



Recollection and familiarity in recognition memory: Evidence from ROC curves

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Received 3 March 2006; revision received 3 July 2006

Available online 30 August 2006

Abstract

Does recognition memory rely on discrete recollection, continuous evidence, or both? Is continuous evidence sensitive to only the recency and duration of study (familiarity), or is it also sensitive to details of the study episode? Dual process theories assume recognition is based on recollection and familiarity, with only recollection providing knowledge about study details. Single process theories assume a single continuous evidence dimension that can provide information about familiarity and details. We replicated list (Yonelinas, 1994) and plural (Rotello, Macmillan, & Van Tassel, 2000) discrimination experiments requiring knowledge of details to discriminate targets from similar non-targets. We also ran modified versions of these experiments aiming to increase recollection by removing non-targets that could be discriminated by familiarity alone. Single process models provided the best trade-off between goodness-of-fit and model complexity and dual process models were able to account for the data only when they incorporated continuous evidence sensitive to details.

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Keywords: Recognition memory; List discrimination; Receiver operating characteristic; Signal detection theory; Memory models

1. Introduction

Dual process theories propose that recognition memory is based on two qualitatively different kinds of memorial processes—recollection and familiarity (Yonelinas, 2002). Recollection is viewed as a discrete or all-or-none outcome that recovers details about the study episode through associations between the test item and aspects of the general study context, other studied items, and the physical characteristics of the studied item itself.

For example, recollection of the study context can support list discrimination judgments (i.e., deciding which list an item was studied in), recollection of other studied items can support associative recognition judgments (i.e., deciding whether a pair of items was studied together), and recollection of the physical characteristics of a study item can support source memory (e.g., deciding if an item was heard in a male or female voice at study). Recollection can also play a role in item recognition. If recollected details are consistent with the test item, it may be classified as a target (*recollect-to-accept*), whereas, if recollected details are inconsistent with the test item, it may be classified as non-target (*recollect-to-reject*).

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If recollection fails, decisions are based solely on familiarity. In contrast to recollection, familiarity “is assumed to be a relatively fast process that reflects the global familiarity or strength of an item” (Yonelinas, 1999a, p. 1416). It provides a continuous value that conveys undifferentiated information about the duration, frequency, and recency of prior exposure to a test item. Although familiarity conveys no information concerning specific details of the study episode, it can often be used as a reasonably reliable indicator of prior exposure, and so can support decisions in an item recognition paradigm (i.e., discriminating studied and unstudied items). Familiarity may also play a role in paradigms such as list discrimination, but only when study recency provides a cue for list membership (e.g., discriminating lists studied 5 min and 5 days ago, Yonelinas, 1999a).

The proposal that recognition memory is based on recollection and familiarity can be tested through examination of the shapes of receiver operating characteristic (ROC) curves (e.g., Yonelinas, 1999a). ROC curves plot, across different levels of decision confidence, the probability of a “yes” answer to the question posed by the recognition task for one type of test item (e.g., a target) against the probability of answering “yes” for another type of test item (e.g., a non-target). In Yonelinas’s (1994) dual process signal detection theory confidence ratings are based on criteria placed on familiarity. In item recognition paradigms larger familiarity values are associated with higher confidence that a test item is old (i.e., was studied) as, on average, familiarity for studied items is greater than familiarity for unstudied (new) items. Dual process signal detection theory also assumes that high confidence old responses can result from recollect-to-accept processes and that high confidence new responses can result from recollect-to-reject processes. Other versions of dual process theory have been proposed (see Yonelinas, 2002 for a review), but here we focus on dual process signal detection theory and refer to it simply as dual process theory.

We report tests of dual process theory using ROC data from a list discrimination paradigm, replicating Yonelinas (1994), experiment one, and an item recognition paradigm, replicating Rotello et al. (2000), experiment one. In these paradigms recollect-to-accept processes can be used to make decisions about targets and recollect-to-reject processes can be used to make decisions about non-targets that are very similar to targets. In the list discrimination paradigm, targets and similar non-targets correspond to items presented in two different study lists separated by a short pause. In the item recognition paradigm, similar non-targets differ only in plurality from studied items, half of which are in plural and half in singular form. For example, if *hand* is a studied, target, item then *hands* is a similar non-target item. In both the list and plural discrimination paradigms similar non-targets can be rejected on the basis

of recollected details, concerning either the list context or the plurality of the studied item, respectively. Both paradigms also included new non-target items that had not been studied in either list or in either plurality. For these items, recollection is assumed to play no role and decisions are based purely on familiarity, which would be less for these items than for either targets or similar non-targets.

In both the list discrimination and plurals paradigm, targets and similar non-targets have been chosen to have nearly equal levels of familiarity. In the list discrimination paradigm, targets and similar non-targets are drawn from different lists distinguished at study only by a short pause. In the plurals paradigm, similar non-targets differ from targets only in terms of their plural form (e.g., hand vs. hands).¹ When targets and similar non-targets have equal familiarity, dual process theory assumes that they can only be discriminated by discrete recollection. As a result, this theory predicts that the ROC curve relating targets to similar non-targets is linear (see Appendix A for details). Rotello et al. (2000) found an almost exactly linear ROCs of this type, but Yonelinas (1994) did not (see Fig. 1, right panels). Linear ROCs have been found in related paradigms, such as associative recognition (Yonelinas, 1997) and source identification (Yonelinas, 1999a), that also equate familiarity. However, these results appear to be exceptions, with the majority of findings indicating non-linear ROCs in associative and source recognition paradigms (e.g., Glanzer, Hilford, & Kim, 2004; Healy, Light, & Chung, 2005; Hilford, Glanzer, Kim, & DeCarlo, 2002; Kelley & Wixted, 2001; Qin, Raye, Johnson, & Mitchell, 2001; Slotnick, Klein, Dodson, & Shimamura, 2000; Verde & Rotello, 2004).

It is possible that strategic factors may affect the shape of the relevant ROC curves. Such strategic factors could influence whether participants attempt recollection, and whether they use recollected details to accept or reject test items. In Rotello et al.’s (2000) first experiment participants were instructed to recollect-to-reject (i.e., respond “no” with high confidence if they recalled studying the test item in its alternative plurality), whereas Yonelinas (1994) did not give these instructions. Consistent with the influence of strategic factors, in a second experiment where Rotello et al. did not give recollect-to-reject instructions non-linear target versus similar non-target ROCs were found.

¹ Equal familiarity, on average, seems more likely in the list discrimination paradigm, where the first and second studied lists were equally often designated as the target in testing, than in the plural discrimination paradigm, where features related to the target’s plurality would be more familiar. We compared estimates of familiarity between these two paradigms to examine this issue further.

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