cures about how treatment works when it does and how to improve treatment strategies. Understanding implicit cog-
nition can lead to more accurate assessment of maladap-
tive cognition and judgment as well as enhance the success of treatment and improve our ability to estimate prob-
ability of relapse and vulnerability of developing disorders.

Although individuals often consciously choose how to act and what to think about, a good proportion of behav-
ior and thinking is automatic. Through practice, many behaviors become automated or habitual, and many as-
pects of cognitive processing occur outside awareness and beyond conscious control. Automatic processing, charac-
terized by a rapid, involuntary stimulus-driven registration process (Beck & Clark, 1997), is clearly adaptive because
danger is best detected quickly. However, for people with anxiety disorders, the involuntary, fear response is trig-
ergged at times when objective danger is not present. Cogni-
tive theories have proposed automatic, or implicit, cogni-
tive mechanisms by which this process occurs. This article will discuss these proposed mechanisms in light of their potential relevance to clinical practice.

Elements of Implicit Cognition in Anxiety

The basic premise for all cognitive theories of emotional disorders is that problematic behavior and emotional dys-
function arise from, or are exacerbated by, the malinter-
pretation of stimuli (Dugas, 1988, 1997). In his early writings, Beck (1967) drew on the concept of cognitive schema as a way of understanding the thinking process by which individ-
uals make sense of the environment. Schemas are conce-
ptual frameworks that organize the information that screen, code, and evaluate stimuli within a person's range of perception, serving to categorize and interpret experiences. These cognitive processes occur in conscious (explicit) ways as well as in relatively automatic (implicit) ways outside of awareness or beyond conscious control.

Under the rubric of this familiar theory, many writers have proposed specific ideas about how cognition might operate in psychopathology. For example, Beck and Clark (1997) propose a three-stage model to explain the role of explicit cognition and implicit information processing in the development and maintenance of pathological anx-
iety. The first stage involves rapid recognition of threat, in a process that is proposed to be entirely automatic. In stage two, the person perceives and recognizes the threat, which sparks activation of a "primal threat mode," facili-
tating efforts to maximize safety and minimize danger. Perception of the threat and activation of the primal threat mode are believed to be automatic in terms of being rapid, involuntary, rigid, and primarily in response to a stimulus. Nevertheless, the initial threat appraisal is also hypothesized to involve some elaborative, strategic cognition—the beginning of semantic analysis of the

threatening stimulus. Finally, in stage three, secondary
elaboration occurs, which involves full activation of elab-
orative, semantic processing. This stage is comparatively slow and effortful, but because the primal threat mode has been activated, cognitive processing of threat infor-
mation may continue to be relatively involuntary.

In the model proposed by Beck and Clark, as well as others following the general cognitive model, cognitive schemata play a role in generating predictions that will receive preferential attention, how ambiguous stimuli will be interpreted (e.g., dangerous vs. safe), and which ele-
ments of experience will be added to memory. The specific predictions that are fear and anxiety schemata should lead the individual to be more attentive to potential threat, more likely to interpret ambiguous cues as threatening, and more likely to remember threat-relevant cues (Beck, 1976; Beck, Emery, & Greenberg, 1985).

These information processing biases represent mea-
surable consequences of the theoretical schema construct, and they form the cornerstone of the research conducted thus far in implicit cognition in anxiety. Each of these bi-
as is thought to result from the danger-focused schema or cognitive framework that guides the individual to make threat-enhancing evaluations across the range of cognitive pro-
cesses involved in making sense of the environment. In this way, the schema functions as an overarching back-
drop that works like "anxiety-tinted glasses." The theory notes that the anxious individual is frequently unaware of the ways the anxious schema leads to erroneous judg-
ments of danger. Consequently, understanding the pro-
duced cognitive biases can explain the ways in which im-
plicit cognition may play a critical role in pathological anxiety.

Researchers have looked for evidence of each of these information processing biases, and excellent reviews have been published by MacLeod and Mathews (1990), MacLeod and Mathews (1994), and McNally (1996). Testing

the cognitive model has been challenging because the concept of schema has been hard to define and oper-
ationalize (Fiske & Taylor, 1991). For example, traditional questionnaire measures are largely unable to capture basic associations in memory, a popular characterization of

schema. Although self-report has been useful to examine cognitive content, questionnaires are not likely to reveal cognitive structure or processing (Segal, 1988). Cognitive

structure in this sense may be understood as a coherent set of interconnected associations in memory that are not solely present as a consequence of state anxiety. More re-
cently, researchers have relied on reaction time techniques and other innovative tools to test predictions derived from the cognitive model of anxiety.

