Are Cognitive Symptoms of Schizophrenia Mediated by Abnormalities in Emotional Arousal?

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ABSTRACT
We tested 28 individuals with schizophrenia (SZ) and 16 healthy individuals on a test of logical reasoning and “cognitive gating,” defined as the ability to discriminate between relevant and irrelevant information in confirming or disconfirming a given belief. The Logical Reasoning and Cognitive Gating Task tests both processes under neutral and affect-laden conditions. This is done by presenting formally identical constructs using benign and emotionally arousing language. When separated by symptom profiles, we found statistically significant differences for performance and arousal response between patients with delusions, patients with formal thought disorder, and patients with neither delusions nor formal thought disorder, as well as between patients and healthy controls. When analyzed by error type, we found that nearly all errors by delusional patients were caused by overly restrictive information choice, a pattern that may be related to a delusional patient’s tendency to “jump to conclusions” on Bayesian probabilistic tasks. This is in contrast to patients with formal thought disorder, whose low performance resulted also from overly extensive information choice. The tendencies towards restriction were exacerbated by arousal, which is consistent with studies on cognition and arousal in healthy individuals. After briefly examining research on emotional arousal and SZ, and the interaction between emotional arousal and restriction of perceptual cues in healthy individuals, we conclude by suggesting a model which accounts for the distinctive cognitive characteristics of delusional patients by their possessing distinct vulnerabilities to emotional arousal. Specifically, these results suggest the possibility that delusional patients process information in a manner that is essentially intact. However, delusional patients may possess an acute vulnerability to emotional arousal that might cause delusional individuals to behave cognitively as if they were healthy individuals under significantly more severe forms of stress.

CNS Spectrums 2002;7(1):65-69

INTRODUCTION
Standard diagnostic criteria include dampened emotions as one of the symptoms of the negative syndrome of schizophrenia (SZ), a reflection of the flat or inappropriate affect with which many patients present. At the other end of the spectrum is the stereotype of the “madman” pulled apart by his own raging passions. Philosophers from Plato to Descartes have seen reason and emotion as existing in strict opposition to one another, engaged in a zero-sum accounting in which more of either necessarily implied less capability for the other. In our study, we examined psychotic delusions and formal thought disorder, two distinct varieties of “irrationality” in SZ, and these symptoms’ interrelationship with emotional arousal. After presenting some of our preliminary results on logic deficits and patterns of information-gathering in neutral and emotional contexts, we analyze and discuss these results in relation to related research on arousal in SZ and the interaction between emotional arousal and perceptual restriction in healthy individuals. We conclude by presenting a model for delusions in which false perseverative beliefs are the result, rather than the cause, of heightened emotional arousal in patients with SZ.

SYMPTOM-SPECIFIC DIFFERENCES IN LOGICAL REASONING AND COGNITIVE GATING

From the point of view of cognition, delusions have at least five relevant features. First, delusions consist of conclusions that are typically false. Second, these conclusions are formed with insufficient empirical basis. Third, these conclusions are maintained in the face of contradictory information. Fourth, there is a general self-consistency within the set of conclusions; the false conclusions form a “web of beliefs” or a “belief structure” rather than occurring independently and randomly. Fifth, delusions typically have emotional themes and are reinforced by emotional context and stress. In all formal representations of reasoning, false conclusions can result only by two processes: inappropriate choice of “input” (premises) or by invalid inferences from that input. As we have argued elsewhere, most studies on logic deficits in SZ have failed to consider the importance of both these processes, typically concentrating on faulty inferences. Our aim was to investigate the point in the information stream at which reasoning “breaks down” in delusional
and thought-disordered patients, looking at both influences and choices of premises, and elucidating the role, if any, that emotional arousal plays in the disruption of their reasoning. Our study was also largely motivated by the recent empirical work by Garety, Hemsley, and Wessely; Huq, Garety, and Hemsley; Linney, Peters, and Ayton; and others which seem to indicate a peculiar style of information-gathering on the part of delusional patients—a tendency to “jump to conclusions” on the basis of inadequate evidence.

