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Automatic Processing in Spider Phobia: Implicit Fear Associations Over the Course of Treatment

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This study evaluates the cognitive model of anxiety by investigating treatment-related changes in automatic associations to evaluate schematic processing. Spider-phobic participants (n = 31) and healthy controls (n = 30) completed fear-based Implicit Association Tests (IATs), which are reaction-time measures that tap implicit associations without requiring conscious introspection. The specific tasks involved classifying pictures of snakes and spiders along with semantic categorizations (good vs. bad, afraid vs. unafraid, danger vs. safety, and disgusting vs. appealing). Phobic individuals were assessed before and after group-based exposure treatment and 2 months later; controls were assessed at matched time points. Results supported clinical applications for implicit fear associations, including prediction of phobic avoidance, and treatment sensitivity of the fear- and disgust-specific automatic associations.

Cognitive models of anxiety and fear posit that maladaptive schemas guide information processing so the anxious person selectively attends to potentially threatening cues, interprets ambiguous cues as threatening, and preferentially recalls relevant threat cues (Beck, 1976; Beck, Emery, & Greenberg, 1985). These cognitive biases are believed to maintain anxiety and avoidance by keeping threat cues salient. In this article, we report on a study of implicit fear associations among individuals with spider phobia to test the prediction that automatic processing (as a proxy for schematic operations) would change over the course of therapy.

Schema-based theories imply that improvement in symptoms should be associated with, and perhaps even preceded by, changes in maladaptive schemas (e.g., Beck & Clark, 1997; Young, 1999). Yet, despite the importance of cognitive models in guiding research and treatment, and evidence of anxious-biased processing across a range of information-processing tasks, there has been little work directly investigating change in fear schemas. Our prediction of fear schema change following treatment is based on converging lines of research examining the presence of fear schema, such as the work of Riskind, Williams, Gessner, Chrosniak, and Cortina (2000) on looming maladaptive style and the malleability of other cognitive processes, such as evidence of change over treatment on the modified Stroop task shown by Kindt and Brosschot (1999). We use the term *fear schema* to refer to maladaptive fear-related cognitive structures (sometimes defined as *interconnected associations in memory*) that can be activated automatically.

Evaluating schemas is challenging because cognitive structure is itself an abstract term. We rely on the definition offered by Posner and Warren (1972), who wrote, "When we say a structure exists in memory, we are really saying that one item will activate another in a quite direct and simple way, even perhaps when the subject does not intend for it to occur. If we had methods to tap structure uninfluenced by conscious search, we might reflect the structure of memory more simply" (p. 34). This approach recognizes the potential relationship between automaticity and structure (Bargh, 1982), which applies to schema research in that schemas are thought to exert an automatic influence on cognitive processes. Furthermore, evaluation of responding that is less vulnerable to controlled, strategic processes may minimize some of the confounds of self-report measures, such as social desirability (Ferguson, Rule, & Carlson, 1983).

The Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) shows promise for assessing memory-based cognitive structures referred to in schema theories. The IAT measures automatic associations in memory (automatic in the sense that evaluations occur outside conscious control and, at times, outside conscious awareness), thus appearing to share many of the qualities ascribed to schemas. In addition, this methodology minimizes the influence of self-presentational concerns (Greenwald et al., 1998) and typifies the relationship between automaticity and structure outlined by Posner and Warren (1972). Moreover, the IAT uses a within-subject design, so the influence of mood state is controlled because the anxiety-evoking stimuli are present in all conditions being compared.

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The IAT has been used increasingly to study constructs such as social prejudice (Dasgupta, McGhee, Greenwald, & Banaji, 2000; Rudman, Greenwald, Mellott, & Schwartz, 1999), and the instrument has adequate psychometric properties (for a review, see Greenwald & Nosek, 2001). Similar to many tasks used by social cognition researchers (Fazio, 2001), the IAT is a reaction-time task that purportedly reflects strength of association between concepts in memory. Specifically, the task involves comparing the time taken to classify stimuli when paired categories match a person's automatic associations versus the time taken when paired categories contradict automatic associations. In the case of spider phobia, we compared response time for classifying stimuli (e.g., photographs of spiders) when category pairs matched the hypothesized fear network or schema (e.g., spider was paired with negative attributes) with response time for classifying stimuli when category pairs contradicted the hypothesized fear schema for spider-phobic individuals (i.e., spider was paired with positive attributes). The IAT is a relative measure; therefore, we used snakes as a comparison for each classification trial (see *Measures* section for more detail).

