

Semantic structure in schizophrenia as assessed by the category fluency test: Effect of verbal intelligence and age of onset

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Abstract

It has been reported that long-term memory function, including the semantic structure of category, is impaired in patients with schizophrenia. The present study was performed to determine: (1) whether the deficit in semantic structure in schizophrenia is independent of cultural backgrounds, and (2) the effect of age of onset and verbal intelligence on the degradation of semantic structure in these patients. Fifty-seven Japanese patients with schizophrenia and 33 normal control subjects entered the study. The semantic structure was derived by Multidimensional Scaling (MDS) analysis based on data from the ANIMAL category fluency test. The semantic structure was compared between: (1) schizophrenic patients as a whole vs. normal control subjects; (2) earlier onset (age of onset < 20 years) vs. later-onset groups of patients; and (3) high Vocabulary score (score of the Vocabulary subtest from the WAIS-R > 7) vs. low Vocabulary score patient groups. Normal control subjects demonstrated the domestic/size dimension in semantic structure, while no such dimension was obtained in patients with schizophrenia. The subgroup comparisons revealed that the later onset or the high Vocabulary score group maintained a relatively intact semantic structure compared with the earlier onset or the low Vocabulary score group, respectively. These findings suggest that the deficit in semantic structure in patients with schizophrenia is commonly observed irrespective of cultural backgrounds, and that age of onset and the level of verbal intelligence are closely related to severity of degradation of the semantic structure in schizophrenia. © 2001 Elsevier Science Ireland Ltd. All rights reserved.

Keywords: Category fluency; Semantic structure; Age of onset; Verbal intelligence; Schizophrenia

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1. Introduction

Degradation in executive function including planning, initiation and control of goal-directed behavior is commonly observed in patients with schizophrenia (Goldberg and Gold, 1995). The verbal fluency test has been reported to be associated with those cognitive measures and represent some aspects of frontal lobe function (Crawford et al., 1993). In a typical protocol, subjects are instructed to produce as many words as possible in a given time (Spreen and Strauss, 1998). Two types of verbal fluency tests are generally included in the typical assessment scheme such as the Controlled Oral Word Association. One is the letter fluency test, which requires subjects to generate words beginning with certain letters (e.g. F, A and S, or C, F and L). The other is the category fluency test, in which exemplars of specified categories (e.g. ANIMAL¹, FRUIT) are to be produced (Miturushina et al., 1999; Spreen and Strauss, 1998; Lezak, 1995). The optimal performance on the category fluency test requires not only executive function but also a well-organized category structure related to long-term memory (Feinstein et al., 1998). The domains of cognitive function such as long-term memory and verbal fluency are relevant to functional outcomes in patients with schizophrenia (Green et al., 2000). These considerations indicate the need for further study of category structure in schizophrenia.

Clinical studies on patients with Alzheimer's disease (Mickanin et al., 1994; Rosser and Hodges, 1994; Monsch et al., 1992) or schizophrenia (Goldberg et al., 1998; Gourovitch et al., 1996) have revealed that the degree of impairment in the category fluency test is greater than that in the letter fluency test, indicating a difference in the types of cognitive domains related to the performance of these two verbal fluency tests. Recent neuroimaging studies have demonstrated that different regions in the brain are activated during the execution of the two verbal fluency tests (Gourovitch et al., 2000; Paulesu et al., 1997; Mummery et al., 1996; Pujol et al., 1996).

Multidimensional scaling analysis (MDS; Kruskal and Wish, 1978) is a technique to visualize how patients organize the semantic structure that is dependent on long-term memory. In this analysis, the order of verbal outputs is transformed into a dissimilarity matrix, which allows calculation of psychological distances among category exemplars. Based on the derived distance, the 'semantic map', a spatial representation of exemplars, is constructed. Using MDS analysis, the semantic structure of the ANIMAL category has been investigated in patients with geriatric diseases (Chan et al., 1993) or schizophrenia (Rossell et al., 1999; Aloia et al., 1996; Paulsen et al., 1996). Chan et al. (1993) have reported that dimensions of the semantic structure of the ANIMAL category in patients with Alzheimer's disease were clearly different from those of normal control subjects; the knowledge-based dimensions such as domesticity (domestic vs. wild) or predation (carnivorous vs. herbivorous) have been found to be obscured relative to perceptual-based dimensions such as size (large vs. small). These findings suggest that patients with Alzheimer's disease rely more on the perceptual-based than knowledge-based dimension for organizing the semantic structure of the ANIMAL category.

Degradation of the semantic structure of the ANIMAL category in patients with schizophrenia may be qualitatively different from that in geriatric patients. Paulsen et al. (1996) investigated the semantic structure of the ANIMAL category for elderly patients with schizophrenia (with a mean age of approx. 60 years) and age-matched normal control subjects. They found only a blurred domesticity dimension in the semantic structure of the patient group, while both domesticity and size dimensions were clearly present in normal control subjects. Similar results have been obtained in studies that assessed younger (with a mean age of approx. 30 years) groups of patients with schizophrenia (Rossell et al., 1999; Aloia et al., 1996). These latter studies found no meaningful dimensions or clusters in the semantic structure in patients with schizophrenia.

Although these previous studies in English-speaking countries well characterized deterioration of the semantic structure in patients with

¹ Category name is capitalized hereafter.

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