# LEARNING AND REMEMBERING WITH OTHERS: THE KEY ROLE OF RETRIEVAL IN SHAPING GROUP RECALL AND COLLECTIVE MEMORY

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People frequently collaborate to learn and remember information, and this may help groups create shared representations of the world (i.e., *collective memories*). However, contrary to intuitions, collaboration also lowers group recall levels. Such impairment occurs regardless of whether people collaborate when first experiencing, or encoding, an event (the *collaborative encoding deficit),* or when retrieving, or remembering, the event (the *collaborative inhibition effect)*. In understanding how collaboration impairs group recall and enhances shared, or collective, memories it remains unknown as to where collaboration exerts the greatest influence—at encoding or at retrieval—to shape these distinct phenomena. The current study simultaneously compared collaboration at these two stages and revealed the power of collaborative retrieval. Collaboration impaired the group recall product at both time points, but especially so at retrieval. Furthermore, only collaborative retrieval played a significant role in the formation of collective memories.

Cognitive psychology experiments have typically studied individuals learning and remembering in isolation; however, in many real world settings memory is a social process. Although collaboration is prevalent, and may be instrumental in helping individuals construct a shared representation of the world with others

(Echterhoff, Higgins, & Levine, 2009), at the same time it can be detrimental to group recall (see Rajaram, 2011; Rajaram & Pereira-Pasarin, 2010 for reviews). In the present study, we examined the extent to which collaboration, both at encoding and at retrieval, may affect the quantity of information recalled by the group, that is, the *group recall levels,* while simultaneously creating a shared representation of the world within the group, that is, the formation of *collective memories*.

## THE NEGATIVE IMPACT OF COLLABORATION ON GROUP RECALL LEVELS

Considerable evidence shows that collaboration during *retrieval* lowers group recall (see Rajaram & Pereira-Pasarin, 2010; Weldon, 2001). Although a group of people working together recalls more than any one individual, they recall less than would be predicted based on a "pooling of abilities," an effect known as *collaborative inhibition* (Weldon & Bellinger, 1997). The comparison here is between a collaborative group and a *nominal* group of equal size. Nominal groups are groups in name-only, and their recall product consists of the pooled, non-redundant recall of individuals recalling alone. Counterintuitively, nominal groups recall significantly *more* than collaborative groups (Weldon & Bellinger, 1997). Thus, collaborative inhibition refers to the finding that in recall the whole (i.e., collaborative group recall) is *less* than the sum of its parts (i.e., nominal group recall).

Collaborative inhibition at retrieval is a robust phenomenon and is in large part explained by the retrieval disruption hypothesis (Basden, Basden, Bryner, & Thomas, 1997). Simply put, during encoding each group member develops an idiosyncratic way of organizing information in memory. Later, at retrieval, when information is provided in a different order (as part of someone else's recall) it disrupts the individual's organizational structure and lowers her recall performance, which in turn lowers the group performance. For this reason, collaborative inhibition is eliminated when the memory test already has a set organization such as a recognition or cued-recall test (Clark, Hori, Putnam, & Martin, 2000; Finlay, Hitch, & Meudell, 2000). Providing all individuals with an organizational framework disrupts the organizational strategies of both nominal and collaborative group members, thereby eliminating collaborative inhibition.

Less is known about collaboration's role at *encoding* (but see Andersson & Ronnberg, 1995; Finlay et al., 2000; Hollingshead, 1998), and we recently examined this issue (Barber, Rajaram, & Aron, 2010). Participants created sentences from unrelated word pairs, either individually or with a partner. Later, participants completed a cued-recall test in which they saw the first word and had to recall the corresponding target. This was done either individually, with the partner from encoding, or with a new partner (who had performed the encoding task with another participant). Results revealed a *collaborative encoding deficit*; participants who encoded collaboratively recalled less than participants who encoded individually. This was true regardless of whether participants completed the memory task individually, with a new partner, or even with their partner from encoding. This deficit was likely due to differences in cue efficacy such that individually generated items were more idiosyncratically meaningful, and therefore better recalled than collaboratively generated items (i.e., differences in cue uniqueness; see Andersson

& Ronnberg, 1997; Mäntylä & Nilsson, 1983). In brief, collaboration impairs group recall regardless of whether it occurs at retrieval or at encoding.