Most studies of the “jumping to conclusions” style of reasoning use the “colored bead” methodology, in which an opaque jar is filled with beads of two different colors. The subject is asked to guess the proportion of beads of one color to beads of another color, typically a choice between two options: 85% white, 15% black or 85% black, 15% white. In order to make this guess, the subject is presented with one bead from the jar at a time and is given the opportunity to take any number of “draws” from the jar as necessary in order to make a confident guess. Results are scored based on the accuracy of the guess, the “confidence-level” of the guess as measured by self-report, and the number of “draws” requested before the subject feels confident enough to guess.

Of the seven Bayesian probabilistic reasoning studies reviewed by Garety and Freeman, all noted significant differences between delusional patients and healthy individuals in their performance on this task, even when matched for intelligent quotient and age. Delusional patients required significantly fewer draws in order to make their decision, and were significantly more confident that the decisions they made were correct. However, as Garety and Freeman noted, the combined results of these and seven other studies, which tested probabilities but not data-gathering, make it clear that the deficit is not one of estimating probabilities as they had first hypothesized, but specifically one of overly restrictive information-gathering. Nor did patients show any deficits in putting together information (deduction) or in testing hypotheses, as long as the relevant premises were preidentified. Garety and Freeman state, “Taking all the [fourteen] studies together, a picture emerges of people with delusions showing a tendency to seek less information to reach a decision, but not, when presented with information, being unable to use it.”

In our study, we wished to determine whether a bias in “jumping to conclusions” extended to “everyday” decision-making in contrast to the somewhat artificial “colored bead” task, and the extent to which this bias is affected by emotional arousal. Additionally, we wanted to revisit the hypothesis posed by von Domarus to determine whether false conclusions might result not only from patterns of information-gathering, but also from invalid inferences—perhaps a deficit that occurs only under emotional arousal. The items that test inferences could serve to refine Garety and Freeman’s observation regarding the patients’ ability to “use” presented information. With this in mind, we tested SZ patients with varied cognitive-symptom profiles on a Logical Reasoning and Cognitive Gating task. This task measures both logical reasoning and patterns of information-gathering in the evaluation, and presumably therefore also the formation, of beliefs under both neutral and threat conditions.

**STUDY DESIGN**

**Subjects**

This study was approved by the New York State Psychiatric Institute and Columbia Presbyterian Medical Center Institutional Review Boards, and all subjects consented to the study before participating; for patients, capacity to consent was determined by their treating physicians. For this preliminary analysis, we examined data from 28 individuals with positive-symptom SZ and 16 healthy individuals. All patients were recruited from the New York State Psychiatric Institute’s Schizophrenia Research Unit, the Washington Heights Community Service, and affiliated outpatient clinics. Patients and controls were matched for education, gender, and age. Diagnosis of SZ was determined by the Diagnostic Interview for Genetic Studies. Symptom status was determined by administration of the Positive and Negative Symptom Scales as well as chart review and/or consultation with the patients’ treating physicians. Patients were grouped by symptoms, possessing either (a) systematized structured delusion(s); (b) formal thought disorder; or (c) no delusions and no formal thought disorder (ie, hallucinations only). For this analysis, there were 10 patients with delusions, 5 patients with formal thought disorder, and 13 patients without delusions or formal thought disorder. Groups were mutually exclusive; thus, no patient was included in more than one group. Although patients are often diagnosed as having both delusions and formal thought disorder, for our purposes this was not possible by definition since patients with disorganized thought processes could not also have ideas that were systematized and structured. Our reason for separating patients this way was to maintain a relatively “clean” cognitive-symptom–specific sample; the limitations of this approach will be discussed along with our results. All healthy individuals were screened for past or present mental or neurologic illness using either the Schedule for Affective Disorders and Schizophrenia-Lifetime Version, as part of the New York State Psychiatric Institute’s Comparison Group Project, or using a structured interview combined with the Wisconsin Psychosis Proneness Scales. All participants who had studied formal logic, computer programming, or “advanced” mathematics (more than one semester of calculus) were excluded from the study. Other inclusion criteria for the study were English fluency, ability to read easily and to understand the directions, and at least average intelligence. Intelligence for both patients and control subjects was assessed by administration of the Wechsler Adult Intelligence Scale. We tested all patients who consented to the study and met inclusion and exclusion criteria. Researchers were blind to symptom profiles during testing and scoring.
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Task and Methods