In an earlier study, we evaluated whether fearful individuals would show implicit fear associations consistent with cognitive models of fear (Teachman, Gregg, & Woody, 2001). We examined whether self-reported fears of particular animals would be associated with specific implicit associations toward the feared stimulus, as measured by the IAT. Participants included individuals who were extremely afraid (but not phobic) of either snakes or spiders but unafraid of the other animal. These groups served as useful controls for one another, given that spiders and snakes both theoretically represent evolutionarily prepared fears (Seligman, 1971) and share a comparably negative societal evaluation. The IAT response latencies effectively discriminated between individuals with specific animal fears and were robust across several different semantic categorizations (e.g., afraid, dangerous). In addition, Egloff and Schmukle (2002) demonstrated that automatic anxiety associations with the self, measured by the IAT, showed good psychometric properties, including internal consistency and predictive validity.

The current study tested the prediction that automatic associations would change following fear-reduction treatment for spider phobia. This extends our initial findings through the use of a clinical sample, behavioral assessment, and investigation of changes over treatment. Even in specific phobias, researchers have hypothesized that cognitive biases—along with avoidance—maintain pathological anxiety (see review by Merckelbach, de Jong, Muris, & van den Hout, 1996). Accordingly, the present study evaluated whether implicit fear associations among spider-phobic individuals change over the course of successful treatment, and whether such changes are consistent with changes observed in behavioral and self-report measures of fear immediately after treatment and at 2 months follow-up.

Method

Participants

Thirty-one phobic participants completed the treatment program (mean age = 32.6 years, *SD* = 10.7, range = 18–55). Reflecting the disproportionate prevalence of spider phobia among females, 84% were female. In addition to exhibiting extreme fear and avoidance toward spiders, phobic participants were required to be over 17 years old and not suffering from current major depression or psychosis. These exclusion criteria were included because of concerns about biased responding on the implicit association measures of fear (based on evidence that depression affects cognitive processing differently than fear does; e.g., Eysenck, 1992).

An additional exclusion criterion was that the spider-phobic participants could not have an extreme fear of snakes, as indicated by self-report during the initial telephone screen—a necessary criterion because the IAT compared relative associations toward snakes versus spiders. Approximately 20%–25% of potential participants were excluded because of this criterion. Four additional eligible phobic participants began treatment but dropped out before completing the treatment program. These participants were excluded from analyses because they did not receive treatment. Of the 31 who completed treatment, 2 participants did not return for the follow-up assessment, so their data were included in all analyses except those involving follow-up data.

Most of the 30 participants in the nonphobic control group were female (77%), and they had a mean age of 24.0 years (*SD* = 9.4, range = 17–56). Exclusion criteria were an extreme fear of either snakes or spiders, current clinical depression, or psychosis. One additional participant from the control group was omitted from the study because she did not return for the posttest assessment.

Measures

Diagnosis. A trained research assistant administered the simple phobia, major depression, and psychotic screening sections of the *Structured Clinical Interview for DSM–IV* (*SCID–IV*; First, Spitzer, Gibbon, & Williams, 1997) during an initial telephone interview for all participants. The principal investigator subsequently confirmed spider phobia diagnoses during an individualized interview in preparation for group treatment.

Questionnaires. Participants completed two spider fear questionnaires. The Fear of Spiders Questionnaire (FSQ; Szymanski & O'Donohue, 1995) is an 18-item endorsement measure that assesses avoidance and fear of harm from spiders, such as degree of agreement with the statement, "If I came across a spider now, I would leave the room." The Spider Phobia Questionnaire (SPQ; Klorman, Weerts, Hastings, Melamed, & Lang, 1974) is a 31-item true/false measure that describes a range of situations involving interactions with spiders, such as, "I avoid going to parks or on camping trips because there may be spiders about."