As the first goal of this study, we directly compared how collaborative encoding and collaborative retrieval may differentially affect group recall. Although both collaborative encoding and collaborative retrieval produce deficits in group recall, their relative impact is unknown. Past research shows that key variables related to memory can have asymmetrical effects across encoding and retrieval, with some manipulations preferentially reducing memory accuracy at encoding (e.g., Baddeley, Lewis, Eldridge, & Thomson, 1984), and others at retrieval (Mulligan & Lozito, 2006). A comparison of where collaboration exerts its strongest negative effect on group recall is especially interesting in this regard given that the collaborative deficits at encoding and at retrieval arise for different reasons, where the former is associated with cue uniqueness and the latter with retrieval disruption. Thus, this study provides insight into which of these mechanisms is more influential in shaping group recall.

We also examined whether the collaborative encoding deficit and collaborative inhibition effect are additive in shaping group memory. Because the effects arise from different mechanisms they may occur in tandem with one another. Thus, recall may be especially low when people collaborate at both encoding and retrieval. Alternately, two lines of evidence suggest that collaborative inhibition may be attenuated after collaborative encoding. First, collaborative inhibition is attenuated when encoding is poor (Pereira-Pasarin & Rajaram, 2011). This is likely because individuals develop weaker organizational structures with poor encoding, and hence are less affected by organizational disruption. Given that collaborative encoding lowers recall it may thus attenuate the subsequent collaborative inhibition effect. Second, collaborative encoding should lead group members to organize the studied information in a similar manner to one another, and such alignment has been shown to reduce subsequent retrieval disruption and collaborative inhibition (Finlay et al., 2000). In summary, it is possible that collaborative encoding will attenuate the collaborative inhibition effect at retrieval.

## THE POSITIVE IMPACT OF COLLABORATION ON THE FORMATION OF COLLECTIVE MEMORIES

Given that collaboration impairs group recall, why do people frequently engage in collaborative learning and remembering? As a second aim of this study, we examined the possibility that collaboration serves the benefit of creating collective memories within the group. Humans may be the only species that are motivated to experience commonality with one another in their perceptions, feelings, thoughts, and memories (Echterhoff et al., 2009). Thus, understanding the process by which memories come to be shared amongst a group addresses a need specific to human behavior and well-being.

The term collective memory has been used across many disciplines to define a wide variety of phenomena (see Harris, Paterson, & Kemp, 2008; Hirst & Manier, 2008; Wertsch, 2008; Wertsch & Roediger, 2008), and recent psychological literature has defined collective memories as shared memories that shape group identity (see Hirst & Manier, 2008, for a review and conceptual analysis). As in recent empiri-

cal work (e.g., Brown, Coman, & Hirst, 2009; Cuc, Ozuru, Manier, & Hirst, 2006; Muller & Hirst, 2010; Stone, Barnier, Sutton, & Hirst, 2010), we focus solely on the first aspect of this definition. In particular, in the current study we examined how individuals come to converge on shared, overlapping representations of events. This question is important in the study of collective memory formation since a memory must be shared before it can influence group identity.

Cognitive research on understanding this aspect of collective memory has only just begun and has focused primarily on the role of collaboration during retrieval (e.g., Cuc et al., 2006; Gabbert, Memon, & Allan, 2003; Meade & Roediger, 2002; Reese & Fivush, 2008; Stone et al., 2010; Wang, 2008). Compared to individual recall, collaborative recall appears to promote the collective memory formation for four key reasons. First, during collaborative retrieval individuals are re-exposed to items they had forgotten, but that a group member recalled. Because of this re-learning collaborative group members often have higher individual recall on subsequent memory tests than nominal group members (e.g., Blumen & Rajaram, 2008; Weldon & Bellinger, 1997). Second, collaborative retrieval allows for error pruning. When an individual makes a memory error the group members can provide corrective feedback. This leads to fewer errors by collaborative, compared to nominal, groups (e.g., Ross, Spencer, Blatz, & Restorick, 2008). Third, although collaborative retrieval reduces the overall number of errors, it also has the potential to introduce shared errors. That is, social contagion occurs such that one member's errors are incorporated into other group member's memories (e.g., Roediger, Meade, & Bergman, 2001). Finally, both remembering and listening to someone else remembering can cause forgetting of related but not remembered information. Known as socially shared retrieval-induced forgetting (see Cuc, Koppel, & Hirst, 2007), this process leads to overlap in what collaborative group members subsequently remember and forget (e.g., Cuc et al., 2006; Muller & Hirst, 2010; Stone et al., 2010). Together, during collaborative retrieval these cognitive factors are important for the formation of collective memories (see Rajaram, 2011; Rajaram & Pereira-Pasarin, 2010). Indeed, recent research has demonstrated an increased overlap in individual memories after collaborative retrieval (in a collaborative inhibition paradigm: Blumen & Rajaram, 2008; Henkel & Rajaram, 2011; in a retrieval-induced forgetting paradigm: Cuc et al., 2006; Muller & Hirst, 2010; Stone et al., 2010).

