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# Why does collaborative retrieval improve memory? Enhanced relational and item-specific processing ☆

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ABSTRACT

Engaging in collaborative retrieval practice increases performance on subsequent memory tests taken individually (Blumen & Stern, 2011). However, the basis of these *post-collaborative benefits* is largely unexplained. Thus, the primary goal of the current research was to investigate the cognitive mechanisms underlying post-collaborative benefits vis-à-vis the theoretical framework of distinctiveness theory, which postulates that two processes influence memory. *Relational processing* refers to the encoding of similarity among a set of items, whereas *item-specific processing* refers to the encoding of information that differentiates items from one another. The central claim of distinctiveness theory is that memory is enhanced when differences among individual items are processed in the context of the similarity among those items (referred to as *distinctive processing*). The basic design of all three experiments was similar (i.e., close replications with intent to provide multiple estimates of effect sizes on which to base conclusions): Learners were asked to study lists of exemplars from taxonomic categories, followed by recall practice that occurred either collaboratively or individually. All learners completed individual final tests, immediately after practice and/or after a delay. Of greatest theoretical interest for diagnosing the extent to which post-collaborative benefits reflect distinctive processing, we examined indicators of relational processing (clustering and category access) and item-specific processing (items recalled per category and recognition performance). Results across the three experiments established that distinctive processing (i.e., enhancements in both relational and item-specific processing) contributes to post-collaborative benefits across both short and long retention intervals.



## Introduction

A rapidly growing area of research has explored the costs and benefits of collaborative memory, focusing on the cognitive mechanisms that affect learning and retention when retrieval occurs in a group environment (for reviews, see Rajaram, 2011; Rajaram & Pereira-Pasarin, 2010). A majority of prior research has focused on a cost of collaborative retrieval practice, which is the counterintuitive finding that learners recall less information during practice when retrieval occurs collaboratively versus individually—referred to as *collaborative inhibition* (e.g., Barber & Rajaram, 2011; Basden, Basden, Bryner, & Thomas, 1997; Congleton & Rajaram, 2011; Thorley & Dewhurst, 2007; Weldon & Bellinger, 1997). In contrast to lower recall during practice, one benefit of collaborative retrieval practice is increased performance on subsequent memory tests taken individually (Barber, Rajaram, & Fox, 2012; Blumen

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& Rajaram, 2008, 2009; Blumen & Stern, 2011; Congleton & Rajaram, 2011). Enhanced post-collaborative individual memory (hereafter referred to as *post-collaborative benefits*) has received much less empirical attention than collaborative inhibition, which is perhaps surprising given that subsequent retention is of greater interest for practical purposes. For example, students often engage in some form of collaborative retrieval during study but then take an individual exam at a later point in time. Thus, investigating the processes that underlie post-collaborative benefits will have important implications for both theory and application.

Although post-collaborative benefits have been explored to a lesser extent relative to collaborative inhibition, several studies have demonstrated the effect (Barber & Rajaram, 2011; Basden, Basden, & Henry, 2000; Blumen & Rajaram, 2008, 2009; Blumen & Stern, 2011; Congleton & Rajaram, 2011, 2014; Henkel & Rajaram, 2011). An important next step is investigating why collaborative retrieval practice increases subsequent individual memory. One plausible theoretical explanation is *distinctiveness theory* (e.g., Hunt, 2012, 2013), which postulates two processes that influence memory. *Relational processing* refers to the encoding of similarity among a set of items, whereas *item-specific processing* refers to the encoding of information that differentiates items from one another. For example, when studying a list of words that included apple, lemon, grape, and pineapple, relational processing could involve noting that all of these words refer to members of the category "fruit." By comparison, item-specific processing would involve noting unique or distinguishing features of these items, such as that lemons are sour and pineapples have spiky tops. The central claim of distinctiveness theory is that memory is enhanced when differences among individual items are processed in the context of the similarity among those items (referred to as *distinctive processing*). For example, relational processing during encoding can support subsequent recall by defining the search set (e.g., remembering that fruits were studied) but is insufficient for remembering *which* fruits were studied. Having engaged in item-specific processing during encoding increases subsequent recall by facilitating discrimination between candidates within the search set (e.g., a fruit that is sour = lemon; a fruit that has a spiky top = pineapple). Thus, distinctiveness theory postulates that relational processing alone is not sufficient for enhanced memory, but rather that enhanced memory also depends on the processing of item-specific information to discriminate among related items. In support of this theoretical claim, previous research has demonstrated potent effects on memory when relational processing and item-specific processing occur in combination (Hunt, 2012, 2013; Hunt & McDaniel, 1993; Hunt & Rawson, 2011).

Although distinctiveness theory has not been directly investigated in the collaborative memory literature, the involvement of relational processing (one of the two processing components postulated by distinctiveness theory) in post-collaborative benefits has been explored to some extent (Blumen & Rajaram, 2008; Congleton & Rajaram, 2011; Finlay, Hitch, & Meudell, 2000). However, results have shown somewhat mixed outcomes (discussed below), suggesting the need for further research (one goal of the current work). Of greater interest for present purposes, the literature has been silent on the extent to which item-specific processing is a basis of post-collaborative benefits. Given that item-specific processing is a critical factor for the memorial benefits of distinctive processing, a major contributor to post-collaborative benefits may have heretofore gone unexamined. Thus, the primary purpose of the three experiments reported here was to provide a novel evaluation of the extent to which post-collaborative benefits reflect distinctive processing, which requires both relational and item-specific processing.

Below, we describe how distinctiveness theory relates to and extends beyond existing accounts of post-collaborative benefits that have been forwarded in the collaborative memory literature. To foreshadow, although several accounts posit factors that may affect relational processing, current accounts are silent on factors that may affect item-specific processing. Furthermore, although existing accounts suggest factors that may affect post-collaborative benefits they do not postulate what underlying processes may be affected by those factors. Here, we use distinctiveness theory to extrapolate beyond existing accounts to propose why these factors may affect post-collaborative benefits in terms of the underlying processes that are occurring.

## Relational processing

One leading theoretical account in the collaborative memory literature is *cross-cueing,* which refers to when the output of one group member cues another group member to recall an item, providing additional retrieval practice and increasing learning (Harris, Barnier, & Sutton, 2012a; Meudell, Hitch, & Boyle, 1995; Meudell, Hitch, & Kirby, 1992). In terms of distinctiveness theory, cross-cuing would presumably enhance relational processing by strengthening the association among items during group recall. For example, if learners were asked to recall taxonomic word lists, one group member's recall of an exemplar would likely trigger activation of the superordinate category for another group member. Thus, collaborative retrieval practice would lead to enhanced encoding of the categorical relations between exemplars. If the association among items is strengthened via cross-cueing then this would be consistent with the idea that collaborative retrieval practice enhances relational processing, one of the two key components of distinctive processing.

Another leading theoretical account in the collaborative memory literature is the *retrieval disruption hypothesis*, which posits that the output of one group member disrupts the way in which another group member has organized information to be output during recall (Basden et al., 1997; Weldon & Bellinger, 1997). This account would predict that collaborative retrieval practice disrupts relational processing. For example, if one group member starts to recall exemplars from the category "colors" but another member interrupts by recalling exemplars from the category "furniture," the retrieval organization of the first