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Levels of processing effects on recognition memory in patients with schizophrenia

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Abstract

This study sought to characterize the performance of patients with schizophrenia, as compared with healthy participants, on a memory task that required encoding of items to different depths. Participants included 21 individuals with schizophrenia and 26 healthy controls. During the encoding phase of the study, participants processed successively presented words in two ways: perceptually (by making a decision as to whether the letter "a" was present in the word) or semantically (by making a living/nonliving decision for each word). During the recognition phase of the study, participants were presented with a list of words containing items that had been presented during the encoding phase (during either the letter decision task or the semantic decision task), as well as items that had not been seen before (foils). Though patients with schizophrenia performed more poorly overall on the recognition task, recognition was facilitated by semantic encoding to an equivalent degree in both groups. In other words, while significant main effects were present for group and encoding, no group×encoding condition was present. This result is consistent with previous findings of a lack of qualitative differences in performance on learning and memory tasks between patients with schizophrenia and healthy controls. It also suggests that strategies that place constraints on the encoding processes used by patients may help improve the efficiency with which they learn and remember information.

Keywords: Episodic memory; Encoding; Recognition; Schizophrenia

The Levels-of-Processing (LOP) framework, put forth by Craik and Lockhart (1972), posits that greater depth of encoding results in better retrieval. Specifically, information that is processed for meaning (semantic/conceptual encoding) is remembered better than information processed for structural or "superficial" features (perceptual encoding). LOP effects have been demonstrated in healthy adults in a variety of different contexts. The original theory has been extensively studied and remains an important conceptual framework with which to investigate

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memory processes (Lockhart and Craik, 1990; Schacter and Wagner, 1999).

Impairments in memory processes are characteristic of patients with chronic schizophrenia and are most probably related to the disease itself, rather than to the existence or severity of symptoms (Goldberg et al., 1993). Research on schizophrenia to date has shown deficits in core memory functions that appear to be enduring features of the illness (Saykin et al., 1991; Gold et al., 1992; Paulsen et al., 1995; Rushe et al., 1999). Thus, characterizing the memory impairments of these patients is an important goal in understanding this disorder. Certain memory processes (i.e. encoding and retrieval) appear to be impacted more severely than others (Chan et al., 2000). It has been reliably shown that individuals with schizophrenia demonstrate poor performance on tasks involving episodic recall (McClain, 1983; Calev, 1984a,b; Goldberg et al., 1989; Tamlyn et al., 1992; Clare et al., 1993). Additionally, patients with schizophrenia seem to have significant difficulties with the acquisition or encoding phase of memory tasks (Gold et al., 1992, 2000; Heaton et al., 1994; Hawkins et al., 1997). It has been suggested that ineffective learning processes may actually be the driving force behind defective memory performance in schizophrenia (Heaton et al., 1994). Patients with schizophrenia appear to be less likely to encode semantic information than typical controls (Russell et al., 1975; Kareken et al., 1996; Brébion et al., 1997) and have been found to be poor at using semantic information to aid memory (Gold et al., 1992; Paulsen et al., 1995; Heinrichs and Zakzanis, 1998). Executive dysfunction, another prominent neurocognitive feature of this illness (Morice and Delahunty, 1996), may contribute to the schizophrenic patient's impaired ability to employ spontaneous organizational strategies to aid in the efficient acquisition of information (McClain, 1983; Paulsen et al., 1995). Exercising some control over the encoding operations performed by study participants, and prompting them to more effectively encode information (e.g. blocking word lists by semantic category), has been shown to improve performance in patients with schizophrenia (McClain, 1983; Gold et al., 1992).

LOP theory provides an interesting avenue for more in-depth investigation into the memory dysfunction seen in schizophrenia. Expansions of the theory (Craik and Tulving, 1975; Morris et al., 1977; Lockhart and Craik, 1990) since it was introduced in the early 1970s (Craik and Lockhart, 1972), have made it an especially relevant focus of inquiry for schizophrenia research. For example, Craik and Tulving (1975) suggested that "spread" of encoding, or stimulus elaboration, may be another factor affecting the success of subsequent recollection. Specifically, greater elaboration of an item results in an enriched memory trace and subsequently, better memory for that item. Items that are compatible with existing knowledge, or semantic memory, are particularly amenable to this elaborative processing (Craik and Tulving, 1975). Interestingly, individuals with schizophrenia have been found to show impairment in both of these cognitive functions, in both elaborative processing (Traupmann, 1980; Huron et al., 1995) and semantic memory (McKenna et al., 1990; Tamlyn et al., 1992; Clare et al., 1993; McKay et al., 1996). Thus, one might expect patients with schizophrenia to show reduced memory benefit from conditions that promote or require elaborative processing or association of items with semantic memory.

LOP tasks typically involve elaboration of a stimulus and association between to-be-remembered items and existing semantic memory. However, very few studies have looked at the performance of patients with schizophrenia on tasks of this type. In one of the only studies to have employed an LOP paradigm with patients with schizophrenia, Koh and Peterson (1978) had participants make judgments about whether items contained specific letters, rhymed with a word, belonged to a particular category or fit into a particular sentence. Surprisingly, these authors found qualitatively similar patterns of performance to controls, with both groups showing similar mnemonic benefits from deeper encoding. In another early study, Russell et al. (1975) manipulated the "potential for encoding" by presenting lists of cue-target item pairings that differed in their strength of association (high or low intrapair associations). Despite poorer performance by patients with schizophrenia, these authors found that memory improved for both controls and patients with schizophrenia with high-association cue-target pairings. The possibility, as suggested by these two studies, that greater depth of encoding may facilitate memory performance in schizophrenia just as it does in typical participants seems rather