

# Metacognitive training in schizophrenia: from basic research to knowledge translation and intervention

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## Purpose of review

There has been a marked increase in the study of cognitive biases in schizophrenia, which has in part been stimulated by encouraging results with cognitive-behavioral interventions in the disorder. We summarize new evidence on cognitive biases thought to trigger or maintain positive symptoms in schizophrenia and present a new therapeutic intervention.

## Recent findings

Recent studies indicate that patients with paranoid schizophrenia jump to conclusions, show attributional biases, share a bias against disconfirmatory evidence, are overconfident in errors, and display problems with theory of mind. Many of these biases precede the psychotic episode and may represent cognitive traits. Building upon this literature, we developed a metacognitive training program that aims to convey scientific knowledge on cognitive biases to patients and provides corrective experiences in an engaging and supportive manner. Two new studies provide preliminary evidence for the feasibility and efficacy of this approach.

## Summary

The gap between our advanced understanding of cognitive processes in schizophrenia and its application in clinical treatment is increasingly being narrowed. Despite emerging evidence for the feasibility and efficacy of metacognitive training as a stand-alone program, its most powerful application may be in combination with individual cognitive-behavioral therapy.

## Keywords

consciousness, intervention, metacognition, metacognitive training, schizophrenia

## Abbreviations

<b>BADE</b>	bias against disconfirmatory evidence
<b>CBT</b>	cognitive-behavioral therapy
<b>JTC</b>	jumping to conclusions
<b>MCT</b>	Metacognitive Training for Schizophrenia Patients
<b>ToM</b>	theory of mind

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## Introduction

The psychological treatment of schizophrenia has been neglected until recently. With some notable exceptions [1], for decades the attitude prevailed that the delusions characteristic of schizophrenia can be understood but not readily treated, or treated (by means of psychopharmacological agents) but not psychologically understood [2,3]. Over recent years, a gradual paradigm shift has occurred; cognitive-behavioral techniques have been increasingly applied to treatment of psychosis, although this has remained the exception rather than the rule [4,5] and is often confined to research contexts in many psychiatric institutions [6]. At the same time, our understanding of the cognitive underpinnings of schizophrenia has expanded [7,8,9]. (Although the work by Garety and Freeman [9] was published before the start of the annual review period, it deserves particular mention because it was the first systematic review on cognitive biases subserving delusions and remains a 'must read' introduction for scientists who are new to the field.)

This review first summarizes new evidence on cognitive biases that are thought to trigger, aggravate, or maintain positive symptoms in schizophrenia, particularly delusions. We then turn to a new line of therapeutic intervention, termed metacognitive training [10,11]. This program aims to transfer knowledge of cognitive biases obtained from basic research to people diagnosed with schizophrenia, and to provide corrective experiences to patients, with the hope that it will facilitate symptom reduction and act prophylactically against relapse. In the last section of the review, preliminary data on the efficacy of metacognitive training are summarized. This introductory review is solely concerned with cognitive biases and does not touch upon the vast literature on cognitive deficits. Cognitive biases represent thinking distortions and processing preferences rather than performance deficits and limitations of mental capacity (e.g. impairment in

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memory accuracy and attention; for a review, see Heinrichs and Zakzanis [12]).

### Cognitive biases in schizophrenia

A psychological understanding of delusion formation has long been obstructed and sometimes aggressively refuted by claims that delusions are not amenable to understanding (delusions proper). Since the 1980s, however, cognitive research has rendered a strong formulation of this account inconclusive. Several meaningful cognitive mechanisms have been identified as likely to be involved in the pathogenesis of fixed false beliefs [8<sup>••</sup>,9,13<sup>•</sup>]. Likewise, a second prominent view that delusions are nonpathological epiphenomena of primary anomalous experiences [14<sup>•</sup>] has also recently been contested [7]; such experiences are not detectable in a large subgroup of deluded patients.