The next few sections of this article outline the empiri-
cal support for each of the hypothesized cognitive biases, describe the nature of automatic thoughts in anxiety, and

counter additional evidence for implicit cognition in anxiety reflected by automatic associations in memory. We focus on these elements of cognitive processing for review because of the wealth of research on these topics and because these processes are thought to be central to the maintenance and perhaps etiology of anxiety disorders according to cognitive models of emotional dysregulation.

The second half of this article will focus on the rele-
vance of this area of research for clinical practice.

Attention Bias

Cognitive theories suggest that fear-relevant schemata influence allocation of attention toward stimuli that are appraised as threatening within the context of the schema. Evidence consistently suggests that an attention bias does appear to operate in anxiety. Anxious individuals are hypo-

labeled by the phenomenon of attentional bias to threat-related stimuli (Yovel, 2000) and they preferentially process these stimuli, even at an automatic level (MacLeod & Rutherford, 1998; Mathews & MacLeod, 1994). The attention biases consistently ob-

served in anxiety disorders are presumed to be a conse-
quency of schemata that misclassify innocuous stimuli as dangerous because of their association with elements in the fear schema.

The modified stroop task has been the most common tool for examining attention biases in anxiety. The Stroop is a reaction time task that measures how long a person takes to name a word's ink color. Researchers vary the content of the words, with the prediction that anxious persons will name the color of threat-relevant words more slowly than threat-irrelevant words because their attention will be disrupted from the color-naming task to the semantic content of the words. For example, clients with social phobia take longer to name ink color (e.g., blue, red) for words that convey social threat (e.g., embarrasment) than for words conveying physical threat (e.g., ambulance; Hope, Rapee, Heimberg, & Dombeck, 1999; Mathew, Heimberg, & Hope, 1995). Clients with panic

disorder show the opposite pattern (Hope et al., 1994). Naturally, scholars have debated whether this response time difference is truly indicative of attentional bias (Dalgleish & Watts, 1996; Williams, Watts, MacLeod, & Mathews, 1993), but attentional bias has also been ob-

served in anxiety using a very different paradigm, called the dot-probe. Research participants are asked to indi-
cate the location of a dot that appears on a computer screen immediately after the appearance of other stimuli, some of which are threat-relevant. If clients consistently re-
spond faster when the dot appears in the same spatial lo-
cation as threat cues, then an attentional bias is inferred.

The idea is that finding the dot takes less time if the partic-
 participant was already looking at the location where the dot appears than if the participant had to visually search for it. Research using this task has demonstrated clients with

generalized anxiety disorder respond faster when the dot follows words representing social or physical threat (Mac-
Leod, Mathews, & Taira, 1988). Clients with social phobia show this effect only for social threat cues (Ammondson & Stein, 1994), and anxiety-sensitive individuals respond faster to probes in the location of physical threat cues (Rogol, Georgiou, & Hunt, 2001). Although people with anxiety disorders selectively attend to threat-relevant material, the process of selective attention is not pathological per se. The normal process of selective attention is believed to become maladaptive when fear-relevant schemata direct it, because this influ-

ences the anxious person to perceive potential threat in circumstances under which another person would not. The next steps for researchers are to demonstrate that at-
tentional bias occurs with real fear-relevant stimuli rather than words and pictures (McNally, 1995) and to illustrate how the bias affects emotion, explicit cognition, and behavior (Eisendrath, 1997).

Interpretation Bias

Throughout the day, we all make judgments about the safety of our environment. In a simple act like crossing

the street, pedestrians judge whether cars are going to stop or turn through the intersection. Situations like this involve assessing relative degree of danger, and it is no surprise that anxious clients tend to interpret ambiguous

stimuli in a threatening way (Segal, 1990). Cognitive the-
ory explains this phenomenon by pointing to cognitive biases. Because the person's cognitive framework (schema) involves a view of the world as dangerous, the person will err on the side of interpreting a situation as risky.