The 60-item Logical Reasoning and Cognitive Gating Task, developed by Mujica-Parodi and Sackeim, is divided into two parts: Affect Neutral and Affect Laden. Each part contains 30 items. Items in the Affect Neutral and Affect Laden categories are identical in form, differing only in the content of the statements. While neutral items present formal constructs in benign third-person language (e.g., Either John has an apple or John has an orange), emotional items present the same constructs using threatening scenarios posed in the first-person (e.g., Either they are chasing me or they are stabbing me). In each of these 30-item parts, 10 items test the ability to infer using standard intuitive propositional logic inferences (Inferences), while 20 items test the ability to discriminate relevant from irrelevant information in either supporting or disconfirming a given belief (Premise Assessment). In the Inferences subsections, subjects are presented with one or more pieces of information (premises) assumed to be true, and the subjects are asked to choose “what follows” from this information. In the Premise Assessment subsections, subjects are presented with a hypothesis (e.g., Alice says that all firemen like soup). Subjects are then asked to put together information that would show “Alice” to be (in this case) wrong (e.g., John is a fireman, and John does not like soup). These disconfirming pieces of information are presented among several other pieces of information that share words in common with the correct answers but are irrelevant in disconfirming Alice’s statement (e.g., John likes peas, Alice does not like soup, Alice likes firemen, etc.) (Figure 1). Of the Premise Assessment items, half require use of propositional logic while the other half require use of quantifier (class reasoning) logic. In each part, 8 of the Premise Assessment items require choosing evidence to confirm the hypothesis, 24 require choosing evidence to disconfirm a hypothesis, and 8 others require choosing evidence that could provide an alternate explanation for information provided by the hypothesis. All scenarios presented in the items are self-contained; that is to say they do not and could not depend upon prior knowledge about the world, nor do they require that the subject purposefully suspend knowledge about true facts.

One attractive feature of the measure we used is that scoring on the Premise Assessment subsections permits one to discriminate between errors of information Over-Inclusion, errors of information Under-Inclusion, and Contradictions. Errors of Over-Inclusion were defined as the subjects’ use of irrelevant information in evaluating a hypothesis. Conversely, errors of Under-Inclusion were defined as the subjects’ dismissal of relevant information in evaluating a hypothesis. Contradictions occurred either when a subject endorsed two pieces of information that were mutually incompatible (e.g., Alice ate her lunch on the train and Alice was asleep the entire time she was on the train) or when a subject endorsed a piece of information that contradicted the information given for the item. Nearly every item included an option of the form, “No amount of information leads me to believe that (the statement above) is true (or false).” Endorsements of these choices were counted separately as Not Enough Information, the most extreme form of Under-Inclusion, except when subjects endorsed them with other chosen information, in which case they were counted as Contradictions.

FIGURE 1. A sample item on the Logical Reasoning and Cognitive Gating Task (Premise Assessment).

FIGURE 2. Percentage of correct Inference items in neutral and threat conditions for delusional patients, thought-disordered patients, nondelusional/non-thought–disordered patients, and healthy controls.

