laboratory. First, upon confrontation with a phobic cue, phobics experience substantially higher levels of fear than normals viewing unobtrusive slides. Second, problems involving differences in stimulus material are circumvented. In experiments with normal subjects, emotionality is manipulated by using slides differing in content. Such a procedure does not control for the possibility that stimulus characteristics other than emotionality (e.g., saliency) are responsible for the memory effects observed. In the present experiment, stimulus material was identical across conditions. All subjects saw the same (phobic) cue.

In order to eliminate possible side-effects from exposure to high levels of fear, spider phobics were offered therapy after participating in the experiment. Therapy was modelled after the brief exposure treatment developed by Öst (1989). This treatment has been established to be effective (e.g., Arntz and Lavy, 1993; Öst, 1989). In this manner, ethical constraints were circumvented.

To recapitulate, spider phobics and low-fear controls were exposed to a spider. Next, their memory for different aspects of this situation was tested. Following the
attentional narrowing hypothesis (Christianson, 1992), it was predicted that compared to low-fear controls, spider phobics would display enhanced memory for central information, and impaired memory for peripheral information.

METHOD

Subjects

Spider phobics
Thirty-nine female spider phobics participated in the study. Their mean age was 29.6 years (range 16–60 years); 74% of the phobics had completed a medium to high level of education. Phobic subjects were recruited through articles about spider phobia in local newspapers and magazines. They agreed to participate in various experiments as part of a large spider phobia project. In exchange for participating, phobic subjects received exposure treatment.

Low fear controls
Twenty-five women served as controls. Mean age was 31.9 years (range 20–40 years); 66% of the controls had completed a medium to high level of education. They were recruited through an advertisement in a local newspaper and were paid for participating in various experiments. Phobic and control subjects did not differ with respect to age, $t(62) = -1.17$, $p > 0.05$, or education, $\chi^2(4, N = 64) = 1.66$, $p > 0.05$.

Stimulus material

During the experimental procedure (see below), five central details and five peripheral details were present in the laboratory. Central details were: (a) a live brown house spider (*Tegenaria atrica*); (b) a glass jar closed with a bright blue lid; (c) a dark blue cloth with a yellow/green/red flower pattern; (d) a white plywood shelf; and (e) a transparent plastic box. Peripheral details were: (a) an old-fashioned black alarm clock; (b) a poster with various Mickey Mouse figures; (c) a black fan depicting a Chinese farmhouse in different colours; (d) two toy animals; and (e) a bunch of artificial tulips in a white vase. The peripheral items were deliberately made outstanding (i.e., not to be expected in a laboratory) to diminish the possibility that central items would be more memorable due to differences in salience.

Assessment

The Spider Phobia Questionnaire (SPQ; Klorman, Weerts, Hastings, Malamed and Lang, 1974) was used as a self-report measure of spider phobia severity (range 0–31).

A Behavioural Approach Test (BAT; range 0–8) assessed to what extent subjects were able to approach a spider (see for a detailed description, de Jong, Visser & Mereckelbach, 1996). In addition, subjects rated their anxiety level at the closest point of approach (BAT-anxiety, range 0 = *absolutely not anxious* to 100 = *extremely anxious*).

1Medium education level reflects an intermediate vocational qualification (MBO); high education level refers to a high vocational qualification (HBO) or university degree.
Subjects rated their subjective anxiety levels during confrontation with a large spider on a 100 mm Visual Analogue Scale (VAS; range 0 = absolutely no anxiety to 100 = extreme anxiety). The mean of four VASs (see procedure) was used as an indication of subjective anxiety level during the experiment.

Subjects’ memory for central and peripheral details was evaluated with an interview. They were instructed to focus specifically on the characteristics of the experimental situation, and not on their feelings or cognitions during the experiment. Then, they were asked to describe as many details as they could remember from the experimental situation (Free Recall, FR). Next, subjects were asked to describe each of the target items in detail (Cued Recall, CR). When not mentioned spontaneously by the subjects, the interviewer explicitly inquired about certain characteristics of that target item (e.g., ‘What colour was the spider?’). The audiotaped interviews were scored by counting correct responses. Four scores were obtained: (a) Free Recall, Central Details (FR-C, range 0–5), (b) Free Recall, Peripheral Details (FR-P, range 0–5), (c) Cued Recall, Central Details (CR-C, range 0–18), and (d) Cued Recall, Peripheral Details (CR-P, range 0–26).