Although it is clear that collaborative retrieval leads to collective memory formation, little is known about the role of collaborative encoding. On the one hand, intuition suggests that collaborative encoding should lead to shared, overlapping memories amongst the group members because people encode the same event and do so together. On the other hand, in every-day life situations people frequently have discrepant memories for events that were co-experienced (or collaboratively encoded). Thus, collaborative encoding may not have as strong of an effect as collaborative retrieval in collective memory formation.

The notion that collaborative retrieval, rather than encoding, is critical to the development of collective memories is supported by previous theoretical ideas and empirical work. First, memory retrieval is a reconstructive, rather than reproductive, process, and this malleability is thought to facilitate the formation of collective memories (Hirst, 2010). For example, collective memories can develop for events that were never personally experienced by the individual (Kihlstrom,

2002). That is, collective memories can develop solely from joint reminiscing in the absence of having experienced the same original event. Furthermore, Wertsch (2002, p. 37) has argued that collective memory "seems to be shaped more heavily by the conditions in which it is 'retrieved'. . . than by the conditions of its original formulation." Evidence for this can be seen in the way that biased retellings shape subsequent memory. For example, retelling an event in a humorous manner leads to lasting distortions in memory compared to retelling in a factual manner (Dudukovic, Marsh, & Tversky, 2004). Thus, the way an event is retrieved can alter subsequent memory for the event.

Research on the power of retrieval (see Rajaram & Barber, 2008; Roediger & Guynn, 1996) further supports the prediction that collaborative retrieval is especially important in creating collective memories. For example, repeated testing improves long-term retention more than repeated studying, a phenomenon known as the *testing effect* (Karpicke & Roediger, 2007), and these retrieval benefits have been argued to be a key element in the creation of collective memories (Roediger, Zaromb, & Butler, 2009).

In the current study we examined the relative contributions of collaboration, both at encoding and also at retrieval, in shaping collective memories as well as group recall levels. That is, the current study's design allows us to simultaneously assess the independent and combined roles of collaboration at encoding and retrieval in impairing group recall while promoting collective memory formation.

## METHOD

### PARTICIPANTS AND DESIGN

One-hundred eighty Stony Brook University undergraduates participated for credit, with 45 participants (15 triads, always strangers) randomly assigned to each condition: (a) Encode Alone–Recall Alone, (b) Encode Alone–Recall Collaboratively, (c) Encode Collaboratively–Recall Alone, and (d) Encode Collaboratively–Recall Collaboratively (with the same partners from encoding).

### MATERIALS

We generated 195 unrelated nouns from the MRC Psycholinguistic Database (Wilson, 1988). Words were 4–7 letters in length, 1–100 per million in word frequency, and 400–700 in concreteness. Words were combined into 65 unrelated word triads.

### PROCEDURE

*Encoding.* Participants created sentences out of word triads such that the first word of the triad came earlier in the sentence than the second word, which in turn came earlier than the third word. For example, for "*bandage–cousin–boat*": "*The bandage on my cousin's arm came off on the boat.*" In the Encode Collaboratively conditions participants worked in triads and alternated starting, continuing, and fin-

ishing each sentence. The experimenter designated which participant added each part of the sentence, and the order rotated across participants an equivalent number of times.[1]  No time limit was imposed. Although individuals took longer ($M$ = 24.34 min) than collaborative groups ($M$ = 22.00 min), a 2 (Encoding Condition: Alone vs. Collaboratively) × 2 (Retrieval Condition: Alone vs. Collaboratively) did not reveal a main effect of encoding condition on time spent, $F < 1$.

*Delay.* Participants individually solved mazes for 10 minutes.