FIGURE 3. Percentage of correct Premise Assessment items (propositional logic) in neutral and threat conditions for delusional patients, thought-disordered patients, nondelusional/non-thought–disordered patients, and healthy controls.
Testing was performed counterbalanced for section order to control for practice effects. Before beginning the task, each subject was given verbal instructions for the task and was shown four sample items with their correct answers. Extensive pilot testing ensured that the task avoided ceiling and floor effects by testing only everyday reasoning that is intuitive for participants who have had no training in formal logic. The task was not timed and subjects were encouraged to work carefully rather than rush. The average completion time was 1 hour, although there was significant variance (45–120 minutes). Subjects who were working particularly slowly were encouraged to test in two sessions of no more than 1 hour each to avoid tiring, but patients were tested close enough in time (within the week) that symptoms remained constant. All patients and control subjects were interviewed briefly after completion of the task to assess whether the subject had been disturbed by the violent content. Only one subject, a patient, reported being particularly upset by the content. She was immediately permitted to stop testing, and was the only subject who did not complete the study. Interestingly, the vast majority of patients were unable to discern any difference at all in the two sections’ contents. This was in marked contrast to healthy control subjects, all of whom were able to point out the difference in content between sections.

**Scoring and Analysis**

The task is scored by section via five criteria: (1) the number of correct responses out of each 10 item section; (2) the number of Over-Included items, defined as incorrect (irrelevant) pieces of information chosen; (3) the number of Under-Included items, defined as correct (relevant) pieces of information that were not chosen; (4) the number of Contradictions endorsed; and (5) the number of Not Enough Information choices endorsed. The Premise Assessment sections used all five criteria. The Inference sections used only the number of Correct Responses and Contradictions as criteria. Both Over- and Under-Inclusion scores were divided by the total number of possibilities for Over- or Under-Inclusion as percentages of total irrelevant items endorsed (for Over-Inclusion) or percentages of total relevant items not endorsed (for Under-Inclusion). Errors of Contradiction and endorsement of the Not Enough Information choice were scored similarly as the number of items of this kind that a subject endorsed divided by the number of possible items of this kind that could be endorsed. Between-group analysis was performed by multiple analysis of variance, with post-hoc tests (Tukey) for differences between individual subject groups. Within-group analysis was performed using paired t-tests between the neutral and threat conditions.

**RESULTS**

In our study, we hypothesized that patients might develop delusions in response to inadequate patterns of information-gathering, patterns that are exacerbated by emotional arousal. Preliminary results provide compelling preliminary evidence that patterns of reasoning among delusional patients do differ qualitatively from those of both healthy individuals and patients with other symptom profiles, particularly under emotional arousal, and that delusional patients are unique in that they possess a vulnerability to even minimal emotional stimulation.

Under conditions of neutral emotional stimuli, delusional patients, in comparison to SZ patients with symptoms other than delusions, consistently performed better than these other patient groups on logical reasoning and assessment of relevance, nearly equivalent to performance by healthy individuals (Figures 2–4). Under the neutral condition, multivariate analysis of variance (MANOVA) revealed significant statistical differences between the four groups. Using a Bonferroni corrected model, \( F = 5.852, P = .002 \) (Inferences); \( F = 3.729, P = .019 \) (Propositional Premise Assessment); and \( F = 5.104, P = .005 \) (Class-Member Premise Assessment). Under the threat condition, MANOVA also revealed significant statistical differences between the four groups. Using a Bonferroni corrected model, \( F = 6.628, P = .001 \) (Inferences); \( F = 3.950, P = .015 \) (Propositional Premise Assessment); and \( F = 3.540, P = .023 \) 

![FIGURE 4. Percentage of correct Premise Assessment items (Class-Member Reasoning) in neutral and threat conditions for delusional patients, thought-disordered patients, nondelusional/non-thought–disordered patients, and healthy controls.](image)

![FIGURE 5. Percentage of different error types (choice of Under-Inclusion, Over-Inclusion, and Contradiction).](image)
(Class-Member Premise Assessment). Post-hoc analysis (Tukey), however, indicated that the significance could be accounted for solely by the wide differences in performance between healthy controls and patients with formal thought disorder (as well as between better delusional patients and healthy individuals on Inferences under the threat condition) than between any of the other groups.