If an individual's cognitive framework is organized in a

way that highlights potential danger in evaluation of

everyday events, then this effect should be measurable by providing a stimulus that could be interpreted in more than one way, such as pictures or vignettes that could be taken as benign or threatening. Research has shown that clients with panic disorder interpret threat for ambigu-

ous bodily sensations but not for social or general events (Clark et al., 1988; Stolar & McNally, 1991). Interpre-

tation bias in social phobia appears especially poignant, because clients consistently judge their own social performance much harsher than observers do (Rapee & Lim, 1992; Stopa & Clark, 1995; Woody, 1996).

Memory Bias

Implicit memory biases are characterized by emotional

influence on memory in the absence of conscious or explicit recall of the precipitating information. Explicit

memory processes, on the other hand, involve a conscious effort to remember information. The research on memory bias in anxiety is confusing, making it difficult to draw firm con-
clusions (Dalgleish & Watts, 1995). Some reviewers assert
that implicit memory bias is frequently observed in anxiety disorders (MacLeod & Rutherford, 1998), while others argue that the evidence of implicit memory bias is weak (Russo, Foa, & Bowles, 1999). Explicit memory tasks sometimes show differences between anxious clients and normal controls (Becker, Rinck, & Margraf, 1994; Cline, Shear, Gancienne, & Zetlin, 1994), but many studies fail to find explicit memory differences (Brosschot, 1990; Mogh, Mathews, & Weinman, 1987; Rapee, McCabe, Meville, Ravenscraft, & Roddy, 1994).

Interestingly, memory biases are observed more reliably in depression (Tsigas & Watts, 1999), raising the question of whether cognitive theories would expect a uniform pattern of biases (e.g., equivalent processing biases influencing attention, interpretation, memory, etc.). As more data are collected, cognitive theories may be modified to reflect distinct processing biases across disorders.

Although the role of systemic memory bias in anxiety disorders is somewhat contentious among researchers, clinicians regularly encounter anxious clients who seem to recall only the threatening aspects of an experience. An important distinction for treatment planning is whether the report is accurate, represents biased interpretation at the time of the event, or involves biased recall of specific elements of the event. Given the poor evidence for explicit memory bias, even among well-designed studies, it may be more consistent with the current research literature to treat these accounts as biased interpretation.

Automatic Thoughts

Negative automatic thoughts are a classic example of the blend of implicit and explicit processing. The term "automatic thoughts" has intuitive appeal because it suggests unbidden thoughts that jump to mind without conscious introspection. In some respects, however, the term is a misnomer, given the way cognitive psychologists use the term "automatic." As Beck and Clark (1997) clarify, "These thoughts are automatic in the sense that they are involuntary, rapid and specific to the threatening situation. However, they do not share some characteristics of elaborative processes in that they are the products of an initial semantic analysis." Threat and individuals can be taught to become aware of their automatic thinking (p. 53).

Automatic thoughts reflect another product of the anxiety-biased schema. If an individual has a tendency to attend to and professionally recall potential threat cues, as well as interpret ambiguous situations as dangerous, then the individual would be expected to experience corresponding negative thoughts and subjective anxiety. Common examples include: "I am vulnerable and will be hurt," "Something terrible is going to happen," and "I can't cope with anxiety." Such thoughts are adaptive in situations of objective danger, but they lead to maladaptive avoidance when erroneous danger appraisals occur.

These erroneous appraisals are the hallmark of pathological anxiety. What is "automatic" about automatic thoughts? Shiffrin and Schneider (1977) defined three elements of automatic processing that have shaped research in this field. In their view, automatic processing is capacity-free (i.e., requiring no cognitive resources or effort), involuntary (i.e., obligatory and difficult to control), and unconscious (i.e., requiring no conscious awareness). McNally (1995) examined these criteria with respect to anxiety disorders and concluded that automatic biases in anxiety disorders can be fundamentally characterized as involuntary, but not necessarily capacity-free or consistently unconscious. The clinical manifestation of this observation is that some clients may continue to feel afraid even while consciously evaluating their fear as irrational. Consider a person with obsessive-compulsive disorder who understands how HIV is transmitted yet still feels the need to avoid any red object due to irrational fears of contamination. Likewise, clients who are sufficiently distracted by something else (i.e., their cognitive resources are fully occupied) may not notice a danger cue, illustrating McNally's point that so-called automatic biases in anxiety disorder may require cognitive resources rather than being capacity-free.

