

The role of retrieval inhibition in the associative memory impairment of schizophrenia

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Abstract

To examine retrieval-induced forgetting (RIF) in schizophrenia, subjects studied category–exemplar words taken from either strong or weak categories, and then practiced retrieval by completing category word-stems on half of the word pairs. Patients had reduced recall and recognition, but showed the expected RIF effect of better recall of unpracticed items from unpracticed categories than for unpracticed items from practiced categories. By contrast, patients and controls showed differing RIF for recognition as a function of categorical dominance: whereas controls showed RIF only for dominant category exemplar word pairs, patients showed RIF for both dominant and weak categories. Different patterns of baseline practiced retrieval for weak associate pairs in schizophrenia may explain this finding. The results failed to support faulty RIF in the associative memory impairment of schizophrenia.

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1. Introduction

Bleuler (1911) first identified schizophrenic discourse as often marred by intrusions of dominant but contextually-inappropriate word associations, as illustrated by his patient listing her family members as “father, son, and Holy Ghost”. Is such disturbance

related to a failure to suppress highly active but irrelevant representations from consciousness? In computational and neuropsychological models of cognition, inhibitory processes play an important role in both memory retrieval and selective attention (e.g., Anderson and Spellman, 1995; Collins and Loftus, 1975; Roediger et al., 2001). In associative memory models, in particular, a retrieval cue, such as a category (e.g., FRUIT) activates a network of associates from which the to-be-remembered target is isolated and selected. Activation spreads from a category node (e.g., FRUIT) along network members, even if only one item is sought (e.g., ORANGE). For the desired target to be retrieved, some

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inhibitory mechanisms are thought to be necessary to suppress activated, interfering alternatives (Anderson and Spellman, 1995). These inhibitory mechanisms would serve to deactivate the representation of a competing item in associative memory (Anderson and Spellman, 1995).

We used a newly-developed, retrieval-induced forgetting (RIF) paradigm to examine the mnemonic mechanisms by which a common category cue activates competition among exemplars for access to conscious recollection (Anderson et al., 1994). This gives rise to a phenomenon known as retrieval-induced forgetting whereby encoding and retrieving some associates of a category cue leads to the suppression of other competing and interfering associates during recall. An inhibitory process suppresses the competing category members, leading them to be forgotten. The RIF paradigm is based on the assumption that repeated encoding and retrieval of an item will strengthen the ease of recall of that item, while at the same time leading to the loss of retrieval access of other related items. Thus, the RIF paradigm is of particular interest to the study of the associative memory impairment of schizophrenia because it provides a means to isolate retrieval inhibition from other potential mechanisms of retrieval interference in the disease-related associative disturbance.

The RIF paradigm involves three phases: learning or encoding, retrieval-practice, and delayed category-cued recall. For encoding, subjects study 36 experimental words from six dissimilar categories, each presented as category–exemplar pairs (e.g., FRUIT–BANANA, FRUIT–ORANGE; METAL–IRON, METAL–ALUMINUM). For retrieval-practice, subjects complete category-plus-exemplar stem cue tests (e.g., FRUIT OR___) for only half of the categories and exemplars. For example, subjects complete stem cue tests for FRUIT–ORANGE but not for FRUIT–BANANA and METAL–IRON. Following a 20-min interval, subjects are presented with each category name from the encoding phase, and instructed to recall as many exemplars of that category that they remembered during anytime in the experiment (see Anderson et al., 1994).

Practiced category–exemplar pairs (e.g., FRUIT–ORANGE) are recalled best, but surprisingly the benefit of practice does not extend to related unpracticed associates of the same category (e.g., FRUIT–BANANA). In fact, although they are studied for the same amount of time, the related unpracticed items (e.g., FRUIT–BANANA) have a lower rate of recall than the unrelated, unpracticed items (e.g., METAL–IRON) Anderson et al. (1994) termed this pattern of cued recall [e.g., FRUIT–ORANGE > METAL–IRON > FRUIT–BANANA] as the RIF effect. They proposed that retrieval practice of

some of the members of a category results in retrieval inhibition of associated, unpracticed members. This pattern of cued recall has been replicated by other studies (Anderson and Spellman, 1995; Butler et al., 2001; Smith and Hunt, 2000; but see Williams and Zacks, 2001). Moreover, several studies have suggested that the effect may be localized to the recall stage, as only retrieval but not encoding manipulations result in forgetting of related material (Anderson et al., 2000; Bäuml, 1996, 1997; Ciranni and Shimamura, 1999).

We recently examined RIF in patients with chronic schizophrenia (Nestor et al., 2005). In two experiments, patients with chronic schizophrenia showed significantly overall reduced delayed cued recall. However, patients and controls showed similar RIF for unrelated categories (e.g., FRUIT–ORANGE, METAL–IRON), as reflected by lowest recall for members of a practiced category in comparison to members of an unpracticed category. These results pointed to intact within-category inhibition for patients. Kissler and Bäuml (2005) have demonstrated a similar finding using a part-list cuing paradigm. In a second experiment, we examined RIF for word-pair exemplars from both related and unrelated categories (e.g., COTTON–SHIRT, LEATHER–SKIRT). Here the results failed to demonstrate RIF for either controls or patients, but instead pointed to a significant decline in cued recall for related but not unrelated category–exemplars for patients in comparison to controls (Nestor et al., 2005; Experiment 2). The results suggested faulty specificity/distinctiveness for encoding and retrieval, but not abnormal RIF may contribute to the associative memory disturbance of schizophrenia (Nestor et al., 2005).

In the current study, we examined the role of RIF in recall and recognition in patients with chronic schizophrenia. The associative disturbance of schizophrenia is often characterized by difficulties overriding prepotent, dominant responses, as illustrated in the foregoing Bleuler example (see Han et al., 2003; Nestor et al., 2002). We therefore manipulated associative strength word pair exemplars taken from strong and weak categories to examine the effect of categorical dominance on RIF for both recall and recognition in patients with chronic schizophrenia.

2. Method

2.1. Participants

Eighteen right-handed male patients with chronic schizophrenia recruited from the VA Boston Healthcare System – Brockton Division had a mean age of

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