Significant statistical differences, using paired t-tests, were evident in comparing performance under the neutral and threat conditions (Figures 2–4). Even with the quite mild emotional stimulation provided by the task, by which only one subject reported being affected, delusional patients’ performance showed pronounced decline in the threat conditions: $df=9, \ P=.004$ (Inferences) and $df=9, \ P=.033$ (Class-Member Premise Assessment). Patients with formal thought disorder showed an inverse pattern, performing lowest on logical reasoning and assessment of relevance, but under conditions of mild emotional arousal, showing significant improvement ($df=4; \ P=.035$). Patients with no delusions and no formal thought disorder performed between the other two patient groups; their changes in performance mirrored those of healthy subjects, declining mildly under arousal. Interestingly, Class-Member reasoning was disproportionately affected for all groups, which may indicate that Class-Member reasoning is more vulnerable to emotional arousal than other types of reasoning. One way of making sense of this is that Class-Member reasoning seems to depend more explicitly than propositional logic on finding counterexamples to mental models. Information-gathering extends to two steps, rather than having only one: (1) identifying relevant from irrelevant premises (each a statement about particular sets) and (2) identifying relevant from irrelevant members of that set.

When scores were analyzed by item with regard to the specific kind of errors that accounted for overall performance, important differences became apparent. These results are summarized in Figure 5. Healthy subjects, when aroused, tended to slightly restrict the amount of available information, dismissing irrelevant information. As we shall describe, this pattern is in line with what we would expect given research on perceptual restriction under emotional arousal in healthy individuals. Delusional patients showed a similar pattern of information-restriction under arousal, but in greatly exaggerated form, presumably dismissing most of the relevant information necessary to adequately reason; in this case, the difference between Under-Inclusion in the neutral and threat conditions reached significance ($df=9; \ P=.022$). Thought-disordered patients, on the other hand, included far more information in the neutral condition than healthy individuals, taking in much information that was, in fact, irrelevant, a tendency that was not affected by arousal. Under these conditions, thought-disordered patients’ performance seems to have improved because of their reduction of Under-Inclusion errors with arousal.

Although differences between delusional patients and nondelusional/non-thought-disordered patients look slight when compared on measures of Over-/Under-Inclusion, the differences become much more apparent when one examines endorsement of the Not Enough Information option. As previously explained, this option may be characterized as extreme Under-Inclusion, because it signifies that the subject saw no piece of information as relevant in confirming or disconfirming the hypothesis. As shown in Figure 5, MANOVA and post hoc tests (Tukey) showed significant differences between delusional patients and all other symptom groups on this measure ($F=3.964, \ P=.015$ for the threat condition). Delusional patients chose this option over half of the time (54%) in the aroused condition, which is all the more striking given their relatively high level of ability to reason using inferences in the neutral condition. Performance for thought-disordered patients on this measure was consistent with prior results that showed Under-Inclusion that became less pronounced with arousal.

As shown in Figure 5, the rate of endorsement for Contradictions was low overall, although thought-disordered patients were most likely to choose them.

This study had two main limitations. The first was one of power, particularly for the thought-disordered group, which only had five members. This problem is a consequence of our analysis using preliminary results. With further testing, we expect to eventually have 50 subjects in each cell, and this increased power should clarify the somewhat ambiguous results for the thought-disordered group. The second limitation has to do with the manner in which we characterized patients, which was by beliefs rather than by feelings. A few of the patients expressed vague feelings of fear, sometimes stating that “people might be out to get them.” However, if these vague feelings were not crystallized into actual belief structures, the patients were not characterized as “delusional” for our study. One potentially important consequence of this decision is that many members of the other two nondelusional patient groups may have also shared an increased vulnerability to arousal, but may not have had sufficient cognitive resources to create stories (in the form of delusions) to explain these feelings of fear. Future analyses will hopefully be able to clarify this issue.

