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Metaphor comprehension deficit in schizophrenia with reference to the hypothesis of abnormal lateralization and right hemisphere dysfunction



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ABSTRACT

Sixteen patients with schizophrenia are presented with 'literal', 'conventional metaphor', 'novel metaphor' and 'unrelated' expressions in minimal and sentence contexts. In both contexts, these patients have greater difficulty in processing conventional and novel metaphor expressions than in processing literal expressions. However, in the sentence context, performance improves significantly for conventional metaphors as compared with that for novel metaphors. The results are interpreted in the light of Rachel L.C. Mitchell and Tim J. Crow's theory of abnormal lateralization and right hemisphere dysfunction in schizophrenia. The difficulty in processing metaphors in general and novel metaphors in particular may be due to right hemisphere dysfunction in schizophrenic patients. Interestingly, 'task difficulty' is found to be an important parameter modulating metaphor comprehension in patients with schizophrenia and, therefore, may also be a crucial factor in deciding the hemispheric bias of metaphor processing.

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1. Introduction

Difficulty in processing metaphorical meaning has been argued to be a unique trait in patients with schizophrenia. This trait is not found in patients with related psychiatric disorders such as schizotypal personality disorder (Langdon and Coltheart, 2004). In a study conducted by De Bonis et al. (1997), subjects were asked to detect a metaphor similar or contrary to a proverb with an abstract meaning, through a two-condition forced-choice response task. The subjects with schizophrenia were found to be impaired in both conditions. Other researchers too observed similar deficits of metaphor comprehension in schizophrenic patients (Anand et al., 1994; Drury et al., 1998; Iakimova et al., 2006b; Kircher et al., 2007; Langdon et al., 2002; Mashal et al., 2013).

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This difficulty in metaphor processing has been associated with right hemisphere (RH) dysfunction and abnormal cerebral lateralization in schizophrenia (Mitchell and Crow, 2005). Several studies report abnormal lateralization in schizophrenia (Gruzelier et al., 1999; Oertel et al., 2010; Pearson et al., 1996; Ross and Pearson, 1996; Schiffman et al., 2005; Schlaepfer et al., 1994; Swanson et al., 2011). Mitchell and Crow (2005) pointed out that abnormal lateralization could be the cause of RH dysfunction in schizophrenia:

... there are frequent examples of cases whereby following a neurological insult to language processing regions in the left hemisphere, the brain is able to reorganize itself somewhat, and homologous structures in the right hemisphere consequently play a greater role in the mediation of that function. However, the right hemisphere functions previously subserved by the new mediator are inevitably affected by this reorganization and are therefore compromised. Could this phenomenon explain the effects of abnormal lateralization for language and right hemisphere dysfunction in schizophrenia? (p. 971)

As suggested by Mitchell and Crow (2005), RH dysfunction has been reported in some recent research too (Ortuño et al., 2011; Ribolsi et al., 2012; see also Barnett et al., 2005b). Niethammer et al. (2000) claimed that non-affected and affected twins of pairs discordant for schizophrenia showed a trend towards higher scores for neurological soft signs on the left half of the body in comparison to control subjects. This is clearly in disagreement with the observations made by Torrey (1980), who reported lateralization of neurological soft signs to the right half of the body, which suggests a left hemisphere (LH) dysfunction. Thus, recent studies have challenged previous research focusing on LH dysfunction in schizophrenia (Flor-Henry, 1976; Gur, 1978). In addition to these theories, some studies suggest that there is an overall under-connectivity in the brain rather than any particular hemispheric dysfunction in schizophrenia (Andreassen, 1998; Friston and Frith, 1995; Mohr et al., 2008; Walker and McGuire, 1982). Barnett et al. (2005a) combined theories of RH dysfunction and under-connectivity and asserted that RH dysfunction, rather than callosal dysfunction, may better explain inter-hemispheric deficits in schizophrenia. Thus, there is a strong possibility of RH dysfunction in schizophrenia.

Reports suggest that RH plays a crucial role in metaphor processing (Ahrens et al., 2007; Brownell et al., 1990; Bryan, 1988; Rinaldi et al., 2004; Stringaris et al., 2006; Winner and Gardner, 1977), particularly in novel metaphor processing (Arzouan et al., 2007; Bottini et al., 1994; Cardillo et al., 2012; Desai et al., 2011; Diaz et al., 2011; Gold and Faust, 2010; Gold et al., 2011; Mashal et al., 2005, 2007; Pobric et al., 2008; Schmidt et al., 2007; Sotillo et al., 2005). An investigation of metaphor comprehension in schizophrenic patients with regard to the influence of factors such as saliency, context and task difficulty may shed some light on the issue of hemispheric dysfunction, as each of these factors has been reported to demonstrate some hemispheric bias.

The Graded Salience Hypothesis (GSH) (Giora, 1997, 1999) states that salient meanings are processed in the LH and the non-salient meanings are processed in the RH. The LH has been reported to be more sensitive to a sentence context compared to the RH (Coulson et al., 2005; Faust and Chiarello, 1998; Franzmeier et al., 2012). Similarly, some studies claim that the RH is preferentially used for cognitively difficult tasks (Hildebrandt et al., 1995; Just et al., 2003; Just and Varma, 2007; Reiterer et al., 2005; Yang et al., 2009).

This study attempts to investigate RH dysfunction in schizophrenia by assessing parameters (saliency and context) that have already been hypothesized to have a hemispheric bias. Experiments 1 and 2, conducted for this purpose, explore the effects of saliency and context, respectively, on the metaphor comprehension ability of patients with schizophrenia.

2. Experiment 1

2.1. Method

2.1.1. Participants

The experimental group consisted of 7 male and 9 female patients with schizophrenia ($n = 16$; average age: 39.6 years, $SD = 9.6$; average education: 13.8 years, $SD = 2.1$). The patients were diagnosed with schizophrenia by two senior psychiatrists, independently, on the basis of the International Classification of Diseases, version 10 criteria. The Brief Psychiatric Rating Scale was administered to patients to assess the severity of symptoms.

A comparison group of 16 healthy controls, matched for age, sex, education and family income, participated in this study. Care was taken to maintain homogeneity in the background of the patients and the matched controls as far as possible. The matched controls were selected on the basis of their scores on the 12-item Normal Health Questionnaire.

All participants were native speakers of Bengali and had at least 12 years of formal education. According to self-reports, all participants were right-handed.² All participants underwent auditory and visual screening tests to ensure they did not have difficulties in identifying visual and/or auditory cues as well as instructions and thus could perform the experimental tasks. All participants gave written informed consent before testing. The demographic and clinical details of the patients and the matched controls are given in Tables 1 and 2, respectively.

² Apart from self-reports, the second author (S.S.) asked selected questions from an adapted version of the Edinburgh Handedness Inventory before documenting the handedness of the study participants. Interestingly, despite strong evidence of abnormal laterality in the schizophrenic patients, all patients turned out to be right-handed. This could be because of the cultural bias in India where left-handedness is not socially approved and usually left-handed children are forced to use their right hand.

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