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Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Brief report

Detecting motion signals of intent in schizophrenia

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ARTICLE INFO

Article history:

Received 26 September 2013

Received in revised form

6 May 2014

Accepted 8 June 2014

Available online 26 June 2014

Keywords:

Psychosis

Intentions

Social cognition

ABSTRACT

Twenty-four patients with schizophrenia and 18 controls detected chasing in displays of moving disks. Compared to controls, patients had relatively higher hit rates for less direct compared to more direct chasing trials. Perceiving intent was generally intact in patients, despite the well-known difficulties with inferring intentional mental states in schizophrenia.

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1. Introduction

People with schizophrenia perform poorly on theory of mind tasks where they must reason about behaviour in terms of mental states that represent, but are separate from, reality. Yet, they also show 'hyper-mentalising' when task performance is not indexed by correctness of mental-state attributions (see Langdon and Brock, 2008, for discussion of hyper- versus hypo-mentalising in schizophrenia). For example, Bucci et al. (2008) showed videos of actors making either gestures or incidental movements and found that patients with referential delusions were more likely than other groups to attribute intent to incidental movements. Blakemore et al. (2003) presented videos of simple moving shapes, some of which depicted one shape's movement being contingent upon another (e.g., one shape hitting another), and found that persecutory-deluded patients were more likely to attribute contingency where none existed. Russell et al. (2006) presented videos of moving shapes in random, goal-directed, and theory-of-mind (e.g., tricking, coaxing) conditions. While patients, in general, failed to attribute higher-order mental states on theory-of-mind videos (thus showing hypo-mentalising), those with referential/persecutory delusions and third-person hallucinations were more likely to describe random videos using intentional mental-state language (thus showing inappropriate hyper-mentalising).

While these studies show that social-cognitive impairment in schizophrenia takes the form of both hypo-mentalising (omissions)

and hyper-mentalising (inappropriate commissions), they do not tell us whether lower-order social cognition – in particular, the ability to detect simple intent – is similarly disrupted. Gestures, for example, are complex visual signals of communicative intent. And, while Blakemore et al. used simpler motion cues, they asked participants to judge the presence of contingent causality, rather than the presence of simple intent. Magical ideation in patients may have biased them to see magical connections where none existed, thereby obscuring their capacity to detect simple intent. Russell et al. considered various forms of intent but relied upon experimenters' coding of participants' verbal descriptions, which confounds the ability to detect intent with declarative ability to describe intent.

We used similar videos to those used by Russell et al. and Blakemore et al. in a new psychophysical task, the 'chasing' paradigm (Gao et al., 2009), to examine the basic ability to detect intent – chasing – in patients with schizophrenia and healthy controls. This task provides objective indices of hit rates and false alarms, rather than relying upon subjective ratings. If lower-order social cognition is disrupted in similar ways to that seen on other paradigms, hit rates will be lower (hypo-mentalising) and false alarms higher (hyper-mentalising) in patients than controls.

2. Method

2.1. Participants

Twenty-four patients with schizophrenia ($n=17$) or schizo-affective disorder ($n=7$), all medicated at the time of testing, and 18 healthy controls took part. Exclusion criteria included history of head injury, neurological disease, developmental disorder, $IQ < 75$, substance abuse (met DSM-IV criterion for 2+ /last 5 years) and < 7 years formal education.

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Table 1
Means (S.D.) of demographics and cognition scores of both groups and clinical demographics of patients.

	Patients (n=24)	Controls (n=18)	Statistics
Basic demographics			
Age (years)	45.0 (8.9)	42.7 (13.2)	ns
Gender(male/female)	16/8	10/8	ns
Formal education (years)	13.0 (3.45)	15.1 (3.4)	ns
IQ estimate(NART)	106.4 (12.3)	109.6 (10.1)	ns
Cognition scores			
Digit span	17.2 (3.8)	18.4 (5.4)	ns
Spatial span	14.9 (2.8)	17.9 (2.9)	$t(40)=3.43$, $p=0.001$
Clinical demographics			
Age of illness onset (years)	25.0 (9.9)		
Duration of illness (years)	20.4 (10.8)		
Mean SANS ⁺ global rating	1.6 (0.8)		
Mean SAPS ⁺ global rating	1.9 (1.1)		

* 0=absent; 1=questionable; 2=mild; 3=moderate; 4=marked; 5=severe.

2.2. Materials and procedure

2.2.1. Chasing task

Participants completed 20 practice trials and 120 experimental trials depicting four moving disks. On half the trials one of the disks (a 'wolf') chased another disk (a 'sheep'). The sheep and distractors changed direction randomly. The subtlety of the wolf's chase varied across four 'heading-angles': 0°, 30°, 60°, 90°. At 0°, the wolf directly chased the sheep. At other heading-angles, the wolf deviated from head-on within the angle of subtlety (see [Supplementary materials](#) for illustrations). After each 10 s display, participants pressed a key to indicate whether a chase was present or absent (with time-out set at 1 s). A red/green coloured frame appeared around the display to provide feedback, after which the next trial began. The same algorithm generated both the chasing-present and chasing-absent trials, with the sheep being made invisible for the latter. In this way, all visual and dynamic characteristics were similar across the chasing-present and chasing-absent trials.