Automatic Associations

Automatic associations theoretically reflect simple elements of the anxious schema, which guide higherlevel cognitive processes (like interpretation biases), which in turn contribute to subjective anxiety and avoidance behavior. We use the term automatic associations to refer to memory-based links between two concepts. These links or associations are automatic in the sense that evaluations occur outside conscious control and, at times, outside awareness. Automatic associations share many of the qualities ascribed to schemas because the cognitive structures referred to in schematic processing are often described as interconnected associations in memory. They are cognitive structures in the sense described by Powers 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. 54)

Social cognition researchers have recently developed a paradigm that may be useful for examining implicit cognitive processing related to fear. The Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) has been used to measure unconscious attitudes primarily related to social prejudice (Dasgupta, McGhee, Greenwald, & Banaji, 2000; Rodman, Greenwald, Mellott, & Schwartz, 1999) and is now being tested more broadly in other areas of psychology. For more information and a sample test, see www.implicit.harvard.edu. The task measures automatic memory-based associations, and is frequently interpreted as an index of implicit attitudes that do not require conscious introspection and are relatively uninfluenced by conscious control. In this respect, the IAT reflects the involuntary nature of anxiety because it is difficult to strategically alter one's responses, even if one is aware of the purpose of the task. (This does not necessarily reflect automaticity in the sense of occurring outside conscious awareness).

In an initial study applying the IAT to anxiety, we found that associations related to fear-provoking stimuli were represented at an automatic level, and these representations were related to self-reported fear (Teachman, Gregg, & Woody, 2001). The study was designed to evaluate the degree to which self-reported fears of particular animals would be associated with distinct implicit attitudes about the feared stimulus. Participants included individuals who were extremely afraid of either snakes or spiders but unafraid of the other animal. These groups effectively served as controls for one another, given that spiders and snakes both theoretically represent maximally prepared fears (Seligman, 1971) and share a comparably negative societal evaluation. The IAT responses discriminated between individuals with snake versus spider fears on the basis of the animals of afraid, dangerous, disgusting, and bad. A subsequent study showed that performance on IAT tasks using these four descriptors correctly classified 79% of participants as phobic or not (Teachman & Woody, 2003). De Jong, van den Broek, and Hijnjting (2003) also used the IAT to examine implicit spider fear, and found reliable (across assessment points) evidence of negative automatic associations toward spiders.

The IAT may prove to be a particularly useful tool to assess implicit fear cognition because it assesses involuntary implicit associations in memory rather than those under strategic control. Importantly, it appears to be relatively free of the influence of social desirability and demand effects.

Relevance to Clinical Practice

Applying basic research findings to clinical practice always presents a challenge, but the findings in implicit cognition have potential to add to assessment and intervention approaches for anxiety. Implicit cognition can potentially enhance understanding of cognitive specificity, delineate processing biases across disorders, identify idiosyncratic cognitive profiles to provide more individually tailored treatment, and improve the predictive utility of cognitive vulnerability markers for anxiety. We will discuss each of these points in turn and then outline possible targets of treatment, including attention, interpretation, and memory biases, and suggest approaches to modify automatic fear associations.

Cognitive Specificity

Despite the similarity among cognitive theories of emotional problems, research in information processing suggests that different disorders may be associated with different types of processing biases, rather than a common set that functions similarly across emotional problems. Most of the cross-disorder comparisons of cognition have involved cognitive content, such as themes of loss in depression versus danger in anxiety (Beck, 1976; Jones & Menzies, 1998; Woody, Taylor, McLean, & Koch, 1998). Few researchers have emphasized process specificity, or considered differences in attention, judgment, or different types of memory. Comparing findings related to the process of cognition in depression and anxiety can lead to interesting hypotheses about what distinguishes these closely related problems.

Williams et al. (1997) proposed that the early stages of information processing play a critical role in pathological anxiety, whereas the later stages are more integral to depressive cognition. At the risk of oversimplifying their theory, they point to the distinction between early and later cognitive processing when the processes of priming versus elaboration occur, as delineated by Graf and Mandler (1984). The early steps in the process, involving activities like attention, when information is integrated or primed in the system, are thought to be relatively automatic. During later processing, the individual employs more extensive conscious processing and tries to construct meaning of the stimulus rather than simply detect it.