IATs. The IAT is a response-time task in which individuals classify words or pictures into superordinate categories to index the relative strength of their automatic associations to target constructs. (See http://www.yale.edu/implicit for more information and a sample test.) Implicit associations to one target category are assessed relative to associations with a comparison target category. In this case, automatic associations with spiders are measured relative to automatic associations with snakes. For each IAT task, we presented two sets of category pairs simultaneously. One pair was always spiders and snakes (the target categories); this pair was matched with a second, simultaneously displayed descriptive category pair (good and bad, danger and safety, disgusting and appealing, or afraid and unafraid).

Participants saw four category labels on the computer screen concurrently: a target and descriptor category paired on one side of the screen (e.g., spiders and disgusting) and the opposing set of target and descriptor categories paired on the other side of the screen (e.g., snakes and appealing). Stimuli representing one of these four categories appeared in the center of the screen on each classification trial; the task was for participants to indicate on which side of the screen each stimulus belongs (i.e., what category it fits into) by a key-response indicating left side or right side. Thus, participants are forced to classify stimuli related to all four concepts by using just two responses (left or right) because each side of the screen has two of the four concept labels.

Figure 1 illustrates a sample classification trial. The target category "snake" and the descriptor category "danger" have been paired on the left side, and "spider" and "safety" categories have been paired on the right. The correct response for all participants in this case is to classify the stimulus into the spider category on the right side of the screen using the right-sided key. Participants are simply placing the stimuli into the assigned category, not stating their direct opinion about the stimuli. (They learn which stimuli fit into each category during practice trials.) An incorrect response would be followed by feedback—that the classification was inaccurate—before immediately proceeding to the next classification trial. After a series of trials with these category pairings, the categories would be switched so that the snake category would be paired with safety, and spider would be paired with danger. In this example, the stimulus is a photograph of a spider, but in different trials, stimuli were pictures (of spiders or snakes) or words (fitting the descriptor categories, such as "harm" for the category "danger").

The idea behind the task is that stimuli are classified more quickly when the target and descriptor category pairings match the individual's automatic associations with the target categories (snake/spider) versus when the target and descriptor category pairings are mismatched. Phobic participants classified the pictorial and word stimuli when the target animal categories were paired with associatively "matched" descriptor categories and also when the target animal categories were paired with "mismatched" descriptor categories (matched in the sense of reflecting their hypothesized individual automatic associations to the constructs). The predicted matched category pairing for spider-phobic participants occurs when spider is paired with a negative descriptor (and snake with a positive descriptor), and the mismatched category pairing occurs when spider is paired with a positive descriptor (and snake with a negative descriptor). The control participants completed the identical tasks; however, neither category pairing condition was considered matched or mismatched, given that this group was expected to hold equally negative associations toward snakes and spiders (so no difference in classification times across the category pairing conditions was expected).

The dependent variable is the difference between average latency of responding across all trials when one set of categories is paired (e.g., spider + safety and snake + danger) minus average response latency when the opposing set of categories is paired (e.g., spider + danger and snake + safety). Thus, the average response time for matched category pairs (according to hypothesized automatic associations) is subtracted from response time for mismatched category pairs. We predicted that the phobic sample would show a highly fearful view toward spiders and that this spider fear schema would be much stronger and more elaborated than their view toward snakes. Consequently, we would see the phobic participants displaying more negative automatic associations toward spiders than toward snakes. This *IAT effect* occurs when the phobic group is significantly slower at classifying stimuli when spider is paired with a positive descriptor compared with the condition when spider is paired with a negative descriptor. In contrast, the nonphobic control sample was expected to have moderately negative views toward both snakes and spiders; however, they were not expected to differ in their automatic associations toward these animals, so no IAT effects were expected.

Three pretested words were used to represent each of the descriptor categories, such as "tempting" to reflect the category "appealing." The stimuli were approximately matched for length and ease of categorization on the basis of pilot data. Similarly, three photos of snakes and spiders were used to represent the target categories. Snakes were selected as the relative target category to compare with spiders because both are common, specific animal fears; moreover, in our pilot work, we established that the snake and spider stimuli were evaluated equally negatively and were matched for the degree to which they evoke fear and disgust. (For more details on the selection of the snake category and the word and pictorial stimuli, see Teachman et al., 2001.) Equal numbers of stimuli from each of the four categories (snake, spider, and two descriptors) appeared during each IAT task, so that participants classified both words and pictures in all four of the snake/spider IAT tasks.