### Jumping to conclusions and need for closure

The most consistent research finding of cognitive distortions in schizophrenia pertains to a specific data gathering bias, termed jumping to conclusions (JTC), whereby patients terminate data collection prematurely and weigh evidence insufficiently when arriving at strong conclusions. Although the notion of JTC may at first appear circular and almost descriptive of what is observed during a psychotic breakdown (e.g. mistaking a crackling on the telephone line as evidence for surveillance), it also manifests in delusion neutral scenarios and it appears to extend to remitted phases [15<sup>••</sup>] and to healthy individuals with schizotypal traits [16<sup>••</sup>]. It may therefore tentatively be suggested that JTC is a precursor rather than a consequence of psychosis. We have proposed a variant of this hypothesis, termed liberal acceptance [17,18], which may account for hasty decision making in patients with schizophrenia under some conditions (especially binary and discrepant response options) as well as greater ambivalence under others [19<sup>•</sup>]. The longitudinal course of JTC is not yet clearly understood, however [15<sup>••</sup>,20]. Need for closure and JTC may not overlap as much as was originally proposed in early studies [21], but instead they may constitute independent cognitive biases in psychosis [22<sup>•</sup>]. It should be noted, however, that a similar bias, referred to as intolerance of ambiguity, is implicated in obsessive–compulsive disorder [23]. Interestingly, recent evidence suggests that patients are largely unaware of their hastiness, and often view themselves as rather hesitant and indecisive [24<sup>•</sup>–26<sup>•</sup>].

### Attributional style and self-esteem

Investigations into causal inference have concluded that patients with schizophrenia display deviances in attributional style. Reminiscent of observations reported by Kraepelin [27], early research in this area has fairly consistently found a bias to externalize and particularly to personalize blame in acutely deluded patients (i.e.

scapegoating [28,29]). Again, this bias is not confined to delusional scenarios but reflects a ubiquitous response pattern that manifests with items sharing no or low delusional content. Although current research continues to report deviances of attributional style in patients with schizophrenia, especially of paranoid subtypes, the existence of a self-serving bias in paranoia has not been unequivocally supported. Two new studies found a general tendency for acute patients to view others rather than themselves as the main cause for events, irrespective of whether these are negative or positive [30,31]. Recently, it was questioned whether differences in attributional style are part of the vulnerability to psychosis [32]. Moreover, the bias appears to be more pronounced in chronic than in first-episode patients [33]. A promising new line of research has investigated the impact of belief type in general [34<sup>••</sup>] and its connection to cognitive biases in particular [35<sup>•</sup>]. Further investigation is needed to determine whether different delusional themes such as grandiose ideas or poor-me versus bad-me types of paranoia [36] may be governed by different and perhaps opposing attributional styles, which could have obscured potential group differences in prior studies.

Studies using the Implicit Association Test support the viewpoint that deviances in attributional style are related to decreased covert/hidden self-esteem, a notion previously mentioned by Adler [37] and later elaborated by Bentall *et al.* [38]. A recent study [39<sup>•</sup>] demonstrated that delusional patients had greater self-esteem than did those with remitted symptoms, possibly reflecting an ambivalence of patients toward their symptoms. Although symptoms are, in the majority of cases, accompanied by a sense of endangerment and anxiety, they also on occasion provide their holder with a sense of importance and company (e.g. positive voices). In line with this, insight has been associated with depressive symptoms [40<sup>•</sup>], particularly low self-esteem [41]. Although we do not claim that these factors cause schizophrenia, ‘gain from illness’ may be a potent maintenance factor that, in our opinion, requires further investigation.

### Metamemory

Another line of research has addressed metamemory biases, particularly response confidence and memory vividness. The latter states that recollections in patients with schizophrenia are vague and not very vivid [42,43<sup>•</sup>]. Poorly elaborated and vague memories have also been observed in other psychiatric disorders; the specificity of this abnormality to psychosis is therefore unclear. Our group has repeatedly demonstrated that patients with schizophrenia are overconfident in errors while at the same time being underconfident in correct responses [44–46,47<sup>•</sup>,48]. This two-fold response pattern may be accounted for by liberal acceptance/JTC [49<sup>••</sup>]; premature termination of data collection may lead to

neglect of cues for incorrect decisions, thereby promoting high-confident errors in patients, whereas control individuals adopt more scrutinous strategies expressed as a reluctance to endorse fully an interpretation based on incomplete evidence. Along the same lines, healthy control participants exhibit greater confidence in correct responses relative to patients with schizophrenia, because the detection of multiple supportive cues increases response confidence [49<sup>••</sup>,50]. A recent study identified a general pattern of overconfidence in patients with schizophrenia, which was more pronounced for errors [51<sup>•</sup>]. Other independent replications are beginning to emerge [50,52]. As was the case for the aforementioned biases, enhanced overconfidence in errors is not restricted to delusional inaccurate memory (e.g. being convinced that one has been abducted by aliens) and is seen as a risk factor and antecedent rather than a correlate of paranoid symptoms.