Williams and his colleagues suggest that anxiety disorders are characterized by biased processing of threat-oriented information that occurs mainly at the early priming stage, affecting the passive, more automatic aspects of information processing. This accords well with the robust attentional bias in anxiety disorders we discussed earlier, and it may be an explanation for the inconsistent findings on memory bias. In contrast to the confusing results for anxiety, memory biases are more consistently observed in depressed clients. Williams et al. argue that these more consistent memory effects may reflect a bias in later elaborative processing. Note that the terms early and late processing are used for ease of discussion, but
In related work, Mogg, May, and Eysenck (1989) suggest that anxious clients, in an effort to manage anxiety, may use strategies like distraction to actively avoid elaborative processing of threat material. As a consequence, anxious individuals may not think carefully about threat-related information, despite their initial selective attention toward this same information. This failure to elaborate would prevent adequate processing to construct information into long-term memory. In essence, avoidance strategies may be so effective that anxious individuals ultimately remember less than normal controls. This hypothesis is supported by a study showing that clients with social phobia who were about to give a speech showed poorer recall for faces compared to normal controls (Pérez-López & Woody, 2001). Such cognitive avoidance contrasts with the ramification characteristic of depression, suggesting a need for different targets of treatment.

Clinical Implications. Distinct cognitive therapy approaches have been developed for anxiety disorders and for depression, reflecting differences in cognitive content. Developing specific approaches that account for differences in implicit cognitive processes may also be fruitful. If anxiety is mainly characterized by biases in the passive, automatic aspects of encoding, then useful intervention may involve using specific strategies to strengthen attention to cues indicating relative safety and to counter the automatic bias to attend to stimuli consistent with the threat schema. One example of this type of intervention is attentional training (Papageorgiou & Wells, 1998; Wells & Papageorgiou, 1998), in which clients learn strategies to manipulate their focus of attention and practice taking an alternative attentional perspective. More cognitive therapies already encourage more elaborate processing of situations that are perceived as threatening as a way to facilitate more objective danger appraisals.

Iodiographic Cognitive Profiles. Within a given disorder, core fears and “danger” associations differ across clients. In a treatment study of spider phobics, some clients showed concern that the spider itself was dangerous (i.e., would cause physical harm), while other phobics feared danger following from the anxiety response (i.e., fearing they will go crazy). Still others were motivated by disgust and concern about contamination from the spider (Thorne & Salovey, 1997). Some clients readily report their fears and the internal and external stimuli that trigger them, but other clients have difficulty accessing this information. Thus far, research on implicit cognition has not provided tools for clinicians to use in detecting idiographic cognitive profiles, but recent research on automatic associations may hold promise in this regard.

Using the IAT described earlier, we examined automatic associations over the course of treatment for spider phobia (Teachman & Woody, 2003). Although we did not directly examine idiographic automatic associations, the results suggest it may be useful to do so. We found that implicit attitudes about spiders showed treatment-related changes with regard to some attitudes (afraid and disgusting), but not others (danger and fear). Particularly, methodological factors may explain the results, but it is also plausible that dominant automatic fear associations differ across individuals with the same specific phobia.

Furthermore, these results suggest that some treatment interventions, in this case primarily in vivo and self-directed exposure, may help clients change some aspects of schema about the feared stimuli while leaving others unchanged.

Clinical Implications. When the technology improves to enable measurement of automatic associations in clinical settings, then interventions may be targeted to match these automatic associations in addition to the explicit cognitions that are now the typical focus of cognitive therapy. For example, phobics who fear the spider will attack could practice associating spiders with “safety,” while phobics who fear they will become so anxious they will lose control could practice associating spiders with “coping” or another concept that reflects mastery. In this way, clinicians could be more confident that each client’s unique fear profiles would be targeted.

Cognitive Vulnerability.

In the early part of this article, we briefly reviewed what is currently known about cognitive biases in anxiety disorders. Although these implicit cognitive processes are hypothesized to be involved in the maintenance (and perhaps etiology) of maladaptive fear and anxiety, research on the causal status is quite thin. Some evidence indicates that self-report measures of some cognitive constructs, like anxiety sensitivity, have some predictive value in identifying those vulnerable to development of pathological anxiety (Schmidt, Lersch, & Jackson, 1997, 1999).

