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Elaborative processing in the Korsakoff syndrome: Context versus habit

Ilse Van Damme *, Géry d'Ydewalle

Department of Psychology, University of Leuven, Tiensestraat 102, B-3000 Leuven, Belgium

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Abstract

Using a procedure of Hay and Jacoby [Hay, J. F., & Jacoby, L. L. (1999). Separating habit and recollection in young and older adults: Effects of elaborative processing and distinctiveness. *Psychology and Aging, 14*, 122–134], Korsakoff patients' capacity to encode and retrieve elaborative, semantic information was investigated. Habits were created during initial training, whereupon cued-recall memory performance was examined, with habit opposing as well as facilitating recollection of earlier studied words. A first group of patients was instructed and tested in the same way as healthy controls and showed poor test performance. Nevertheless, when given more processing and response time, additional explanation, and explicit encouragement, a second group of patients performed similarly to healthy controls. The results suggest that, when given adequate support, Korsakoff patients are able to encode and make use of semantic, contextual, and sequential information. Word distinctiveness, however, only influenced performance of controls.

Keywords: Korsakoff patients; Amnesia; Semantic processing; Explicit memory; Process-dissociation procedure; Associations

1. Introduction

Korsakoff patients are most dramatically characterized by memory problems, in particular by severe anterograde and retrograde amnesia. Historically, the syndrome has served as a prime example of the dissociation between implicit (indirect, unconscious) and explicit (direct, conscious) memory performance (Phaf, Geurts, & Eling, 2000; Schacter, 1987): Korsakoff patients perform poorly when explicitly asked to report about the past, but show a normal 'unconscious' effect of past experience in their performance on a variety of implicit memory tasks (Jacoby, 1991). Already in 1907, Claparède described a patient, suffering from Korsakoff syndrome and possessing memories which could not be brought to mind consciously (Nicolas, 1996). Since then, many studies have reported normal priming effects in amnesic (Korsakoff) patients (e.g., Beauregard et al., 1997; Graf, Shimamura, & Squire, 1985; Phaf et al., 2000; Schacter, 1987; Warrington & Weiskrantz, 1974). Accordingly, the patients seem to suffer from a retrieval deficit, rather than from an encoding deficit: Learning does take place, but the retrieval of information is less successful when effortful, controlled, or conscious recollection is a prerequisite (Groeger, 1997). A recent series of studies using a word-stem completion paradigm (d'Ydewalle & Van Damme, 2007) has provided further evidence for this claim.

1.1. Systems versus processes

The spared and impaired functions of amnesic patients have been linked to different underlying memory systems with presumed distinct anatomical bases (McBride & Dosher, 1999; Phaf et al., 2000). This is supported by the neuropsychological observation showing that damage to a particular region of the brain may be accompanied by a specific loss of memory. More specifically, one presumes that the brain damage of Korsakoff patients selectively affects the memory system for conscious recollection, but leaves the system responsible for other forms of memory relatively intact (Brunfaut & d'Ydewalle, 1996; Cermak, Verfaellie, & Chase, 1995).

* Corresponding author. Fax: +32 16 326099.
E-mail address: ilse.vandamme@psy.kuleuven.be (I. Van Damme).

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According to a transfer-appropriate processing approach (Morris, Bransford, & Franks, 1977; Roediger, 1990), however, explicit and implicit tests require different retrieval operations and consequently benefit from different types of processing during the encoding phase (Brunfaut & d'Ydewalle, 1996; Roediger, 1990; Roediger & Srinivas, 1993). Explicit memory tasks mainly require conceptual or semantic processing, whereas performance in implicit tasks is primarily (but not necessarily) based on perceptual processing. Hence, memory is seen in terms of processes rather than in terms of separate systems: There is one unitary memory that can be used in different ways, with the level of task performance positively related to the extent that cognitive operations at test are similar to those engaged in during initial learning (Morris et al., 1977; Roediger, 1990; Roediger & Srinivas, 1993).

