A model of memory impairment in schizophrenia: Cognitive and clinical factors associated with memory efficiency and memory errors

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ABSTRACT

Background: Memory impairments in patients with schizophrenia have been associated with various cognitive and clinical factors. Hallucinations have been more specifically associated with errors stemming from source monitoring failure.
Methods: We conducted a broad investigation of verbal memory and visual memory as well as source memory functioning in a sample of patients with schizophrenia. Various memory measures were tallied, and we studied their associations with processing speed, working memory span, and positive, negative, and depressive symptoms.
Results: Superficial and deep memory processes were differentially associated with processing speed, working memory span, avolition, depression, and attention disorders. Auditory/verbal and visual hallucinations were differentially associated with specific types of source memory error.
Conclusions: We integrated all the results into a revised version of a previously published model of memory functioning in schizophrenia. The model describes the factors that affect memory efficiency, as well as the cognitive underpinnings of hallucinations within the source monitoring framework.

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1. Introduction

Patients with schizophrenia demonstrate cognitive dysfunction that might be as incapacitating as their positive and negative symptoms (Elvevag and Golbdberg, 2000) and that cannot be explained merely by general intellectual disability (Gray et al., 2013). A substantial memory deficit is commonly observed, mostly characterised by inability to conduct effective encoding of information (Cirillo and Seidman, 2003). This deficit might be secondary to a number of factors. We previously conducted a study of various aspects of verbal memory and source memory in a schizophrenia sample (Brébion et al., 2005a). Measures of memory efficiency in terms of the amount of correct responses, as well as measures of memory errors, were tallied. Verbal memory efficiency measures were split into superficial encoding assessed by rote rehearsal and deep encoding assessed by semantic organisation of the target words. We integrated all our results into a model that describes the associations of various cognitive and clinical factors with specific types of memory dysfunction (see Fig. 1). According to this model, processing speed is a major cognitive underpinning of verbal memory

efficiency in schizophrenia and is related to both superficial and deep encoding. Selective attention has a more restricted role, insofar as it is only related to superficial encoding. At the clinical level, the deep memory processes of semantic organisation are affected by depression and by the use of medications with anticholinergic activity. Among the negative symptoms, only avolition is related to verbal memory efficiency. With regard to memory errors, they can be seen as stemming from various types of source memory failure. These memory errors are associated with hallucinations and/or delusions. Unexpectedly, we observed in our previous study that they were also inversely associated with certain negative symptoms reflecting diminished emotion or social interaction.

We conducted a further investigation into another independent sample of schizophrenia patients, in an attempt to extend and refine our model. Verbal as well as visual memory was investigated. Again, we tallied measures of memory efficiency, split into superficial and deep encoding, and measures of memory errors. Semantically organisable lists of words were used to assess the ability to carry out deep encoding of information. To broaden the exploration of encoding depth, we also used lists of mixed high- and low-frequency words. High-frequency words can be processed relatively automatically, whereas the processing of low-frequency words is more effortful. Further, we simultaneously presented mixed black-and-white and coloured pictures in a visual recognition task. Coloured pictures were assumed to draw more attention and therefore undergo deeper encoding, to the detriment of the other