2.2.2. Basic cognition

Participants then completed the NART to index IQ, and tests of digit span and spatial span.

2.2.3. Interviews

Finally, patients were interviewed using the Diagnostic Interview for Psychosis (DIP; [Castle et al., 2006](#)) to confirm diagnosis and the Scales for Assessing Positive and Negative Symptoms of Schizophrenia (SAPS/SANS) to rate symptom severity. Controls were screened for psychotic and affective disorders and substance abuse using the Structured Clinical Interview for DSM-IV Axis 1 Disorders (SCID; [First et al., 1996](#)).

3. Results

Groups did not differ on age, gender-ratio, IQ or digit span. Spatial span was lower in patients (see [Table 1](#)).

Initial analyses of chasing task results used 2(group: patient vs. control) × 2(gender) × 4(heading-angles) ANCOVAs with spatial span as the covariate. Spatial span was subsequently dropped from the analyses since no effects were significant. Results for false alarms showed a significant main effect of gender, $F(1,38)=4.12$, $p=0.05$, and a significant interaction of gender by heading-angle, $F(2.69, 102.34)=3.09$, $p=0.035$. Males false-alarmed less than females, particularly for the larger, more difficult heading-angles. No group effects were significant. In contrast, hit rates showed a significant interaction of group by heading-angle, $F(1.88,71.46)=3.59$, $p=0.035$. No other results reached significance. The interaction reflected a cross-over pattern (see [Fig. 1](#)), with no simple contrasts being significant. Patients had relatively higher hit rates than controls for the less direct compared to more direct trials.

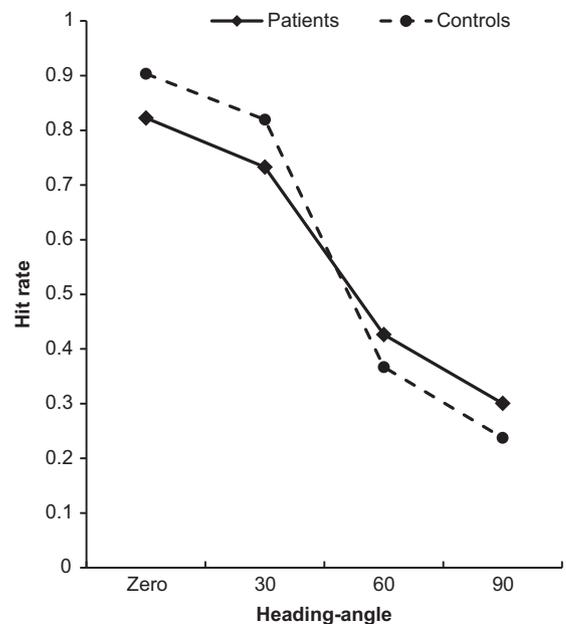


Fig. 1. Mean hit rates by heading-angle and group.

No correlations of hit rates or false alarms with symptom ratings or other demographics were significant.

4. Discussion

Despite the abnormalities of hypo- and hyper-mentalising on tests of higher-order social cognition in schizophrenia, patients showed no general impairment of the ability to detect simple intent (i.e., chasing). Indeed, patients had relatively higher hit rates on less direct (more difficult) compared to more direct trials, with no group effects for false alarms. That patients had lower hit rates on the easier, more direct trials is perhaps not so surprising given the difficulties with smooth-pursuit visual tracking in schizophrenia ([Slaghuys et al., 2005](#)). That patients were relatively better on the less direct trials is more surprising, although pockets of superiority in schizophrenia are not unprecedented (see, e.g., [Gray and Snowden, 2005](#)). These latter findings might be interpreted within a costs-benefits evolutionary perspective; that is, while there is an advantage in better detection of subtle signals of intent, relatively better detection of indirect intent might promote persecutory ideation (although we acknowledge no significant correlations with current severity of persecutory delusions in the current study).

While findings require replication in a larger sample, our preliminary results suggest that, not only does social-cognitive impairment take the form of hypo- and hyper-mentalising in schizophrenia, but also deficits of higher-order social cognition dissociate from pockets of relatively better, lower-order social cognition (see also [Langdon et al., 2006](#), for evidence of heightened sensitivity to other people's gaze in schizophrenia). Specifically, our findings support a theoretically important distinction between lower-order **perception** of intent (which was relatively intact, if not better under some conditions, in patients) and higher-order **inferences** of the contents of intentional mental states (which previous studies indicate is impaired in schizophrenia).

Acknowledgements

This work was supported by the Australian Research Council (ARC) by an ARC Future Fellowship (FT110100631) awarded to the

first author and funding of the ARC Centre of Excellence in Cognition and Its Disorders (CE110001021). Recruitment was facilitated by the Australian Schizophrenia Research Bank (supported by the National Health and Medical Research Council of Australia), Pratt Foundation, Ramsay Health Care, Viertel Charitable Foundation and Schizophrenia Research Institute.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.psychres.2014.06.012>.

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