### **Bias against disconfirmatory evidence**

In addition to undue conviction and the falsity of a belief, a failure to integrate evidence that may disconfirm a belief is the third defining core feature of delusions (e.g. people providing evidence that challenges a delusional belief may be avoided or discredited as being part of the conspiracy). Recently, a bias against disconfirmatory evidence (BADE) was demonstrated using delusion-neutral material in patient samples [53<sup>•</sup>,54<sup>•</sup>,55,56<sup>••</sup>], which was more pronounced in, but not confined to, patients with delusional ideas. Using sequences of either pictures or contextual verbal information, patients with schizophrenia were less able to disengage from initially tempting interpretations, which, over the course of three trials, became increasingly implausible.

### **Theory of mind**

Social cognition or theory of mind (ToM) is commonly included in the study of cognitive biases that are important for understanding psychosis, although this concept may overlap more with cognitive impairment than with cognitive biases. Social cognition encompasses a wide range of aspects, including social knowledge/competence, emotion detection (e.g. faces, prosody, and irony) and social reasoning, and there is a tendency to subsume very different cognitive processes under the umbrella term ToM. Prominent paradigms tapping social cognition are first-order and second-order ToM tasks, which map the ability to theorize accurately about what is on another person's mind and to consider how situational context leads to a divergence of another person's understanding of a situation from one's own understanding of the same situation. Deficits in this area have repeatedly been found in schizophrenia, but the results are equivocal with regard to their association with paranoid schizophrenia [8<sup>••</sup>] (however, see Janssen *et al.* [32]). This does not, however, preclude an important role for ToM in the formation of

false beliefs. Cognitive biases such as JTC and BADE may be rather benign in conjunction with normal neuropsychological faculties and social reasoning (i.e. a type of reasoning that is perhaps most popularly exemplified by the character of Sherlock Holmes). Under specific conditions, fast and frugal heuristics are even superior to cautious reasoning style models [57]. When hasty decision making (and any of the other cognitive biases) combines with the well documented neuropsychological and social cognition impairments in schizophrenia, however, this may lead to serious consequences, including psychotic misinterpretations. Studies addressing the interrelationship and redundancy of these biases have only just begun to emerge [15<sup>••</sup>,58] (Woodward TS, Mizrahi R, Menon M, *et al.*, unpublished data).

### **Metacognitive training for patients with schizophrenia**

The aforementioned evidence suggests that cognitive biases are present in many patients with schizophrenia but are beyond conscious reflection. This underlines the importance of metacognitive intervention, because bringing these biases to the awareness of patients may be beneficial in counteracting psychosis. In particular, metacognitive training may effectively complement other treatments such as cognitive-behavioral [4,5<sup>•</sup>] and pharmaceutical interventions.

In the following, we introduce a group intervention for psychotic patients, termed Metacognitive Training for Schizophrenia Patients (MCT), which targets all of the aforementioned cognitive biases. The program is available in English, German, Dutch and French language free of charge via the internet ([http://www.uke.uni-hamburg.de/kliniken/psychiatrie/index\\_17380.php](http://www.uke.uni-hamburg.de/kliniken/psychiatrie/index_17380.php)) [10,11<sup>••</sup>].