1.2. Semantic processing

Early studies using the levels-of-processing (LOP) framework of Craik and Lockhart (1972) showed that Korsakoff patients did not benefit from semantic encoding instructions, whereas other amnesic patients and healthy control subjects did (Cermak & Reale, 1978; Wetzel & Squire, 1980). In line with these findings and building further on the memory processes account, Brunfaut and d'Ydewalle (1996) provided evidence that Korsakoff patients are particularly handicapped in conceptual/semantic processing, and that the critical dissociation in these patients is not between implicit and explicit memory, but rather between the ability to process perceptual versus conceptual information. Similarly, but more generally, Blaxton (1992) concluded that the amnesic memory deficit is revealed only under conceptual processing conditions, and Verfaellie, Schacter, and Cook (2002) suggested that amnesic patients have problems with the encoding and storage of semantic gist information. Early studies demonstrating impaired implicit memory for newly formed associations in Korsakoff patients (e.g., Cermak, Bleich, & Blackford, 1988) also give support to this account.

In the present paper, however, the conceptual/semantic deficit account is challenged. Findings from several studies contradict the view that conceptual processing conditions yield an (implicit) memory deficit in amnesia (for a review, see Vaidya, Gabrieli, Demb, Keane, & Wetzel, 1996). Cermak et al. (1995) demonstrated that the distinction between implicit and explicit tasks captured the performance of amnesic (Korsakoff) patients better than the distinction between data-driven and conceptually driven processes, leading to the conclusion that these patients can indeed benefit from conceptual processing (see also McDowall, 1981). Moreover, LOP-effects in implicit memory tasks have been obtained not only in normal controls, but also in amnesic patients (e.g., Jenkins, Russo, & Parkin, 1998).

In a recent series of experiments (d'Ydewalle & Van Damme, 2007) using a 'direct' stem completion task (i.e., with three-letter stems as cues to retrieve earlier studied words), Korsakoff patients as well as memory-intact controls showed better performance after semantic encoding than after perceptual encoding, although the difference was larger for controls. When instructions clearly indicated that guessing was allowed at test, all significant group differences disappeared, and the same LOP-effect was obtained in both groups. However, when asked afterwards whether they could 'remember' or just 'knew' the items they had completed (modified version of the 'Remember'/'Know' procedure, see Richardson-Klavehn, Gardiner, & Java, 1994), the patients were unable to report 'remembering' the semantically encoded items, whereas controls could. These results point to the conclusion that there is indeed semantic processing in Korsakoff patients, but that the encoded information is mainly retrieved in an automatic, involuntary manner. Healthy controls, on the other hand, additionally benefit from conscious, intentional recollection. This offers an explanation for previous findings of larger LOP-effects in controls than in amnesic patients (e.g., Squire, Shimamura, & Graf, 1987), as was already suggested by Hamann and Squire (1996), and Jenkins et al. (1998).

Importantly, however, whereas the foregoing studies do cover the encoding of single-item information, they do not address the question of whether inter-item associations and other contextual information are encoded during the study phase. Moreover, based on brain imaging research, a deficit in the encoding of such relational information might be expected in Korsakoff patients. The brain areas reported to be damaged in the syndrome include both frontal and diencephalic regions (e.g., Reed et al., 2003; Shimamura, Jernigan, & Squire, 1988), and the medial temporal/hippocampal region (Sullivan & Marsh, 2003; see also Oscar-Berman & Evert, 1997; Parkin & Leng, 1993), or at least some extended hippocampal system involving the hippocampal-anterior thalamic axis (Caulo et al., 2005). The latter area is not only involved in (conscious) recollection (e.g., Schacter, Alpert, Savage, Rauch, & Albert, 1996), but also in encoding (e.g., Kopelman, Stevens, Foli, & Grasby, 1998; Stern et al., 1996) and in (successfully) binding elements into an integrated memory trace (e.g., Jackson & Schacter, 2004; Kroll, Knight, Metcalfe, Wolf, & Tulving, 1996).

Indeed, several theories have proposed that the formation of new associations between previously distinct elements constitutes the basic deficit in amnesia (e.g., Cohen, Poldrack, & Eichenbaum, 1997; Johnson & Chalfonte, 1994; see also Verfaellie, Martin, Page, Parks, & Keane, 2006). Even further, the context memory deficit hypothesis (CMDH; see Mayes, Meudell, & Pickering, 1985, for a review) states that "amnesics suffer from a primary deficit in the processing and/or storage of contextual information, and that this primary impairment is responsible for a secondary impairment in the ability to recall and recognize other kinds of complex information" (Mayes, Downes, Shoqeirat, Hall, & Sagar, 1993, p. 745). Whereas demonstrations of impaired memory in Korsakoff patients