In theory, persons should be vulnerable to problems with anxiety if they are vigilant to the occurrence of a given type of danger cue, routinely interpret ambiguous situations as dangerous, or selectively recall dangerous elements of events. Therefore, theoretically, evaluating cognitive biases may enhance prediction of who is at risk for anxiety disorders. Although theories abound, little experimental research has addressed this question of cognitive vulnerability. In a promising approach, MacLeod and Hagnon (1993) used information processing techniques to track subsequent associations. In women undergoing a stressful medical diagnostic procedure, MacLeod and Hagnon found stroop task results predicted subsequent negative emotional response even better than self-reported trait anxiety did.

If implicit fear cognition does serve as a critical vulnerability marker for development of anxiety disorders, how might the process work? Power and Dilglish (1997) proposed two possible pathways by which preferential evaluation of threat stimuli may lead to an anxiety disorder. First, selective attending to and recalling threat-related information would likely increase the probability of anxious appraisals. Essentially, the world seems like a more dangerous place if danger cues are salient across multiple cognitive processes. The second proposed pathway involves a low threshold for threat appraisal. Vulnerable individuals may more readily interpret a situation as dangerous, resulting in many different stimuli that would serve as fear cues.

Clinical Implications. If these theories are correct, then measures of implicit cognition could potentially predict not only vulnerability to develop anxiety but also vulnerability to relapse for existing treatment. Clients who show improvement during treatment should be at higher risk for return of fear if their patterns of implicit cognition about the feared stimuli remain unchanged. Reinforcement of automatic fear would render these clients more vulnerable to experience anxiety and avoidance when they revert to more heuristic, less effortful processing in the face of a major stressor or unexpected confrontation with the feared stimuli. Should this hypothesis prove accurate, it may have significant consequences for determining when to terminate treatment and how to predict high-risk situations for a given individual. This predictive validity would be important not only for anxiety disorders, but also for other disorders like depression, where rates of relapse are higher.

Targets of Treatment.

The involuntary nature of implicit cognition in anxiety presents a challenge for helping clients to change these anxiogenic cognitive processes. Clients often feel their reactions to feared stimuli are automatic, in the sense of not being under their intentional control (Mayer, Merckelbach, & Mursi, 2000). Certainly, the uncontrollability of intrusive ideation is a prominent characteristic of pathological anxiety. McNally (1995) goes as far as to postulate that the inability to terminate fear-evoking ideation once it has begun may be the key to pathological anxiety. Supporting this idea is evidence that children may learn to inhibit automatic fearful responding, and this process plays a role in determining whose fear remits versus whose becomes pathological. Consequently, let’s to Kyre-Brown and Skidmore show an attentional bias toward spiders regardless of their reported spider fear, but among children aged 9 to 12 years, only phobic participants show the bias (Kインド, Bierman, & Bronscho, 1997; Kindt, van den Hout, de Jong, & Hoekema, 2000). Thus, providing strategies to counter the involuntary biases that drive the fear response may augment current anxiety treatments.

Attenes. One target of treatment relevant to this discussion is focus of attention. Research on self-focused attention has most clearly documented effects to social phobia, but it is underutilized as a factor in other disorders as well. Any time an individual’s internal experiences (cognitive or physical) constitute a potential threat, self-focused attention would be expected to exacerbate anxiety. Examples would include body scanning in panic disorder and hypochondriasis, as well as vigilance for unaccepted thoughts in obsessive-compulsive disorder. The treatment goal would be to broaden the focus of attention from the to include other aspects of the environment to facilitate a fuller and more accurate appraisal of the situation. Attention training, described earlier, may help achieve this goal.

Interpretation. Although interpretation biases may occur on an implicit level (i.e., rapidly and/or outside awareness), strategic cognition may still help the client interpret so that he or she does not act on the initial interpretation but instead investigates the situation more thoroughly. This type of goal is standard fare for cognitive interventions for anxiety, but there has been very little research to demonstrate that these strategies can influence implicit cognition. Some support for the contention that automatic interpretations can be influenced by conscious strategies comes from studies indicating that providing information to individuals about their threat expectations can modify their electrodermal skin response (Soares & Ohman, 1995). This result is a particularly impressive demonstration because skin conductance is relatively impervious to voluntary control. Learning theorists have gone further, proposing a variety of mechanisms by which maladaptive schemata can evolve to be more in line with actual experience (Rumelhart & Norman, 1978).

