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Context memory and binding in schizophrenia

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Abstract

The current study aimed to provide evidence for the context-memory hypothesis, which proposes that schizophrenia is linked to a deficit in retrieving contextual information and in binding the different components of a memory together. A new task was developed in which memory for the content of events could be assessed in conjunction with memory for both source and temporal information. Forty-three patients with schizophrenia and 24 normal controls took part in the study. Patients were found to be less accurate in identifying the source and temporal context of events. Furthermore, whereas controls tended to identify correctly both source and temporal context of events, patients tended to have a more fractionated recollection of those events. The study provides support for the context-memory hypothesis by demonstrating that patients with schizophrenia show a fundamental deficit in binding contextual cues together to form a coherent representation of an event in memory.

Keywords: Context memory; Binding; Schizophrenia

1. Introduction

Schizophrenia has increasingly been linked to a deficit in integrating contextual information in memory and several authors have proposed that many of the cognitive deficits observed in schizophrenia result from an impairment in the ability to process contextual information (e.g., Bazin et al., 2000; Cohen and Servan-Schreiber, 1992; Rizzo et al., 1996a; Servan-Schreiber et al., 1996). In the sphere of long-term memory research, a context-memory hypothesis (e.g., Danion et al., 1999; Rizzo et al., 1996a,b; Schwartz et al., 1991) suggests that patients with schizophrenia have a deficit in binding together different contextual information to form an intact memory representation.

In episodic memory research, a distinction between the 'content' and 'context' of memory events is often made, the content referring to the event itself while information about context usually refers to extrinsic features that are not part of the stimulus itself, such as the source of an action or its temporal context. There is evidence that memory for the content and context of an event may be functionally dissociable and may rely on different anatomical regions of the brain (Cabeza et

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al., 1997; Nyberg et al., 1996). However, memories require not only the retention of particular features but also the cognitive processes for binding the features together. Binding processes combine different elements into a complete memory representation and provide the knowledge that certain features belong together (Chalfonte and Johnson, 1996).

Evidence supporting the context-memory hypothesis in schizophrenia rests primarily on findings of impairment in source recognition (Danion et al., 1999; Keefe et al., 1999; Vinogradov et al., 1997), in judgements of temporal order as assessed by recency discrimination tasks (Rizzo et al., 1996a; Schwartz et al., 1991) and in memory for spatial location (Rizzo et al., 1996b). While this hypothesis is supported by demonstrations that patients perform poorly on tasks assessing individual contextual cues, more convincing evidence for a general binding impairment would lie in demonstrating that patients are not able to reconstruct a complex memory occurrence based on a combination of contextual cues.

The current study aimed to test directly the hypothesis that schizophrenia is linked to a deficit in binding different elements in memory together. A new task was developed where memory for events could be assessed in conjunction with memory for both source and temporal information: Each participant watched or performed pairings of common household objects in two different sessions. The task therefore tested recognition for specific events, the source of these events, when the events occurred and the ability to bind the two contextual features together.

2. Method

2.1. Participants

Forty-three patients with a DSM-IV diagnosis of schizophrenia were selected from a psychiatric hospital in Perth, Western Australia. Their demographic and clinical data are presented in Table 1. All patients were receiving typical, atypical or a combination of neuroleptics. A control group comprised 24 individuals with no personal or first-degree family history of psychiatric illness was then selected from the community. Exclusionary criteria for all participants included a history of head injury and neurological illness. Patients and controls did not differ in premorbid IQ as measured with the National Adult Reading Test (Nelson, 1982), age or educational level. The study was approved by the University of Western Australia and Graylands Hospital Ethics Committees, and signed informed consent was obtained from all participants.

Table 1
Demographic and clinical data for patients with schizophrenia and healthy control participants (means and standard deviations)

	Controls ($n=24$)	Patients ($n=43$)	Group Comparisons	p
Age	34.67 (8.81)	36.73 (8.41)	$t=0.95$	0.34
Gender	20 M, 4 F	35 M, 7 F		
Handedness	19 R, 4 L	35 R, 6 L		
Years education	11.75 (1.89)	10.97 (1.97)	$t=1.55$	0.12
NART	103.62 (4.75)	100.21 (9.32)	$t=1.66$	0.10
Age of first hospitalisation	–	23.09 (5.80)		
Number of admissions	–	9.35 (7.79)		
Duration of illness (years)	–	13.64 (8.14)		
Chlorpromazine equivalent	–	942.78 (445.35)		

2.2. Memory for context task

This task was adapted from Conway and Dewhurst, 1995; Danion et al., 1999; Huppert and Piercy, 1978. Participants watched or performed pairings of two sets of 24 household objects over two sessions 30 min apart.

2.2.1. Materials

There were 48 common household objects. Half were allocated to the ‘watch’ action (participants watched the experimenter pair the objects) and half to the ‘perform’ action (participants performed the pairing themselves). A series of cards provided instructions to position objects next to one another or to watch the experimenter perform the action. In the recognition test, 24 pairs of objects were presented: 16 pairs were kept in their original combination (intact pairs), and 8 pairs were objects that were re-paired in new combinations (rearranged pairs). No new objects were added. Objects in new combinations were kept within the same action sequence (watch/perform) and presentation session (1 or 2).