In addition to the four snake/spider IAT tasks, two control tasks were included to ascertain whether observed changes over treatment in the phobic group were due to spider-specific fear reduction rather than more general changes or testing effects. A task comparing associations toward "fruit" versus "garbage" (paired with the attribute categories "bad" vs. "good") was included as a control for the effects of practicing the IAT tasks repeatedly over time.

Furthermore, the snake/spider tasks were intended to measure fearful associations toward spiders specifically rather than fear responding more generally. Thus, we included a second control task that was a more general fear-related task to increase confidence that change on the snake/spider tasks was due to a change in spider fear rather than changes in fear more broadly. This second control task compared associations toward "fire" versus "other elements" (paired with the attribute categories "afraid" vs. "unafraid"). The pictorial stimuli for the two control tasks were photographs of fruit, garbage, fire, and various natural elements (such as clouds

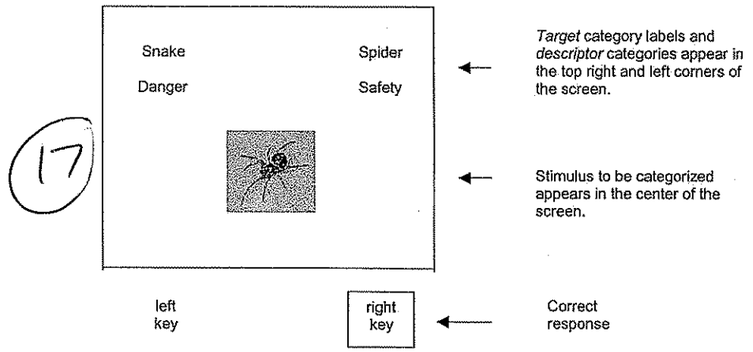

Figure 1. Schematic depiction of the Implicit Association Test procedure. Participants classify the stimulus by using either the right or the left key. The correct classification of the spider picture is on the right key in this example. This classification trial would represent an associatively mismatched pairing for spider-phobic individuals (as they are not expected to associate spiders with safety).

and water), rated by an independent sample of participants as comparable to the snake and spider pictures in valence and fearfulness. The word stimuli used in the control tasks were those used in the afraid/unafraid and bad/good tasks for the snake/spider IATs.

In each IAT task, there were two critical trial blocks: one block of trials where the sets of target and descriptor categories were matched for spider-phobic participants (e.g., spider + disgusting, and snake + appealing) and one block in which the sets of target and descriptor categories were mismatched for spider-phobic participants (e.g., spider + appealing, and snake + disgusting). Based on standard IAT design, and following the methodology used in Teachman et al. (2001), each critical block consisted of 48 classification trials: The first 12 were practice trials, and the remaining 36 constituted the experimental data. The data for the word and picture stimuli were combined because each block (i.e., category pairing condition) of classification trials involved classifying both words and pictures (an equal number of stimuli from all four categories was classified). The analysis examined the average response time for all classification trials in a given block.

The IATs were completed on desktop PC computers and programmed using Inquisit (Draine, 1999) running in either Windows 95 or Windows NT. Participants gave responses for the left-side categories by pushing the "A" key with their left forefinger and responses for the right-side categories by pushing the "5" key (on the numeric keypad) with their right forefinger.

Behavioral avoidance task (BAT). This task measures fear and avoidance in response to a fear-evoking spider. A large (4-inch long) harmless tarantula was placed in a cage at one end of a room. Participants were asked to enter the room and approach the spider as close as possible, ultimately touching the spider. Participants were explicitly told that they could escape this task at any point. At several steps throughout the task, the experimenter prompted participants to give a verbal report of their current anxiety and disgust levels on a 0–100 scale, where 100 represented extreme emotion. To avoid influencing participants' sense of safety, an independent evaluator (i.e., not the therapist) conducted the BAT.[1] As soon as participants indicated that they did not want to continue further in their approach to the spider (or when they touched the spider), final ratings of anxiety and disgust were obtained.