Procedure

First, subjects completed the SPQ and performed the BAT. Next, they participated in an experimental task that is reported elsewhere. Regarding this task, the following is of importance for the present study. Subjects were seated in the laboratory, in which the five peripheral items were already present. The peripheral items were within the subjects’ viewing range. The central details were part of the experimental procedure. After a short instruction, subjects were asked to perform a behavioural test involving a medium-sized spider in a transparent box (Central Detail) on a white shelf (Central Detail). Next, the experimenter entered the room, holding a glass jar (Central Detail) containing a large live spider (Central Detail). The jar was covered with a cloth (Central Detail) and was held at 50 cm distance from the subject. Subjects were told that the covered jar contained a live spider and were instructed to watch closely when the experimenter pulled the cloth away. The experimenter uncovered the jar 5 seconds after the instruction was given. Next, subjects were exposed to the glass jar and spider for 5 seconds. Directly following this confrontation, subjects completed the Subjective Anxiety VAS. This sequence (behavioural test and confrontation) was carried out four times consecutively. The entire experimental procedure took approximately 30 minutes.

After participating in the experiment, subjects were taken to another room by a different experimenter. No reference was made to the upcoming recall test. Subjects completed a filler questionnaire that was unrelated to fear of spiders and were left alone for 10 minutes.

Finally, the memory interview was conducted by either a research assistant or the first author. The total time between the last confrontation with the spider and the

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2 Specific information about the memory interview and scoring procedure is available from the authors.

3 In the experiment, two different spiders were used: one during the behavioural test and one during confrontation. We chose to only test subjects’ memory for the spider used during confrontation for the following reason. The distance of the medium-sized spider to the subject ranged between 3 and 0 m. Because this spider was not clearly visible at 3-m distance detailed descriptions of it could not be expected. The large spider was held at a standardized and relatively short (50 cm) distance from the subjects. Therefore, this spider was equally visible for every subject.
start of the interview varied somewhat, but never exceeded 15 minutes. After subjects gave their consent, the interview was recorded on audiotape. The interview took approximately 20 minutes. Afterwards, subjects were debriefed.

RESULTS

Anxiety measures

On all anxiety measures, scores of control subjects were distributed in a non-normal fashion. Therefore, Mann–Whitney *U* tests were used in order to evaluate differences between phobic and control subjects. On the pre-test anxiety measures, Mann–Whitney *U* tests resulted in highly significant differences between phobic and control subjects, SPQ, $z = -6.74, p < 0.001$; BAT, $z = -6.31, p < 0.001$; and BAT-Anxiety, $z = -6.25, p < 0.001$. These results confirm that phobic subjects displayed substantially more fear of spiders than controls. Likewise, during the experiment phobic subjects reported considerably more anxiety upon confrontation with a large live spider than control subjects, $z = -6.52, p < 0.001$. Table 1 gives the means and standard deviations of all dependent variables.

Detail memory

Free recall data

Scores on the free recall test were analysed with a 2 (Group) $\times$ 2 (Type of Detail) analysis of variance with repeated measures on the last factor. In general, controls remembered more details than phobics, as shown by a significant main effect for group, $F(1, 62) = 4.97, p < 0.05$. In addition, a significant main effect for type of detail, $F(1, 62) = 95.3, p < 0.001$, indicated that overall, more central than peripheral

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<th>Spider phobics (n = 39)</th>
<th>Low-fear controls (n = 25)</th>
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<tr>
<td></td>
<td>Mean</td>
<td>Mean</td>
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<tr>
<td>SPQ</td>
<td>23.4 (2.9)</td>
<td>2.9 (1.8)</td>
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<tr>
<td>BAT</td>
<td>4.8 (1.9)</td>
<td>7.8 (0.5)</td>
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<td>BAT-anxiety</td>
<td>68.7 (23.7)</td>
<td>8.6 (1.6)</td>
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<tr>
<td>Subjective anxiety</td>
<td>47.9 (25.1)</td>
<td>2.4 (3.2)</td>
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<tr>
<td>FR-C</td>
<td>3.0 (1.3)</td>
<td>3.2 (1.4)</td>
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<tr>
<td>FR-P</td>
<td>0.5 (0.9)</td>
<td>1.1 (1.2)</td>
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<tr>
<td>CR-C</td>
<td>0.63 (0.15)</td>
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<tr>
<td>CR-P</td>
<td>0.15 (0.13)</td>
<td>0.31 (0.13)</td>
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Standard deviations are given in parentheses.


*High scores on the BAT reflect better performance.

*Number correct out of 5.

*Proportion correct.
information was remembered. The critical group × type of detail interaction did not reach statistical significance, $F(1, 62) = 0.61, p > 0.05$.

**Cued recall data**

Because different total scores could be obtained for central and peripheral detail characteristics on the cued recall test (18 vs. 26, respectively), these data were first transformed into proportions. Next, the cued recall data were analysed in the same way as the free recall data. Significant main effects for group, $F(1, 62) = 15.9, p < 0.001$, the type of detail, $F(1, 62) = 387.4, p < 0.001$, were found. That is, controls remembered more details than phobics and overall, more central than peripheral details were remembered. In addition, there was a significant group × type of detail interaction, $F(1, 62) = 6.41, p < 0.05$. A post hoc $t$-test revealed that phobic and control subjects differed significantly with respect to peripheral details: phobics had lower cued recall scores for peripheral details than controls, $t(62) = -4.87, p < 0.001$. The groups did not differ on memory for central detail information, $t(62) = -1.43, p > 0.05$.

