

The allusive cognitive deficit in paranoia: the case for mental time travel or cognitive self-projection

R. Corcoran*

Division of Psychiatry, University of Nottingham, Nottingham, UK

Delusional beliefs are characteristic of psychosis and, of the delusions, the paranoid delusion is the single most common type associated with psychosis. The many years of research focused on neurocognition in schizophrenia, using standardized neurocognitive tests, have failed to find conclusive cognitive deficits in relation to positive symptoms. However, UK-based psychological research has identified sociocognitive anomalies in relation to paranoid thinking in the form of theory of mind (ToM), causal reasoning and threat-related processing anomalies. Drawing from recent neuroscientific research on the default mode network, this paper asserts that the common theme running through the psychological tests that are sensitive to the cognitive impairment of paranoia is the need to cognitively project the self through time, referred to as mental time travel. Such an understanding of the cognitive roots of paranoid ideation provides a synthesis between psychological and biological accounts of psychosis while also retaining the powerful argument that understanding abnormal thinking must start with models of normal cognition. This is the core theme running through the cognitive psychological literature of psychiatric disorders that enables research from this area to inform psychological therapy.

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Defining paranoia: cognitive self-projection and the default mode network

It is tragic for the soul to be apprehensive of the future and wretched in anticipation of wretchedness. What madness it is to anticipate one's troubles!

Lucius Annaeus Seneca (4 B.C.–A.D. 65)

According to Freeman & Garety (2000), paranoia can be defined as the belief that harm is occurring, or is going to occur, to the person and that the persecutor has the intention to cause harm. According to these authors, it is the intention on the part of the other source that distinguishes paranoia from anxiety. Thus the paranoid state involves a focus on threat to the self from other agents. It is this facet of paranoia that the attributional style, attention to threat and theory of mind (ToM) literature has rested upon to date. However, in Freeman & Garety's definition there is a clear emphasis on future thinking. When the paranoid individual projects him/herself into the future, he/she anticipates trouble from other people. This future-thinking element of paranoid ideation was brought out clearly in the recent paper of Bentall *et al.* (2009).

Among other findings, these authors showed that paranoid ideation, as measured by the Paranoia and Self-Consciousness Scale (Fenigstein & Vanable, 1992) and the Peters Delusion Inventory (Peters *et al.* 1999), is so strongly correlated with a measure of the anticipation of future threat as to make paranoid ideation and anticipation of future threat tautologous. This finding about the relationship between paranoid ideation and the anticipation of future threat has recently been replicated in a non-clinical sample (Bennett & Corcoran, unpublished observations). The same anticipation of future threat measure used by Bentall *et al.* (2009) was used in an earlier study by Corcoran *et al.* (2006), who showed that the future estimation of the likelihood of events happening to the self is based, in large part, on the estimation of how often these same things have happened in the past. The measure is therefore an embodiment of the availability heuristic (Tversky & Kahneman, 1973). This inductive reasoning process whereby we project ourselves into the future to estimate the likelihood of things happening, informed as it is in turn by projection of the self into the past, is a definitive example of what Schacter *et al.* (2007) call mental time travel. These authors have argued that the midline brain areas engaged during the recollection of autobiographical events are the same as those that are engaged when we simulate about future events (Schacter *et al.* 2007) and functional magnetic

* Address for correspondence: Dr R. Corcoran, Division of Psychiatry, University of Nottingham, A Floor, South Block, Queens Medical Centre, Nottingham NG7 2UH, UK.
(Email: rhiannon.corcoran@nottingham.ac.uk)

resonance imaging (fMRI) evidence supports this contention (e.g. Botzung *et al.* 2008). Furthermore, these midline structures are the same as those that are active in brains that were commonly referred to as 'at rest' in functional imaging studies, and this network makes up what is now referred to as the default mode network. Hence it seems that the anticipation of future threat, so definitive of paranoia, may be a function of the default mode brain network. However, it is important to point out that mental time travel or cognitive self-projection is not the only process that has been associated with the functions of the default mode. Other ideas include a focus on stimulus-independent thought, which is also of interest in relation to hallucinations. Less specifically, the default mode has been labelled mind-wandering (e.g. see Mason *et al.* 2007).