Memory. Perhaps because memory biases have not been consistently observed in anxiety disorders, few studies have examined treatment effects on memory bias. One study by Zoellner, Schacter, and Cranke (2000) found intriguing results using a sample of spider-fearful participants. During each of two sessions of in vivo exposure, participants completed measures of general memory, memory for the phobic stimulus (i.e., spider), and recall of their anxiety level during exposure tasks. The authors found that better memory for level of anxiety, but not memory for the spider, was related to lower anticipatory and actual anxiety following treatment. These results serve as a reminder that the critical memory for fearful situations may involve aspects of the response, not just the stimulus. More sensitive tools to identify the critical memory bias will be welcome to determine how implicit recall and
recognition guide fear processing, and what interventions might be helpful.

As we have seen, researchers have discovered robust robust memory biases in depression. In this case, it may be helpful to practice repeated rehearsal of positive events to strengthen the availability and salience of these memories. This strategy has proved efficacious in reminiscence therapy for older adults (Arens et al., 1993). Such an approach may also be helpful for anxiety. The idea would be to encourage rehearsal of oneself to be feared elements of fear-evoking situations, such as safety cues or successful coping strategies.

Automatic associations. In contrast to the decades of research addressing attention, interpretation, and memory in anxiety, the examination of automatic associations in psychopathology is quite new. As discussed earlier, initial studies hint toward the potential to assess idiothetic automatic attitudes and identify persons who are vulnerable to relapse or development of anxiety disorders.

For now, several studies (particularly in the field of social cognition) suggest that automatic associations are sensitive to intervention. For example, Dugas and Greenwald (2001) showed changes in automatic racial bias by presenting positive Black American exemplars and negative White American exemplars, leading to a reduction in implicit negative evaluations of Black Americans that lasted for at least 24 hours. Further, Blair, Ma, and Lentz (2001) found that participants who practiced counter-stereotypic mental imagery (i.e., imagining a strong woman) subsequently significantly weakened stereotypes. In the clinical realm, we found that automatic associations about spiders were sensitive to treatment for spider phobia and even predicted phobic avoidance behavior above and beyond self-report (Teachman & Woody, 2003).

Measures of automatic associations may also be useful in clinical tools, although this idea has not been tested. For example, the IAT involves classifying stimuli while pairing different constructs together, such as "spider" and "afraid." For a person who is spider phobic, this is a relatively easy task. However, if the same person is asked to classify stimuli while pairing constructs that stand in contrast to their fearful associations with spiders, such as "space" and "calm," the task might be more challenging, but also may prove useful as an intervention. Categorizing photographs of spiders and spiders in a degree of exposure, which could conceivably lead to more adaptive coping strategies. Although this idea is wholely untested, repeatedly completing a task that involves associating the feared object with a nonfearful descriptor may facilitate the creation of new, more positive, associations to the feared object. To give a panic disorder example, associations of "racing heart" with "exercise" may be strengthened in comparison to "racing heart" with "heart attack." A socially phobic person could practice linking "speech" to "opportuni- ty," rather than to "humiliation" or "failure." Practicing new adaptive associations would probably be insufficient as a solo intervention, but it may constitute a useful home- work assignment and may be a helpful intermediate step for clients who are too frightened to begin in vivo exposure right away.

Priming tasks, where stimuli are presented at varying levels of awareness (e.g., subliminal or supraliminal), may also build new automatic associations relevant to fear schemas. Clients who are resistant to engage in traditional exposure may be willing to participate in exercises which the stimulus is paired outside of conscious awareness (using subliminal presentation). Within this paradigm, level of awareness of the fear-evoking prime might be usefully increased throughout treatment much like traditional fear hierarchies are used. This type of graded exposure may be more palatable for patients who are not willing to confront their fears directly or whose fear-evoking stimuli are impractical for in vivo exposure.

Mechanisms of Change in Implicit Cognition

Implicit cognitive processing is clearly involved in anxiety, although the details of cause and effect need to be worked out. Two questions naturally arise: Does change in implicit cognition contribute to treatment success? If so, which strategies would be useful? Mansell (2000) has offered three possible routes to modify automatic processes, which he notes are similar to pathways that have been proposed to underlie the acquisition of phobias (see Jorg, Morris, & van den Hout, 1996; Rachman, 1991).