MCT is based on the following two fundamental components. The first is knowledge translation. Current research findings on cognitive biases and their link to schizophrenia/delusions are explained comprehensibly to patients and illustrated by multiple examples. The second is demonstration of the negative consequences of cognitive biases. Exercises targeting each bias individually demonstrate the fallibility of human cognition in general, with an explicit focus on thinking biases that are important in schizophrenia. Personal examples of these biases expressed by MCT participants, and discussion of ways to counter them, serve to provide corrective experiences in a fun and supportive atmosphere, yielding obvious advantages over mere lecturing. Patients are taught to recognize and counter thinking biases that are important in schizophrenia, and they are offered alternative strategies allowing them to arrive at more appropriate inferences, thus avoiding automatic 'cognitive traps'.

The MCT objectives are accomplished within the framework of a group intervention (3–10 patients) comprising eight sessions (one cycle), each of which lasts 45–60 min. Ideally, participants undergo two cycles involving parallel but distinct exercises.

In each module, patients are first familiarized with the target domain (e.g. JTC; Table 1). Current scientific

findings are then introduced to the patients, using examples that demonstrate the links to psychosis and generalize to daily living (the section is entitled ‘Why are we doing this?’). Subsequently, a series of exercises are presented, which represent the core of the program. To emphasize the relevance of each module for psychosis, its link is again pointed out at the end of each session (in a slide entitled ‘Transfer to psychosis’) and a generic case

**Table 1 Summary of each metacognitive training module**

Module	Target domain	Description of core exercises
(1) Attribution: blaming and taking credit	Self-serving bias versus depressive attributional style	Different causes of positive and negative events must be contemplated. [For example, ‘a friend was talking behind your back’; dominant interpretation: ‘friend is not trustworthy’ (blaming others); alternatives: ‘I have done something bad’ (blaming self), ‘she is preparing a surprise party for my birthday’ (circumstances)]. Explanations that take into account various causes are preferred to mono-causal explanations. The negative consequences of self-serving attribution are repeatedly highlighted.
(2) Jumping to conclusions: I	Jumping to conclusions/liberal acceptance/bias against disconfirmatory evidence	Motifs contributing to hasty decision making are discussed and its disadvantages are stressed. Fragmented pictures are shown that eventually display objects. Premature decisions often lead to errors, emphasizing the benefits of cautious data gathering. In the second part, ambiguous pictures are displayed. Here, a quick survey leads to the omission of details demonstrating that first impressions may often reveal only half the truth.
(3) Changing beliefs	Bias against disconfirmatory evidence	Cartoon sequences are shown in backward order, which increasingly disambiguate a complex scenario. After each (new) picture, patients are asked to (re-)rate the plausibility of four interpretations. Although on some pictures the initially most likely interpretation prevails in the course of the exercises, patients are ‘led up the garden path’ on others. Thus, patients learn to withhold strong judgments until sufficient evidence has been collected, and they are encouraged to maintain an open attitude toward counter-arguments and alternative views.
(4) To empathize: I	Theory of mind first order	Facial expression and other cues are discussed for their relevance to social reasoning. Pictures of human faces are presented in the exercises. The group should guess what the depicted character(s) may feel. The correct solution often violates a first intuition, demonstrating that relying on facial expression alone can be misleading. In the second part, cartoon strips are shown that either must be completed or brought into the correct order. Participants are shown that social inferences should involve multiple cues.
(5) Memory	Overconfidence in errors	Factors that foster or impair memory acquisition are discussed first, and examples for common false memories are presented. Then, complex scenes (e.g. beach) are displayed with two typical elements each removed (e.g. towel, ball). Owing to logical inference, gist-based recollection and liberal acceptance, many patients falsely recognize these lure items in a later recognition trial. The constructive rather than passive nature of memory is thus brought to the participants’ attention. Patients are taught to differentiate between false and correct memories by means of the vividness heuristic.
(6) To empathize: II	Theory of mind second order/ need for closure	Different aspects guiding theory of mind (e.g. language) are discussed with respect to both their heuristic value and fallibility for social decision making. Then, cartoon sequences are presented, and the perspective of one of the protagonists must be considered, which involves discounting knowledge available to the observer but not available to the protagonist. For the majority of sequences, no definitive solutions can be inferred, which is unsatisfactory for patients with an enhanced need for closure.
(7) Jumping to conclusions: II	Jumping to conclusions/ liberal acceptance	As in module 2, the disadvantages of quick decision making are outlined with regard to events related and unrelated to psychosis. In the exercises, paintings are displayed, for which the correct title must be deduced from four response options. On superficial inspection, many pictures tempt false responses.
(8) Mood and self-esteem	Mood and self-esteem	First depressive symptoms, causes, and treatment options are discussed. Then, typical depressive cognitive patterns in response to common events are presented (e.g. over-generalization, selective abstraction), and the group is asked to come up with more constructive and positive ones. At the end, some strategies are conveyed to help patients to transform negative self-schemata and elevate their mood.