*Group (Nominal or Collaborative) Memory Test.* Participants completed an unexpected, surprise free recall test for 10 minutes. Participants wrote down words from encoding in any order. In the Recall Alone conditions participants worked individually. In the Recall Collaboratively conditions participants worked in triads. Group members resolved disagreements, if any, on their own.

*Final Individual Memory Test.* Immediately following the group memory test, all participants completed a second free recall test for 10 minutes. Regardless of condition, participants here worked individually.

## RESULTS

Alpha level for all analyses was set at .05. Reported effect sizes are partial eta squared ($\eta_p^2$) and Cohen's *d*.

*Group Recall Levels: Collaborative Deficits at Retrieval and Encoding.* A 2 (Encoding Condition: Alone vs. Collaboratively) × 2 (Retrieval Condition: Alone vs. Collaboratively) ANOVA revealed significant differences in correct group recall (collaborative or nominal) on the first memory test, $F(3, 56) = 10.96$, $MSE < .01$, $\eta_p^2 = .37$ (Figure 1).

We first examined the role of collaboration at *retrieval.* As expected, there was a significant main effect of retrieval condition such that nominal groups outperformed collaborative groups, $F(1, 56) = 19.93$, $MSE < .01$, $\eta_p^2 = .26$. However, this was qualified by an interaction between encoding and retrieval conditions, $F(1, 56) = 9.98$, $MSE < .01$, $\eta_p^2 = .15$. Further analyses revealed that collaborative inhibition was present following individual encoding. Here the nominal groups ($M = .44$) recalled significantly more than the collaborative groups ($M = .28$), $t(28) = 5.11$, $SE = .03$, $d = 1.93$. This is the traditional analysis used to examine collaborative inhibition (e.g., Weldon & Bellinger, 1997), and thus we replicated the standard collaborative inhibition effect. In contrast, after collaborative encoding the nominal ($M = .34$) and collaborative groups ($M = .31$) did not significantly differ in recall, $t(28) < 1$. Thus, the collaborative inhibition effect was eliminated following collaborative encoding (see Finlay et al., 2000).

We next examined the role of collaboration at *encoding.* The main effect of encoding condition did not reach statistical significance, $F(1, 56) = 2.97$, $p = .09$, $MSE < .01$, $\eta_p^2 = .05$. However, as noted above, there was a significant interaction between encoding and retrieval conditions, $F(1, 56) = 9.98$, $MSE < .01$, $\eta_p^2 = .15$. Our comparisons of interest revealed that the collaborative encoding deficit was present

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1. The sentence creation task was chosen because it ensures that all individuals equally participate in a task that involves active construction and elaboration of study episodes.
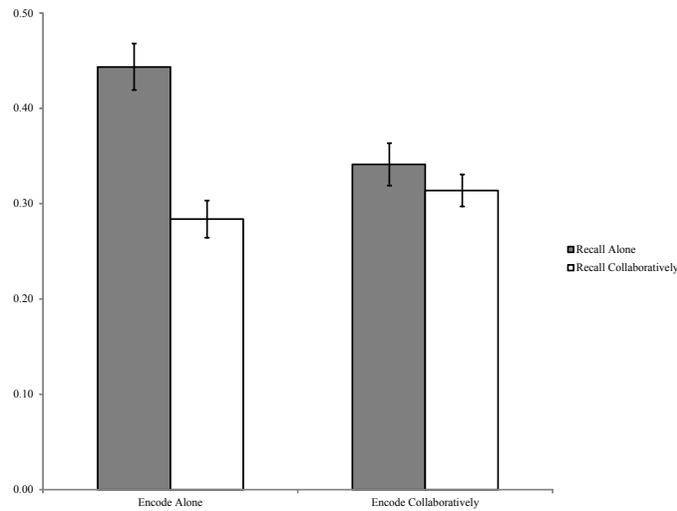
FIGURE 1. Proportion of items correctly recalled by groups (either nominal or collaborative) during the first free recall memory test that measured the group memory product (Error bars are +/- one SE).

when participants subsequently recalled alone. That is, participants in the Encode Alone–Recall Alone condition ($M$ = .44) recalled significantly more than participants in the Encode Collaboratively–Recall Alone ($M$ = .34) condition, $t(28)$ = 3.09, $SE$ = .03, $d$ = 1.17. This extends previous findings that collaborative encoding between dyads impairs cued-recall (Barber et al., 2010) by showing that collaborative encoding between triads impairs free recall. In contrast, the collaborative encoding deficit was absent when followed by collaborative recall. That is, participants in the Encode Collaboratively–Recall Collaboratively condition ($M$ = .31) and participants in the Encode Alone–Recall Collaboratively condition ($M$ = .28) did not differ in amount recalled, $t(28)$ = 1.17, $p$ = .25, $SE$ = .03. However, this result is likely due to a difference between these conditions in collaborative inhibition at retrieval, which was only present after individual encoding.