In a paper examining the default mode network in schizophrenia, Garrity *et al.* (2007) demonstrated aberrant temporal and spatial connectivity in the structures of this network, most notably in frontal, cingulate and parahippocampal areas. Significantly, the paper reports that the default mode activity seen in patients in the medial frontal gyrus, precuneus and the left middle temporal gyrus was correlated with the severity of positive symptoms whereas no correlations with severity of negative symptoms were found. This is consistent with the proliferation of findings of impaired performances on higher-order neurocognitive tasks in patients with negative features as the effortful nature of these tasks disengages the default-mode network structures. Conversely, Garrity *et al.*'s findings also make sense of the fact that these same higher-order neurocognitive tasks are insensitive to the cognitive impairment associated with positive symptoms. Pomarol-Clotet *et al.* (2008) also demonstrated what seemed to be a failure of default-mode network connectivity in schizophrenia. More specifically, these authors found a failure to deactivate an area of the anterior cingulate cortex that seems to be involved in functions related to the sense of self.

ToM and autobiographical memory (AM) as cognitive projection/mental time travel

Fifteen years of research testify to the fact that schizophrenia is associated with ToM deficits. What is less well agreed is whether there is a specific relationship between ToM difficulties and paranoid delusions. The studies from Corcoran, Frith and colleagues (e.g. Corcoran *et al.* 1995; Frith & Corcoran, 1996) have consistently documented relationships between paranoia and ToM but other researchers have failed to support this association (see Harrington *et al.* 2005a). As the midline brain structures associated with

default-mode processing are also reliably activated in ToM imaging paradigms (Singer, 2006), and in the light of the findings of Garrity and colleagues about the relationship to positive symptoms reported above, it seems likely that the association between paranoia and ToM stands. The likely explanation of the failures to replicate lies with the nature of the tasks used to test ToM. Almost as many ToM tasks have been used in the study of ToM in schizophrenia as there are published studies in the area (Harrington *et al.* 2005b). The ability of the various ToM tasks to measure the different facets of imputing mental states to others has not been thoroughly assessed. However, some evidence has shown that ToM tasks do not correlate as well as might be expected. For example, in a study that documented impairments in AM in schizophrenia, Corcoran & Frith (2003) showed that although the bivariate correlation between the hinting task and a ToM stories task stood at a reasonably healthy 0.63, when logical memory performance and IQ were partialled out, this correlation fell to a modest 0.41. Furthermore, although approximately 44% of the variance on the hinting task was explained by variation of performance on an AM test, only 17% of the ToM stories task could be accounted for in the same way. Thus, the tasks seemed to rely on different kinds of skills. Corcoran (2001, 2003) went on to argue that ToM, as measured by tests such as the Hinting task, is a form of inductive reasoning whereby we infer the mental states of others by first referring to AM to see if we can disambiguate the current situation by recalling similar situations that have arisen in the past. Thus, like simulation accounts of mentalizing (Gallese & Goldman, 1998), we infer the mental states of others through reference to the contents of our own minds. Both the proposal of Corcoran, which gives a key role to AM in ToM, and the simulation account of ToM, which proposes that we mentally put ourselves in others' shoes, involve mental time travel or the cognitive projection of the self, into the past (AM) or into the future (simulation). Imaging studies have shown that the anterior mirror neuron system that is assumed to underpin the simulation account of mentalizing and the areas activated by AM overlap and embed the medial frontal areas of the default-mode network (see Spreng *et al.* 2008).

Jumping to conclusions and attributional style as mental time travel

Alongside findings on the subject of ToM difficulties, paranoia seems to be associated with a characteristic attributional style such that people who are currently paranoid tend to explain negative events in a general and unchanging, other-blaming manner (see Bentall

et al. 2001 for a review). Furthermore, research using a probabilistic reasoning task referred to as the 'Beads in the Jar' task has found that people with delusions tend to jump to conclusions on this task as they characteristically ask to see fewer beads before deciding which jar the beads are being drawn from. Both of these tasks embed a mental time travel component. In all attributional style measures, such as the Attributional Style Questionnaire (ASQ; Abramson *et al.* 1978) or the Internal, Personal and Situational Attributions Questionnaire (IPSAQ; Kinderman & Bentall, 1996), one must simulate around or imagine the likely causes of events that will, using the availability heuristic, involve referral to past events. The Beads in the Jar task involves determining the value of future draws of the beads to the decision you will make. As people with paranoid ideation have been shown to ask for fewer beads (Corcoran *et al.* 2008; Freeman *et al.* 2008), it would seem that they do not recognize the inherent value of the information provided by future draws.