**DISCUSSION**

It has long been hypothesized that SZ in general, and delusional symptoms in particular, have a strong emotional component. Kraepelin, one of the first to define SZ as a disease, named emotional disturbances as one of the key components of “dementia praecox.” While von Domarus believed that faulty inferences alone caused delusions, Arieti suggested that faulty inferences might be triggered by emotionally valent content, an idea that may turn out to be surprisingly prescient. More recent research indicates that the prodrome for patients with delusions frequently includes a state of high anxiety, which may be ameliorated by the development of the delusional belief. According to a chart review of the 42 current positive-symptom patients in our study, 67% of these patients were administered adjunctive benzodiazepines on a regular basis as part of their treat-
ment strategies, including 79% of patients with systematized delusions. Research on cortisol levels for patients, a common hormonal measure of stress, support the view that at least a sizable proportion of patients show significant levels of anxiety. A meta-analysis of 25 studies examining cortisol dysregulation across different diagnoses found overall dexamethasone nonsuppression rates (a test of the body’s ability to inhibit the release of cortisol) of 26.4% in SZ as compared to 5% in controls; these rates may in fact be higher when distinctions are made for specific symptoms, a type of analysis that is still relatively unusual. One intriguing pattern consistently found in research of skin conductance response but has yet to be explained concerns why patients with SZ show two completely different levels of arousal response. While approximately 40% show patterns of nonresponse, presumably indicating very low levels of arousal compared to healthy controls, another high percentage of patients show an inverse response of hyper-arousal compared to healthy controls. Guzelian and Venables have suggested that these findings indicate that limbic abnormalities involved in the regulation of arousal may be an important feature of the disease, a hypothesis that we share and which will be tested in our future work.

Empirical evidence suggests that stress not only may result from symptoms, but also that symptoms themselves may be exacerbated by stress. It has long been known that there is a strong causal correlation between relapse in SZ and even minor increases in stress. Increased sensitivity to stress has been linked to spontaneous recurrences of methamphetamine psychosis. Myin-Germeys, Nicolson, and Delespaul, using the Experience Sampling Method (a time-sampling technique), have shown that environmental context can trigger or inhibit paranoid delusions depending upon the level of anxiety that the environment induces in patients. At the physiologic level, Dawson, Nuechterlein, and Schell and Hazlett and colleagues have shown that hyperaroused states of tonic electrodermal activity consistently precede onset of psychosis for some patients, and therefore may be an efficient and accurate measure for predicting psychotic relapse. Cortisol dysregulation also may be related to fluctuations in symptomatology. In a prospective study, Ventura and colleagues report that cortisol levels increased by 250% immediately preceding exacerbation of psychosis, then decreased during the episode to a level between pre-episode and recovery. In two studies, serial dexamethasone tests during treatment indicated a normalization of cortisol function as symptoms abated, with declines in dexamethasone nonsuppression rates from 71% to 20% and from 39% to 20%.

The connections between affective disturbances and symptoms of SZ have provoked various etiologic models that view these disturbances as key to the development of SZ. Grossberg’s model for SZ uses pathologies of the amygdala to account for the deficit syndrome of SZ, while work by Hanlon and Sutherland has linked prenatal damage to the limbic system with later development of the disease. Studies on differences between amygdala volumes for SZ patients and controls have been inconclusive. However, studies have consistently found hippocampal volumetric reductions in patients. This may be significant since the hippocampus plays an important regulatory role in mediating activation of the amygdala, a key structure involved with emotional processing, particularly of fear. A recent meta-analysis of magnetic resonance imaging volumetric studies of the hippocampus in SZ demonstrated a significant bilateral volume reduction of 4%. Postmortem studies have shown that hippocampi of SZ patients have lower cell counts, greater disorientation of pyramidal cells, and small neurons compared with those of controls.