Finally, we compared the magnitude of the collaborative encoding deficit to that of the collaborative inhibition effect. Recall was *lower* when collaboration occurred only at retrieval (Encode Alone–Recall Collaboratively: $M$ = .28) compared to only at encoding (Encode Collaboratively–Recall Alone: $M$ = .34), $t(28)$ = -1.94, $p$ = .06, $SE$ =.03, $d$ = .73. Although this comparison just failed to reach conventional levels of statistical significance, it suggests that collaboration is most damaging when it occurs at retrieval.

*Group Errors.* Intrusions were low, but a 2 (Encoding Condition) × 2 (Retrieval Condition) ANOVA revealed significant differences between the conditions, $F(3, 56)$ = 2.79, $MSE$ < .01, $\eta_p^2$ = .13. As in previous studies (e.g., Ross et al., 2008), there was a significant effect of retrieval condition such that intrusions were higher in nominal group recall (Encode Alone–Recall Alone: $M$ =.03; Encode Collaboratively–Recall Alone: $M$ = .02) than in collaborative recall (Encode Alone–Recall Collaboratively: $M$ = .01; Encode Collaboratively–Recall Collaboratively: $M$ = .01), $F(1, 56)$ = 6.92, $MSE$ < .01, $\eta_p^2$ = .11. Errors did not vary as a function of collaboration at
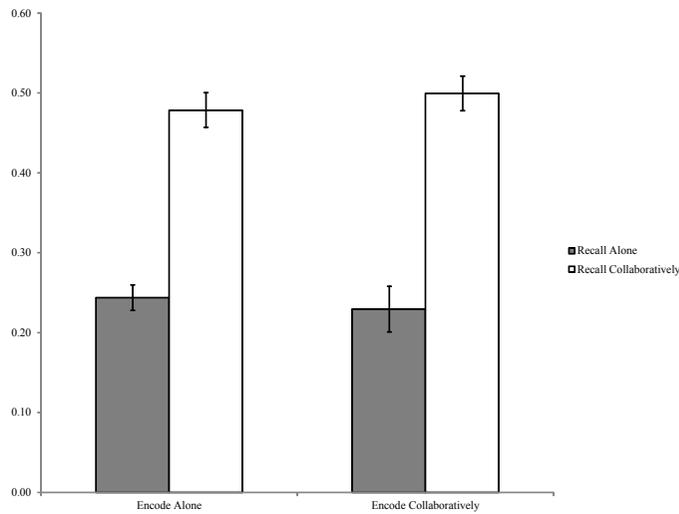
FIGURE 2. Proportion of the nominal group product that was "shared" (by at least two of the group members) during the second free recall memory test that measured collective or shared memories (Error bars are +/- one SE).

encoding (see Barber et al., 2010), $F(1, 56) = 1.10$, $p = .30$, $MSE < .01$. Furthermore, there was no interaction between encoding and retrieval conditions, $F < 1$.

*The Formation of Collective Memories.* We examined the formation of collective memories via a second, individual memory test by calculating the proportion of correctly recalled items that were produced by more than one group member (see Cuc et al., 2006). This ratio score allowed us to examine the overlap of recall for a given triad while correcting for variations in the overall levels of recall. A 2 (Encoding Condition) × 2 (Retrieval Condition) ANOVA revealed significant difference in collective memories as a function of condition, $F(3, 56) = 42.39$, $MSE < .01$, $\eta_p^2 = .69$ (Figure 2).