example of delusional thought is presented. Self-reflection on individual symptoms is encouraged; however, MCT is not the appropriate environment for thorough elaboration and treatment of individual delusional beliefs. This should be restricted to one-to-one therapies such as cognitive-behavioral therapy (CBT).

Exercises are carried out collectively, and special care is dedicated to make sessions supportive, pleasant and entertaining. As mentioned above, exercises serve to elicit common thinking biases and are to serve as a 'sandbox' in which thinking biases can be experienced in a comfortable and safe environment, and new strategies can be explored. Leaflets with exercises assist this process. Table 1 summarizes the structure of each module.

### **Metacognitive training, cognitive-behavioral therapy, and social cognition programs: similarities and differences**

Unlike occupation-based programs devoted to important but more peripheral aspects of psychosis, CBT, MCT, and social cognition programs [59<sup>\*</sup>] share the prospect of ameliorating symptomatic and functional outcome by either directly challenging symptoms (front-door approach; CBT) or indirectly altering the metacognitive infrastructure that is thought to underlie psychosis (backdoor approach; MCT). In the future, the most efficient and effective programs may be to combine MCT and CBT. MCT provides a neutral 'common ground' for discussion of thinking styles relevant to psychosis and may help to challenge some presumptions of the patient regarding the integrity of his or her cognitive system with neutral material. Ideally, this will 'lure' patients to a more in-depth analysis and treatment of their individual problems, which is a core task of individual CBT. MCT may be particularly beneficial for patients who would be overwhelmed by a front-door approach or those seeking to seal over.

### **Metacognitive training: preliminary data on effectiveness**

Three recent studies have been conducted to address the feasibility, safety, and efficacy of the original version of the MCT [60,61<sup>\*</sup>]. In a first pilot study [60], 40 patients were randomly assigned to either MCT or CogPack training (cognitive but not metacognitive remediation). After 4 weeks with two sessions per week (i.e. a full MCT cycle), patients were requested to assess the subjective utility and outcome of the training. Patients rated MCT superior on all 10 outcome criteria, four of which achieved statistical significance (i.e. fun, recommendation to others, being less bored, and usefulness to daily life). Symptom exacerbation or aggravation in relation to the administration of the intervention was not observed in either group. Group adherence was excellent, with only a few sessions being missed.

In a second pilot study [61<sup>\*</sup>], 30 patients were randomly assigned to either MCT or an active control intervention (cognitive remediation). Blind to group status, psychopathology and several cognitive parameters were assessed before and after intervention [4 weeks with two sessions per week (i.e. one full cycle)]. Relative to the active control condition, an accelerated decline in positive symptomatology was observed in the MCT group, assessed using the Positive and Negative Syndrome Scale positive score ( $d = 0.43$ ). JTC, measured using a modified BADE paradigm, was also reduced for the MCT group ( $d = 0.31$ ). Replicating the earlier study, MCT received a more favorable subjective appraisal ( $d = 0.51$ ).

In a third study, Garety and her colleagues (Garety P, personal communication) administered a single session using several exercises from the MCT (particularly from modules 2, 5, and 7; Table 1). A significant decline in JTC behavior, as assessed using one out of two variants of the beads task, occurred in the MCT group but not in the control group, and there was tentative evidence for a decrease in delusion conviction in some of the MCT but none of the control patients. In response to observations made during the training and feedback from participants, several new features have since been integrated into the program.