**DISCUSSION**

The results of the present study can be summarized as follows. First, the manipulation was successful in that during confrontation with a large live spider, phobic subjects experienced substantially higher levels of anxiety than low-fear control subjects. Second, all subjects remembered more central than peripheral details both on free and cued recall tests. Third, irrespective of detail category and type of test, control subjects remembered more details than phobic subjects. Fourth, phobic and control subjects did not differ with respect to the number of target items reported during free recall. However, when asked about the specific characteristics of those items, phobics remembered significantly fewer peripheral details than controls. This finding is consistent with the notion that, during an emotional state (i.e., anxiety), attentional narrowing takes place (Christianson, 1992). The attentional narrowing hypothesis predicts that peripheral details are poorly encoded and, consequently, poorly remembered. Note that the peripheral details in the present study were deliberately made outstanding. Moreover, the peripheral details were present during the entire experimental procedure (approximately 30 minutes), whereas subjects were exposed to central details for considerably shorter periods of time.

The present data do not support the prediction that attentional narrowing results in better encoding and remembering of central information: on the cued recall test, phobic and control subjects remembered central details equally well. One possible explanation for this observation is as follows. An implicit assumption of the attentional narrowing hypothesis is that in emotional and neutral situations, an equal amount of attention would be directed to the environment. Such outwardly directed attention would be distributed differently among central and peripheral information as a function of emotionality. Alternatively, Yuille and Tollestrup (1992) proposed that under stressful conditions, attention may also be focused internally (e.g., on emotional responses), resulting in poor memory for peripheral as...
well as central information. The question arises whether directing attention internally or externally is such an all-or-none phenomenon as Yuille and Tollestrup proposed. Perhaps the spider phobics’ relatively poor peripheral detail memory was a result of directing part of their attention inwardly. Perhaps peripheral details are prone to suffering from such a decrease in external attention, because attending toward a threatening stimulus has survival value for phobics. Admittedly, this is a speculative line of reasoning as direction of attention was not measured.

A second possible explanation for the lack of difference between the groups on central detail memory may have to do with the classification of details as either central or peripheral. We defined central details as those details that were associated with the source of threat, that is, the spider. It may be argued, however, that some details (e.g., the cloth covering the spider) may not be as central as the spider itself. Thus, a stricter definition of central details, based on spider-related stimuli only, might provide a more sensitive test. However, an exploratory t-test indicated that, compared to controls, spider phobics did not report significantly more spider characteristics ($m=1.54$, $SD=0.72$, and $m=1.48$, $SD=0.77$, respectively; $t(62)=0.31$, $p>0.05$). Yet, this index of central details may have been too crude, due to its relatively small range (0–3). Clearly, future studies should use a wider range of strictly threat-related stimuli to examine whether phobics show enhanced memory for central details.

The present study assumed that exposing clinically phobic subjects to their feared object might provide an opportunity for studying the effects of intense emotion on memory. However, some might argue that relying on a clinically anxious sample may have confounded the present results. Meanwhile, there is little evidence for a memory bias in the phobic disorders (Williams, Watts, MacLeod and Matthews, 1988). Furthermore, phobics do not differ from normals in domains other than memory (e.g., personality traits, van Zuuren, 1987). Taken together, phobics appear to be relatively normal people. For this reason, others might argue that phobic fear is too mild to be compared to the terror involved in trauma. Yet, phobics react to their phobic object with intense levels of fear that may even take the form of a panic attack (APA, 1994). Thus, it seems safe to conclude that the current approach may provide a more appropriate analogue to traumatic anxiety than the usual laboratory methods relying on college student samples (e.g., Christianson and Loftus, 1991).

Although the current data are partially consistent with the attentional narrowing hypothesis, several limitations preclude firm conclusions as to the origins of the observed effects. First, it is unclear whether the phobics’ relatively poor peripheral detail memory performance was caused by shallow encoding due to attentional narrowing or by other memory processes. For example, impaired memory for information presented prior to arousal-eliciting stimuli (retrograde amnesia) has sometimes been observed (e.g., Christianson, 1984; Loftus and Burns, 1982). Note that in the present study, peripheral items were not only present during confrontation with the spider, but also prior to this confrontation. Thus, the observed effect might be interpreted as retrograde amnesia, resulting from storage or retrieval problems (see Christianson and Nilsson, 1984). Second, the attentional narrowing hypothesis (Christianson, 1992) assumes that physiological arousal is responsible for an attentional focus. However, the present study did not measure physiological arousal and attention. Therefore, the present data cannot elucidate causal relations between arousal, attention and memory.
In sum, the current data partially support Christianson’s (1992) account of emotional memory. Under highly stressful conditions, phobics displayed a disadvantage in memory for the characteristics of peripheral stimuli. Thus, confronting phobic subjects with their feared object may provide a fruitful approach for studying the influence of high levels of anxiety on memory.

REFERENCES