When interpreting the delusional patients’ unusually restrictive patterns of information-gathering, it is also important to consider a large cognitive science literature on the interaction between emotional arousal and elective attention restriction of perceptual cues in healthy individuals. This research demonstrates that emotional arousal can benefit performance by increasing focused attention on a target and decreasing attention to distracting irrelevant information. However, when attention to peripheral events is necessary for task performance, emotional arousal induces a state of debilitating “tunnel vision,” in which an individual disregards potentially relevant sensory and cognitive stimuli. In 1959, Easterbrook seems to have been the first to fully articulate this hypothesis, and it has been confirmed by a wide range of empirical studies on humans and animals that used induced arousal by reward, electric shock, loud noise, threatening words, test anxiety, and even “pre-parachuting anxiety” on various selective-attention tests. Tests of selective attention used cues for response, such as flashing lights, that were both centrally located and on the subject's periphery. Subjects were instructed to respond either to the centrally located cues as the target, ignoring the peripheral cues, or on the peripheral cues, ignoring the centrally located cues. Significant increases in attention to centrally located cues at the expense of peripherally located cues were seen with studies using both unimodal (visual-auditory) and crossmodal (visual-auditory) central and peripheral cues. Easterbrook states, “It is proposed that emotional arousal acts consistently to reduce the range of cues that an organism uses, and that the reduction in range of cue utilization influences action in ways that are either organizing or disorganizing, depending on the behavior concerned.” Bacon described this process as one of exaggerating the normal tendency to orient such that “cues which initially attract less attention should show further diminished attention under arousal, while cues which occupy the primary focus of attention should perhaps show enhanced attention under arousal.” This hypothesis was supported by his study. By inducing different levels of arousal, Bacon’s experiment also generalized this principle to a continuum, in which the greater the degree of emotional arousal, the fewer the number of perceptual cues to which the subject can attend. In this view, each task has its optimal degree of arousal, following the Yerkes-Dodson Law, since different tasks require
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different ratios between the degree of attention required for a central cue versus the degree of attention required for incidental cues. Research on selective attention in dangerous environments, in which simulation acted as the control for arousal, demonstrate that the tendency to overlook incidental (peripheral) cues in real-life situations can have severe implications for actual performance. A significant decline in performance has been shown for complex tasks that were performed during combat, during deep-sea diving, and during realistically simulated experiments in which subjects thought they were in mortal danger and were required to perform selective attention tasks. As a representative, if a somewhat less extreme example, Weltman and Egstrom administered selective attention tasks to naive divers in a simulated pressure chamber. In this experiment, the divers showed an increase in heart rate and subjective ratings of anxiety when indicators showed an increase in pressure (there was no actual increase in pressure); control subjects performed the same task in the same environment, but without the indicators showing an increase in pressure. Under these conditions, there was significant decline in the aroused group's ability to respond to peripheral light cues, but not to the central task. Freeman, Garety, and Phillips administered selective attention tasks to healthy individuals under minimal stress who possess an unusual vulnerability to emotional arousal interpreted as feelings of euphoria may indeed work at odds with one another, both in healthy individuals and in delusional patients on the logical reasoning task relative to other patient groups. Since vulnerability to arousal is likely to be confounded by stress, the greater the stress, the greater the preoccupation with the delusion. Likewise, as external stressors recede, so too might delusional preoccupation.

CONCLUSION

Within the context of research on both stress and SZ as well as cognition under emotional arousal in healthy individuals, we have argued that the results of our logic study may extend beyond logic deficits to suggest a model of delusions based on vulnerability to emotional arousal. As with classical paradigms, we see that rationality and emotional arousal may indeed work at odds with one another, both in healthy individuals and in delusional patients on the logical reasoning task relative to other patient groups. Since vulnerability to arousal is likely to be confounded by stress, the greater the stress, the greater the preoccupation with the delusion. Likewise, as external stressors recede, so too might delusional preoccupation.
scribed among this population. Finally, while most researchers now routinely make distinctions between positive and negative symptoms in characterizing patients in their studies, results that indicate important subgroup differences between patients with delusions and those with formal thought disorder—both of which are defined as having “positive” symptoms—may convince researchers of the need to conduct their analyses with a finer comb.

REFERENCES