One possibility is that the information processing biases could be innate, needing only to be activated by specific background stimuli. Even in this case, Mansell points to evidence that learning can change innate psychological processes. Assuming an innate basis for certain fears, the expression of the fear may nevertheless differ across individuals based on disparities in the tendency to experience habitats of fear during exposure (Clarks & Jack- son, 1985). Additionally, development of fear responses may vary across individuals as a function of the timing of learning events that would trigger the expression of innate fear responses, because people would experience these environmental triggers at different time points of development (Menon & Clarke, 1998). For example, infants need to have experience with self-produced locomotion in order to show distress when placed on a visual cliff.

A second option is that automatic biases may emerge through early learned or innate processes and may be strengthened throughout repetition. Mansell (2000) is skeptical that repetition and habituation (without conscious mediation) can change automatic processing. As evidence, he cites work in cognitive psychology that suggests conscious attention may be required to learn new cognitive processes (e.g., Hoyer & Lincourt, 1988; Norman & Shallice, 1986). As Mansell points out, even purely behavioral treatment strategies may operate through changes in conscious awareness (Kendall & Wilcox, 1976). On the other hand, some evidence suggests implicit learning may occur without demanding attentional capacity (Stadler, 1995), perhaps indicating that conscious appraisal is not required.

Mansell (2000) suggests a third pathway by which implicit cognition may change: Acquiring new information may change higher-order beliefs, which in turn would modify lower-order automatic processes. This final pathway suggests that conscious appraisal manipulated in cognitive therapy may modify implicit cognition. An automatic bias may operate involuntarily but still be modifiable by voluntary cognition, as demonstrated by the finding of electrodermal skin response being influenced by verbal information that altered expectations of threat (Soares & Ohman, 1993). Critical to this conscious appraisal pathway is the assumption that individuals can actively work to change automatic biases, rather than viewing change in automatic processing as a passive process.

Despite the theoretical pathways proposed above, Mc- Nally (1995) has suggested that verbal interventions will not effectively address the early stages of information processing, which are involuntary and possibly unconscious. As a counter, Beck and Clark (1997) have argued that verbal mediation, such as cognitive therapy, is necessary but not sufficient for treating anxiety. They maintain that verbal approaches can deactivate the automatic mood and affective appraisals (Kandlin & Win- coxon, 1976). On the other hand, some evidence suggests that verbally mediated therapies can influence involuntary cognitive processes. Determining the mechanisms guiding the impact of conscious strategies on automatic responding will likely have important clinical and theoretical implications.

Conclusion

In some respects it is too soon to draw conclusions on the clinical applications of implicit cognition in anxiety because the research is in the early stages. On the other hand, this area of research shows hints of exciting possibili- ties that deserve our attention now: clinicians should stay tuned for new developments, and researchers should focus their efforts more directly on applications of this work to clinical practice.

A better understanding of automatic cognition related to fear is relevant for several aspects of cognitive and behav- ioral practice. First, providing clients with accurate information about automatic cognition requires a basic understanding of recent research in the area. Simply educating clients about the involuntary nature of the anxiety response may be a more effective way to help them understand why they feel compelled to avoid situations they logically understand to be safe. Second, information processing, although it occurs rapidly, has distinct components. Cognitive evidence suggests the maladaptive pro- cesses involved in anxiety occur primarily in the early stages, involving attention and detection of threat. This understanding can guide development of attentional training and other techniques to help clients to use cognitive strate- gies to override their maladaptive automatic

persons with generalized anxiety disorder (GAD) relative to nonanxious controls (Mathews, 1995). Mathews et al. reported treatment did not only significantly reduced the selective interference effect among clients with GAD but also eliminated the difference between the clients and nonanxious controls.

Similarly, Fox and McNally (1986) examined a dichotic listening task among clients with obsessive-compulsive dis- order (OCD). The dichotic listening task involves participants simultaneously listening to two streams of information, while researchers examine the degree to which listeners attend to one stream (e.g., fear-relevant stimuli) in preference to the other (neutral stimuli). Fox and McNally reported OCD patients attended to OCD-relevant stimuli better than neutral words before treatment. After treatment with exposure and response prevention, however, clients no longer showed a bias for word type in the dichotic listening task.

Although several promising studies suggest changes in information processing following treatment, still unclear is which aspect of the intervention affected the change in implicit cognition. Nevertheless, current evidence suggests that verbally mediated therapies can influence involuntary cognitive processes. Determining the mechanisms guiding the impact of conscious strategies on automatic responding will likely have important clinical and theoretical implications.

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