### **Conclusion**

In recent years there has been a marked increase in studies of cognitive biases in schizophrenia. Sophisticated and testable models of psychosis formation have been proposed in an attempt to tie together the complex interactions of cognition and cognitive biases and factors such as stress and anomalous experiences [62,63<sup>\*\*</sup>,64]. The goal of MCT is to sharpen patients' awareness of those cognitive biases and to transfer this knowledge for application to daily life. Preliminary data support the utility of MCT as a stand-alone program, but long-term maintenance of these effects (e.g. greater adherence and clinical benefit) is yet to be established. Given the feasibility and mounting evidence for positive effects of cognitive intervention in schizophrenia, and considering the high rates of relapse and noncompliance under neuroleptic medication, cognitive techniques should increasingly be incorporated into standard treatment programs for schizophrenia.

### **References and recommended reading**

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 641).

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- 39 Moritz S, Werner R, von Collani G. The inferiority complex in paranoia re-addressed: a study with the Implicit Association Test. *Cognit Neuropsychiatry* 2006; 11:402–415.
- Using the Implicit Association Test, a paradigm borrowed from social psychology to detect latent attitudes, it was found that paranoid patients display low implicit/hidden self-esteem (relative to all control groups). Explicit self-esteem was enhanced relative to remitted patients. At least in some patients, a 'gain from illness' should be considered as a maintenance factor of the disorder and as a motif for noncompliance.

- 40** Lincoln TM, Lullmann E, Rief W. Correlates and long-term consequences of poor insight in patients with schizophrenia. A systematic review. *Schizophr Bull* 2007; [Epub ahead of print].

This review demonstrates that there appears to be a positive relationship between insight and depression.

- 41** Cooke MA, Peters ER, Greenwood KE, *et al.* Insight in psychosis: the influence of cognitive ability and self-esteem. *Br J Psychiatry* 2007 (in press).
- 42** Danion J-M, Rizzo L, Bruant A. Functional mechanisms underlying impaired recognition memory and conscious awareness in patients with schizophrenia. *Arch Gen Psychiatry* 1999; 56:639–644.
- 43** Danion JM, Cuervo C, Piolino P, *et al.* Conscious recollection in autobiographical memory: an investigation in schizophrenia. *Conscious Cogn* 2005; 14:535–547.

This study extends prior results obtained by the group around Jean-Marie Danion; patients with schizophrenia hold poorly elaborated autobiographical memories. This may render them prone to later misinformation and 're-editing'.

- 44** Moritz S, Woodward TS. Memory confidence and false memories in schizophrenia. *J Nerv Ment Dis* 2002; 190:641–643.
- 45** Moritz S, Woodward TS. The contribution of metamemory deficits to schizophrenia. *J Abnorm Psychol* 2006; 115:15–25.
- 46** Moritz S, Woodward TS, Cuttler C, *et al.* False memories in schizophrenia. *Neuropsychology* 2004; 18:276–283.
- 47** Moritz S, Woodward TS, Rodriguez-Raecke R. Patients with schizophrenia do not produce more false memories than controls but are more confident in them. *Psychol Med* 2006; 36:659–667.

Using a visual variant of the false memory paradigm, we were able to show that patients with schizophrenia do not display more false memories (partly owing to poor recollection and decreased spread of activation for longer intervals) but, if committed, they may carry more momentum compared with control individuals, because patients are less likely to attach some kind of 'not trustworthy' tag to false memories.

- 48** Moritz S, Woodward TS, Ruff C. Source monitoring and memory confidence in schizophrenia. *Psychol Med* 2003; 33:131–139.
- 49** Moritz S, Woodward TS. Metacognitive control over false memories: a key determinant of delusional thinking. *Curr Psychiatry Rep* 2006; 8:184–190. This review integrates our own findings and independent replications of overconfidence in errors in schizophrenia. This bias seems to be specific to schizophrenia. Its putative underlying cause, liberal acceptance, may not only account for delusions but may also operate in the external misattribution of alien and strong thoughts (i.e. hallucinations).
- 50** Laws KR, Bhatt R. False memories and delusional ideation in normal healthy subjects. *Personal Individ Diff* 2005; 39:775–781.
- 51** Kircher TT, Koch K, Stottmeister F, *et al.* Metacognition and reflexivity in patients with schizophrenia. *Psychopathology* 2007; 40:254–260. In accordance with a prior study from our group, the authors were able to demonstrate alterations in metacognition despite uncompromised memory accuracy. Overconfidence was particularly evident for errors.
- 52** Peters MJV, Cima MJ, Smeets T, *et al.* Did I say that word or did you? Executive dysfunctions in schizophrenic patients affect memory efficiency, but not source attributions. *Cognit Neuropsychiatry* 2007; 12:391–411.
- 53** Moritz S, Woodward TS. A generalized bias against disconfirmatory evidence in schizophrenia. *Psychiatry Res* 2006; 142:157–165. Stimuli of this study largely inspired module 2 of MCT dealing with decision making and changing beliefs.