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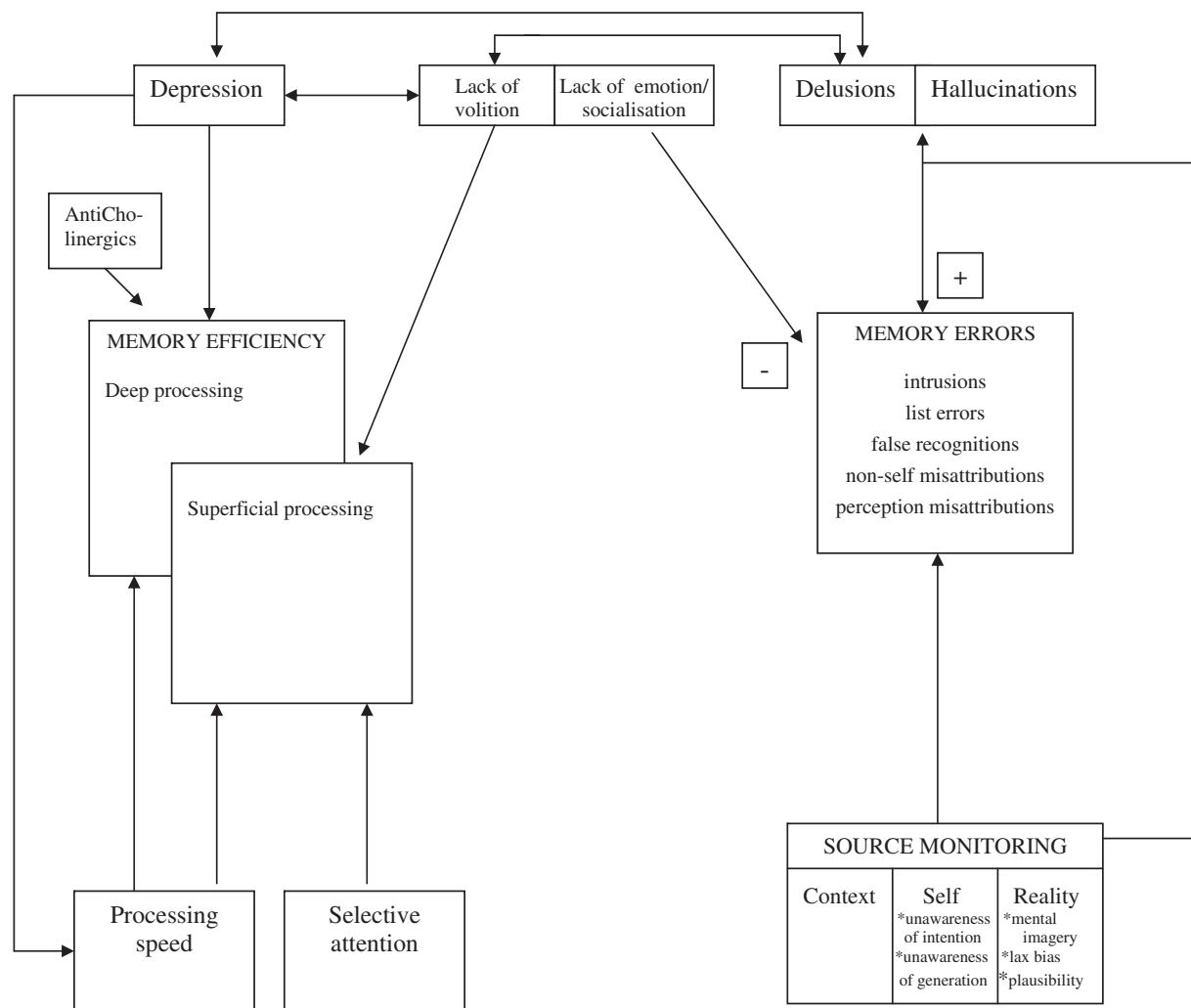E-mail address: gildas.brebion@pssjd.org (G. Brébion).

Fig. 1. First version of the model, published in: Brébion et al. (2005a). A model of verbal memory impairments in schizophrenia: Two systems and their associations with underlying cognitive processes and clinical symptoms. Psychological Medicine 35, 133–142.

pictures. With regard to the potential cognitive underpinnings of memory efficiency, measures of both cognitive and motor speed were included, since they are expected to have differential effects on cognition (Morrens et al., 2006). We also added a measure of working memory span. Indeed, impairment in working memory has been proposed as a core dysfunction in schizophrenia (Silver et al., 2003). With respect to the memory errors, we tallied a broader range of them, derived from the verbal and visual memory tasks as well as from a specific source memory task. We investigated their associations with auditory/verbal and visual hallucinations, rather than merely with a global hallucination score. Lastly, we wished to determine whether the previously observed inverse associations between memory errors and certain negative symptoms could be replicated.

All the associations with underlying cognitive mechanisms and clinical symptoms resulting from this study have been reported in separate publications. In this paper, we integrated all the data into a revised model of memory functioning in schizophrenia.

2. Method

2.1. Subjects

Forty-nine patients with schizophrenia (eight inpatients) were recruited from the South London and Maudsley Trust, London (32 males, 17 females; 26 Caucasian, 19 Black, 4 Indian/Asian; age: mean = 34.7, SD = 7.8; number of years of education: mean = 12.7,

SD = 2.6; National Adult Reading Test (NART) score: mean = 100.9, SD = 13.9). Diagnosis was made on the basis of DSM IV criteria by two experienced psychiatrists who used a clinical interview, patient history, and chart review, and reached a consensus. The patients were primarily suffering from chronic schizophrenia, with disease duration of over 12 months. Exclusion criteria for the study were any evidence of alcohol or drug abuse (DSM IV criteria), organic mental illness or mental impairment, history of brain injury, and current severe physical illness. All but three patients were on daily antipsychotic medication.

Forty-three healthy comparison subjects were recruited via local advertisements and among hospital staff, and were screened to rule out any current or recent psychiatric illness (27 males, 16 females; 28 Caucasian, 13 Black, 2 Indian/Asian; age: mean = 35.0, SD = 9.6; number of years of education: mean = 12.9, SD = 2.8; NART score: mean = 105.7, SD = 11.9). The two groups were not significantly different with respect to age, sex distribution, ethnicity, education level, or premorbid IQ as assessed by the NART. Ethical approval for the study was obtained from the local hospital research ethics committee. After a full explanation of the study, subjects provided written informed consent to participate.

2.2. Clinical ratings

Clinical assessments were conducted by psychiatrists on 41 of the patients (see Table 1). Videotape training in the relevant clinical rating