Links to the affective component of paranoia

Bentall *et al.* (2008) reported that negative self-esteem and the anticipation of threatening events in the future independently predicted level of paranoid ideation and this was replicated in the larger data set reported by Bentall *et al.* (2009). This led Bentall *et al.* to argue that the large affective component of paranoia, which was, for all intents and purposes, the same as the affective component of depression, was independent of the weaker but significant cognitive component of paranoia, which was defined by tests of IQ, working memory, ToM and jumping to conclusions. It is notable that the non-paranoid unipolar depressed groups collected by Bentall *et al.* who also endorsed high levels of anxiety distinguished themselves from the groups with paranoid thoughts by demonstrating an entirely intact performance on the measures that made up the cognitive component of paranoia. Thus, it is this compromised cognitive system, conceptualized here as cognitive self-projection or mental time travel, that seems to distinguish paranoid ideation from anxious and/or depressed ideation. However, the fact that this cognitive component of paranoia was found to be independent of the affective structure of paranoia by Bentall *et al.* (2009) may have more to do with the kinds of cognitive tests that were used rather than the epistemology of paranoia. This is because all of the tests making up the cognitive component modelled by Bentall *et al.* were of neutral content. However, the literature is replete with findings showing heightened processing of threat stimuli in paranoia (e.g. Phillips *et al.* 2000), a feature that is very clearly shared with

anxiety (e.g. Macleod *et al.* 1986). Recent evidence suggests that when stimuli within sociocognitive tasks are imbued with salience by referring to potentially threatening events, findings can look very different. For example, Cummins (unpublished observations) has shown that patients with active or remitted persecutory delusions produce more effective story simulations (a task invoking cognitive projection) when the story content refers to potentially threatening as opposed to more neutral social content. In this, they were different from patients with active depression, who simulated better around non-threatening themes, and healthy controls, who showed no content effect for simulation effectiveness. It therefore seems likely that the cognitive and the affective component of paranoia will functionally merge when sociocognitive tasks that involve mental time travel or cognitive self-projection use threatening content. Performance on tasks like these should correlate strongly with severity of paranoia. In fact, this is precisely what has been demonstrated by Bentall *et al.* (2009) as only the anticipation of threatening events, and not neutral or positive events, is associated with severity of paranoia (Bentall *et al.* 2008). It is possible that the use of salient material in cognitive tasks 'throws a switch' to change mental focus from externally or task-oriented (invoked for neutral stimuli) to internally oriented or experientially mediated (invoked for salient stimuli) processing. Just such a switch has been proposed by Burgess *et al.* (2007) to be at work to regulate activity in dorsal and medial areas within a key node of the default-mode network, the rostral prefrontal cortex [Brodmann area (BA) 10].

Future research

It has been suggested that the allusive cognitive deficit of paranoia amounts to disordered cognitive projection or mental time travel resulting from spatial and temporal dysconnectivity between nodes of the default-mode network. To test this hypothesis, imaging studies of paranoid ideation should be conducted with patterns of activity compared to the default-mode network. Behavioural and imaging studies of cognitive tasks and processes that invoke the need to project the self through time (e.g. studies focusing on prospective memory and counterfactual thinking) should also be conducted in both clinical and non-clinical samples. These studies should include comparison participants with anxiety and depression to replicate Bentall *et al.*'s finding that these conditions do not share the underlying impairment of cognitive self-projection, which is argued here to be associated with paranoia.

A more theoretically succinct and coherent understanding of the cognitive deficit associated with paranoid ideation and how this interacts with the prevailing negative affect associated with paranoia should lead to more evidence-based interventions in psychological therapies (Corcoran *et al.* 2006).

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Declaration of Interest

None.

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