- 54** Woodward TS, Buchy L, Moritz S, *et al.* A bias against disconfirmatory evidence is associated with delusion proneness in a nonclinical sample. *Schizophr Bull* 2007; 33:1023–1028.

The study provides further evidence that a BADE may form part of the vulnerability to psychosis. Positive schizotypal features were associated with a BADE in a large sample of healthy individuals who exhibited varying degrees of psychometrically identified psychosis proneness.

- 55** Woodward TS, Moritz S, Chen EY. The contribution of a cognitive bias against disconfirmatory evidence (BADE) to delusions: a study in an Asian sample with first episode schizophrenia spectrum disorders. *Schizophr Res* 2006; 83:297–298.
- 56** Woodward TS, Moritz S, Cuttler C, *et al.* The contribution of a cognitive bias against disconfirmatory evidence (BADE) to delusions in schizophrenia. *J Clin Exp Neuropsychol* 2006; 28:605–617.

Deluded schizophrenia patients were less likely to give up interpretations that were initially plausible but became increasingly improbable with the provision of additional information. The inability to revise judgments when faced with incompatible information is termed BADE. Many of the stimuli in this study are used in module 3 of MCT. This finding was replicated several times, with some of these studies reporting comparable abnormalities on the BADE in deluded and nondeluded people.

- 57** Gigerenzer G, Goldstein DG. Reasoning the fast and frugal way: models of bounded rationality. *Psychol Rev* 1996; 103:650–669.
- 58** Randall F, Corcoran R, Day JC, *et al.* Attention, theory of mind, and causal attributions in people with persecutory delusions: a preliminary investigation. *Cognit Neuropsychiatry* 2003; 8:287–294.

- 59** Penn DL, Roberts DL, Combs D, *et al.* Best practices: the development of the Social Cognition and Interaction Training program for schizophrenia spectrum disorders. *Psychiatr Serv* 2007; 58:449–451.

The Social Cognition and Interaction Training program has been devised to improve social cognition and also targets some of the cognitive biases addressed in this review.

- 60** Moritz S, Woodward TS. Metacognitive training for schizophrenia patients (MCT): a pilot study on feasibility, treatment adherence, and subjective efficacy. *German J Psychiatry* 2007 (in press).

- 61** Aghotor J. Evaluation of a metacognitive training program for schizophrenia studies: a feasibility study [in German]. Heidelberg, Germany: University of Heidelberg; 2007.

This is a small but well conducted study that confirms the feasibility of metacognitive training and provides evidence for its efficacy compared with an active control group.

- 62** van der Gaag M. A neuropsychiatric model of biological and psychological processes in the remission of delusions and auditory hallucinations. *Schizophr Bull* 2006; 32 (Suppl 1):S113–S122.

- 63** Myin-Germeys I, van Os J. Stress-reactivity in psychosis: evidence for an affective pathway to psychosis. *Clin Psychol Rev* 2007; 27:409–424.

The authors have developed an innovative approach to assess the interrelationship of stress, cognition, and symptoms. Instead of using laboratory tests, data on daily events and people's reaction to them were collected 'in the moment'. Given the waxing and waning character of many schizophrenia symptoms, a longitudinal approach with short intervals promises to reveal new insights into the yet black box of intertwined factors that mediate the latent vulnerability to overt symptoms.

- 64** Garety PA, Bebbington P, Fowler D *et al.* Implications for neurobiological research of cognitive models of psychosis: a theoretical paper. *Psychol Med* 2007 [Epub ahead of print].