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Output interference in recognition memory

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ABSTRACT

Dennis and Humphreys (2001) proposed that interference in recognition memory arises solely from the prior contexts of the test word: Interference does not arise from memory traces of other words (from events prior to the study list or on the study list, and regardless of similarity to the test item). We evaluate this model using output interference, a decline in accuracy as a function of the words presented during test. Output interference is consistent with models that allow interference from words other than the test word, when each test produces a memory trace, and hence a source of interference. Models positing interference solely from prior contexts of the test word itself predict no effect of items presented during test, without added assumptions. We find robust output interference effects in recognition memory. The effect remains intact after a long delay, when study-test lag is held constant, when feedback is provided, and when the test is yes/no or forced choice. These results are consistent with, and support the view that interference in recognition memory is due in part to interference from words other than the current test word.

Introduction

When attempting to remember a specific event, interference is caused by irrelevant memories. This is a well-established and extensively investigated phenomenon (Anderson & Neely, 1996; Crowder, 1976; McGeoch, 1933; Melton & Von Lackum, 1941; Mensink & Raaijmakers, 1988; Murdock, 1974; Raaijmakers & Shiffrin, 1980, 1981; Shiffrin, 1970). Interference in free recall arises when memory traces contain representations of similar items and/or more than one item encountered in similar contexts. Evidence collected over many years suggests that like free recall, item recognition is also subject to interference from traces with similar item and context information (Clark & Gronlund, 1996; Gillund & Shiffrin, 1984; Humphreys, Pike, Bain, & Tehan, 1989; Murdock, 1982). However, this conclusion has been challenged by a model of recognition memory for words that assumes interference arises only from the contextual history of the test word (Bind Cue Decided Model of Episodic Memory, BCDMEM, Dennis & Humphreys, 2001). While no model denies that interference may arise from the prior contexts in which a word has been encountered (cf., Criss & Shiffrin, 2004; Shiffrin & Steyvers, 1997; Steyvers & Malmberg, 2003), BCDMEM makes the strong assertion that this is the *only* factor producing interference, and that stored traces of other words play no role. One test of this assertion can be found by examining output interference: the effect of prior testing of other words before a critical word. BCDMEM claims that neither the number of such prior test words nor their similarity to the words on the study list should affect recognition performance. We evaluate the role of output interference in recognition memory.

Interference in recognition memory

In recognition, subjects study a list of items, and then decide whether items on a test list were studied or not. Dennis and Humphreys (2001) restrict their claims to

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words, so the primary focus of this article will be recognition memory for words. Assessing whether interference from other words on the study list reduces recognition accuracy depends on the assumptions one makes about how recognition is performed. All models assume that recognition requires the representation of two types of information. *Item information* refers to a representation of the semantic, phonological, visual, etc. content of the to-be-remembered item. This information is usually generated when performing a recall task, for instance, and it is the information that one must determine was encountered on the study list when performing a recognition task. There exists ambiguity about terminology when discussing information about other words coded together with a given word; we term such information *associative context information*. We use *list-context information* to refer to the internal and external factors that comprise the situation in which learning occurs or the to-be-remembered information was presented, other than information about other words (cf, Howard & Kahana, 2002).

Interference refers to memory loss that is the result of the interaction of a retrieval cue (consisting of both item- and context information) with similar traces stored in memory. The more similar are the interfering episodic memory traces, the more difficult it is to recall or make a recognition decision about the test item. This occurs because a typical episodic memory paradigm requires discrimination of an item presented on the recent list from *other* items stored in memory (either those stored during list presentation or those stored in previous lists or prior experience) and from prior experiences of that *same* item (either in previous lists or prior experience). In recognition, item and/or list-context information may be retrieved from traces of the test item or from similar traces, or both. Retrieved item information from memory traces of other similar items (from the list or events prior to the list) produces what is referred to as *item-noise* or *item interference*. Retrieved list-context information from memory traces of other similar items from the list or events prior to the list, or from memory traces of the test item itself from events prior to the list produces what is referred to as *context-noise* or *context interference*. In both cases, the similarity of the retrieved information to the test probe is the source of interference.

Models of recognition memory

The subject of the present investigation is the importance of item interference when words are used as stimuli: Does item information, from traces of other words on the study list, from traces of other words on the test list, or from traces of other words prior to the list, produce interference? Item information from pre-experimental traces of other items probably plays at most a small role because they differ from the retrieval probe in both item and context information. The most important source of item interference should therefore come from item information in traces of other items presented on the study list and the other items presented on the test list because they share context information. Although most models of memory assume that both item and context interference play a role in recognition, BCDMEM raises the possibility that, for words, the only relevant factor is context interference. That is, context information retrieved from traces of the test word stored prior to the study list is the sole source of interference. Thus, we seek to distinguish models of recognition memory that posit both item- and context-noise from those positing only context-noise, respectively referred to as *item-noise models* (e.g., Criss & Shiffrin, 2004) and *context-noise models* (e.g., Dennis & Humphreys, 2001).

In both models, the study trial produces a memory trace consisting of a representation of both item and the context information, and the test probe also consists of both types of information. The difference lies in what traces are retrieved from memory (thereby producing interference). In context-noise models (e.g., BCDMEM), word information in the test probe is sufficient to limit retrieval only to traces of the test word (both from the list, if such a trace exists, and from events prior to the list). In item-noise models, retrieval also occurs from traces of other items from the study list, the more similar the test word and the memory trace the more interference is caused by that trace.[1]

Whatever the source of interference, we submit the item- and context-noise models to a critical test. Item-noise models predict that traces of non-target words should have a negative impact on memory performance. Context-noise models do not predict an effect of other items. Of relevance for the present investigation, such non-target word traces include those that are stored during the sequence of recognition test trials following list study.

Prior tests of the models

Like several item-noise models (e.g., McClelland & Chappell, 1998; Shiffrin & Steyvers, 1997), BCDMEM was designed to predict list composition effects. One of the most important list composition findings is that increasing the extent of encoding of non-target traces has no effect on recognition. This is referred to as the null list-strength effect. BCDMEM naturally predicts a null list-strength effect because item information does not contribute to the recognition decision (e.g., Starns, White, & Ratcliff, 2010). Item-noise models predict the null list-strength effect on the assumption that increasing the amount of information

[1] There are two processes by which interference can take place. In some models, the primary way the recognition decision is made is due to a general sense of familiarity (e.g. Gillund & Shiffrin, 1984; Shiffrin & Steyvers, 1997): the activations of all the memory traces that are retrieved are combined, and a positive recognition decision is made if that combined activation (i.e., familiarity) is high enough to exceed a criterion. In other models, termed dual process, a recall (or recollection) process also plays a significant role: sometimes a particular memory trace is recalled and when that trace matches the probe well enough this is sufficient to produce a positive recognition decision (e.g. Atkinson & Juola, 1974; Malmberg, 2008; Malmberg, Holden, & Shiffrin, 2004; Mandler, 1980; Xu & Malmberg, 2007; see Yonelinas, 2002 for a review). In the single process familiarity models, interference is due to additional familiarity contributed by traces matching in item information, context information or both. If recall also plays a role, interference is due to competition between traces: the chances of sampling and retrieving the desired memory trace are higher if there are fewer competing similar traces (either due to item similarity, context similarity, or both).