Procedure

Participants were recruited from the Yale University campus and surrounding communities by posting signs and advertisements in local newspapers and offering monetary compensation. Notices directed toward phobic participants also offered free treatment in conjunction with participation in a research study. Interested participants phoned the clinic, and a trained research assistant administered the diagnostic screening interview by telephone. Phobic participants subsequently took part in an idiographic assessment session with Bethany A. Teachman, followed by three weekly 90-min group sessions of fear reduction.

During the first assessment, all participants completed the six IAT tasks (four snake/spider tasks and two control tasks), the behavioral avoidance task, and the snake fear questionnaires in counterbalanced order. The IAT tasks were presented in random order. In addition, within each IAT task, the order in which the spider + positive attributes versus spider + negative attributes blocks appeared was counterbalanced. After receiving initial instructions on the task, all participants initially completed an unrelated practice IAT task (categorizing green vs. white objects) to ensure that they understood the procedure. Participants were asked to proceed as quickly and as accurately as possible. Error feedback after each incorrect classification trial, and accuracy data at the end of each block, were provided (e.g., participants were told the percentage of stimuli they had classified correctly after each block). Following the pretest session, the phobic group immediately began treatment.

Once the phobic participants had concluded the three 90-min sessions, they completed a posttreatment assessment that was identical to the pretreatment assessment. The normal control group also returned after 2 weeks for their second assessment (to match the phobic group for time between assessments), which was the same as the initial assessment. Finally, the spider-phobic group returned to the clinic 2 months following the end of treatment, again completing the identical assessment procedures.

Therapist. Bethany A. Teachman served as the therapist for the study. She was trained and supervised (using audiotapes of sessions) by a licensed clinical psychologist specializing in the treatment of anxiety disorders, and supervision was maintained throughout the study. A trained research assistant accompanied the therapist during each session to serve as a note-taker and to model interactions with the spider. Different assistants were used for various groups, but all were graduate students who were familiar with the principles of cognitive behavior therapy.

Treatment. The treatment protocol was based on *Mastery of Your Specific Phobia: Therapist Guide* (Antony, Barlow, & Craske, 1997). The protocol was modified to fit a weekly, three-session group format, given evidence that spider phobia can be effectively treated with a short, intensive exposure program (Arntz, Lavy, van den Berg, & van Rijsoort, 1993; Öst, 1996). Groups (N = 11) varied in size from 2 to 6 persons (mean size = 3.7 persons, SD = 1.0). The treatment involved gradual in vivo exposure. Participants were simultaneously encouraged to counter their maladaptive beliefs, such as that spiders are dangerous or that anxiety is unmanageable. Furthermore, the therapist provided factual information about the general dangerousness of spiders as well as information about poisonous local spiders.

Results

Data Reduction

Prior to conducting the planned analyses, data were examined for outliers and excessive error rates following standard IAT analysis procedures (Greenwald et al., 1998). Response latencies less than 300 ms or greater than 3,000 ms were counted as erroneous and recoded as 300 or 3,000 ms, respectively. Data were also deleted if the error rates (i.e., percentage of stimuli classified incorrectly) on the critical IAT blocks were greater than 30%.[2] As a result of these checks, data from the control IAT tasks for 3 participants were omitted.

Descriptive Statistics

The phobic and control groups differed markedly on measures of spider fear, as expected. On the FSQ and SPQ, our phobic group was comparable to the phobic sample in the Muris and Merckelbach (1996) study (our sample means: FSQ = 84.9 ± 13.7, SPQ = 19.7 ± 4.8; Muris & Merckelbach means: FSQ = 89.1 ± 19.6, SPQ = 23.2 ± 2.9). To simplify analyses, the spider fear questionnaires were standardized and averaged for a composite score. At the initial evaluation, the correlation between the FSQ and SPQ was .65 for the phobic group and .50 for the

[1] Due to scheduling conflicts, on occasion the therapist was the only person available to conduct the BAT for the phobic participant. In these instances, all efforts were made to reduce demand characteristics and safety effects.

[2] We used a more conservative cutoff rate of 20% in an earlier study (Teachman et al., 2001) because the sample was composed of college students. Given the more heterogeneous community sample in the present study, a 30% cutoff rate seemed more appropriate given that participants probably had less computer experience, which conceivably contributed to higher error rates.