

Dissociation between the cognitive process and the phenomenological experience of TOT: Effect of the anxiolytic drug lorazepam on TOT states

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Abstract

TOT states may be viewed as a temporary and reversible microamnesia. We investigated the effects of lorazepam on TOT states in response to general knowledge questions. The lorazepam participants produced more commission errors and more TOTs following commission errors than the placebo participants (although the rates did not change). The resolution of the TOTs was unimpaired by the drug. Neither feeling-of-knowing accuracy nor recognition were affected by lorazepam. The higher level of incorrect recalls produced by lorazepam participants may be due to the fact that they were more frequently temporarily unable to access a known item. For some of these items, the awareness of the retrieval failure resulted in a commission TOT (phenomenological TOT after a commission error). The resolution of the TOT conflict is discussed in the light of the anxiolytic and anticonflict effects of lorazepam. The data are discussed in terms of contemporary theories of TOTs and the effects that benzodiazepines have on semantic memory.

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1. Introduction

Healthy people occasionally experience ordinary memory failures at some time or other (Schacter, 1999). Some of these common memory failures are permanent. For example, you will almost certainly never remember what you ate for dinner on 7th June 2005. However, other impairments often prove to be transient. Indeed, it is possible to view tip-of-the-tongue states (TOTs) as temporary and reversible amnesic episodes. TOTs have recently gained importance in a number of areas within the field of cognitive psychology (e.g.,

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Choi & Smith, 2005; Gollan & Acenas, 2004; Hamberger & Seidel, 2003; Lesk & Womble, 2004; Maril, Simon, Mitchell, Schwartz, & Schacter, 2003; Maril, Simons, Weaver, & Schacter, 2005).

A TOT is a state in which a target word is not retrieved but in which the participant feels that he or she knows and will retrieve the target word. TOT experiences tend to be accurate as they predict recognition and recall (see Schwartz, 2002a). Moreover, diary studies show that 89–95% of missing words are subsequently retrieved by the participant in real-world TOTs (Burke, MacKay, Worthley, & Wade, 1991; Ecke, 1997; Schwartz, 2002b; for a review, see Brown, 1991; Schwartz, 2002a).

Diary studies and laboratory tasks also show that 50–70% of TOTs are accompanied by persistent alternates, also known as blockers and interlopers (Burke et al., 1991; Reason & Lucas, 1984). Burke et al., found that nearly 90% of the persistent alternates were from the same syntactic category as the missing word. Although these alternates are recognized as incorrect, the participants are unable to retrieve the correct target. However, in these field studies, it is not possible to collect comparable states of unretrieved words which are not in TOT states (referred to as n-TOTs below). Laboratory studies reveal higher rates of both resolution and persistent alternates among TOTs than n-TOTs (Smith, 1994). In the current study, we examine the role that persistent alternates play in the production of TOTs by using a pharmacological tool that should provide us with an insight into this phenomenon.

We make a distinction between two aspects of the TOT phenomenon. First, we define the cognitive state involved in TOTs as being the failure of the retrieval process to produce a known word (e.g., Burke et al., 1991; Miozzo & Caramazza, 1997; Vigliocco, Antonini, & Garrett, 1997). This cognitive process relates to word retrieval and its failure. In contrast, we define the phenomenological experience of the TOT as the strong and frustrating feeling that a particular target word is about to be retrieved (e.g., Brown & Mc Neill, 1966; Schwartz, Travis, Castro, & Smith, 2000). This experience is metacognitive in nature since it involves a feeling of a future capability to remember.

We argue that the literature supports the idea of this type of distinction between cognitive and phenomenological TOTs (see Schwartz, 2002a). The research suggests that not all temporary retrieval failures are accompanied by TOTs, in the same way that not all phenomenological TOTs are accompanied by the ultimate retrieval of the target (e.g., Schwartz, 1998; Schwartz et al., 2000). Furthermore, research has demonstrated dissociations between retrieval and the number of TOTs (e.g., Schwartz & Smith, 1997; Widner, Smith, & Graziano, 1996). Thus, throughout this paper, we use the term *cognitive TOT*—or simply *retrieval failure*—to refer to the temporary amnesia associated with the failure to retrieve a known word and the term *phenomenological TOT* to refer to the subjective experience of feeling that a word is retrievable. In this study, we show that, in some cases, phenomenological TOTs do not occur until after the participant has found out that his or her retrieval was inaccurate. Thus, we will argue in support of a model of TOTs that makes a distinction between the cognitive and phenomenological aspects of the TOT process (for an opposing view, see Taylor & MacKay, 2003).

1.1. Benzodiazepines and memory

Amnesia-inducing drugs can be used as tools to reveal the functional principles of normal cognitive processing (Danion, 1994). In this paper, we concentrate on whether or not benzodiazepines affect semantic memory. Curran (1991, 1999) has argued that benzodiazepines do not alter semantic memory. These conclusions were primarily drawn on the basis of unimpaired performances in verbal fluency tasks in which participants were required to provide in a fixed time either the largest possible number of items belonging to a given semantic category (Curran, 1991; File, Sharma, & Shaffer, 1992; Fluck et al., 1998; Vermeeren et al., 1995). Allen, Curran, and Lader (1993) and Green, McElholm, and King (1996) found that lorazepam did not affect the accuracy of semantic retrieval.

However, other evidence obtained from sentence verification tasks suggests that semantic memory may be affected by benzodiazepines. Vermeeren et al. (1995) reported that lorazepam-treated participants made more errors than did placebo participants. In addition, File et al. (1992) showed that the benzodiazepine, midazolam, impaired word completion performance. They observed that participants who had been administered benzodiazepine generated more low-frequency exemplars than common words when retrieving categorical information from memory. This may reflect the fact that the “ordinary” high-frequency answers were

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