Findings clearly showed that collaborative *retrieval* played an important role in the formation of collective memories. Completing a prior collaborative recall test led to a higher proportion of memories being shared (Encode Alone–Recall Collaboratively: $M = .48$; Encode Collaboratively–Recall Collaboratively: $M = .50$) than completing a prior individual recall test (Encode Alone–Recall Alone: $M = .24$; Encode Collaboratively–Recall Alone: $M = .23$), $F(1, 56) = 126.53$, $MSE < .01$, $\eta_p^2 = .69$ (see Henkel & Rajaram, 2011; Cuc et al., 2006). Critical for the novel purposes of this study, the same was not true for collaborative encoding. Encoding collaboratively did not lead to a higher proportion of memories being shared compared to encoding individually, $F < 1$. Interestingly, there was also no interaction between encoding and retrieval conditions, $F < 1$. That is, there was no benefit of both encoding and recalling collaboratively ($M = .50$) over simply recalling collaboratively (Encode Alone–Recall Collaboratively: $M = .48$), $t < 1$. In line with previous theoretical ideas (e.g., Roediger et al., 2009), these novel results provide clear empirical evidence that collaborative retrieval is the key element in the creation of collective memories.

Collective memory errors (i.e., the proportion of total errors produced by more than one group member) converged on the same pattern. Collective errors were rare; in fact, no instances were observed when individuals worked alone throughout the experiment. Although some collective errors emerged after collaborative encoding (Encode Collaboratively–Recall Alone: $M$ = .02), this proportion was not significantly greater than zero, $t(14)$ = 1.87, $SE$ = .01, $p$ = .08. In contrast, collaborative retrieval again played a role. Shared errors were significantly greater than zero both in the Encode Alone–Recall Collaboratively ($M$ = .09), $t(14)$ = 2.19, $SE$ = .04, and Encode Collaboratively–Recall Collaboratively ($M$ = .12) conditions, $t(14)$ = 3.32, $SE$ = .13. However, a Mann-Whitney U test did not reveal any significant difference between these two groups, $z$ = -0.63.[2] Although collective errors were rare, these results are useful in the fact they show both accurate and inaccurate recall to produce the same patterns.

## DISCUSSION

This study examined whether collaborative encoding and collaborative retrieval differentially affect memory in terms of impairing group recall and promoting collective memory formation. Across both measures, collaborative retrieval played a stronger role than collaborative encoding.

Collaboration lowered group recall levels. This was true both at retrieval, and at encoding, but especially at retrieval. Replicating prior research (Weldon & Bellinger, 1997), collaborative inhibition occurred at retrieval: Following individual encoding, collaborative groups recalled significantly less than nominal groups. Extending prior research, a collaborative encoding deficit was also demonstrated with a larger group size (triads) and a different memory task (free recall) than had been used in past research (Barber et al., 2010). That is, collaborative encoding led to poorer nominal group recall performance compared to individual encoding. Critically, collaboration at retrieval impaired recall more. Under identical experimental conditions the collaborative inhibition effect at retrieval was greater in magnitude than the collaborative encoding deficit. However, these effects were not additive; although collaborating at encoding lowered group recall there was no added impairment if participants also collaborated at retrieval (see Finlay et al., 2000). This elimination of collaborative inhibition was likely because collaborative encoding aligned the organizational strategies of the group members, thereby minimizing retrieval disruption.

It could be argued that the quality of collaboration was different at encoding and retrieval. The collaborative encoding task took longer, and was anecdotally perceived as more difficult than the collaborative retrieval task possibly because the encoding conditions were highly constrained compared to the retrieval conditions of collaboration. Although these differential constraints may have allowed for increased social loafing opportunities at retrieval, compared to encoding, social loafing cannot readily explain the reported effects. Manipulations at retrieval that

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2. The pattern of results held when examining items recalled by all group members (rather than at least two) both in terms of correct recall and intrusions.

decrease social loafing do not attenuate collaborative inhibition (Weldon, Blair, & Huebsch, 2000). Further, the magnitude of collaborative inhibition does not differ whether retrieval is highly constrained or not (Thorley & Dewhurst, 2007), and the magnitude of the collaborative encoding deficit is *greater* when encoding is constrained than when it is not (Barber et al., 2010).

Our second main aim was to examine the role of collaboration in the creation of collective memories. In support of theoretical proposals that collaborative retrieval is the key element in forming collective memories (e.g., Roediger et al., 2009; Wertsch, 2002), there was a greater overlap in memories after a collaborative, rather than individual, test. As discussed in the Introduction, this outcome was likely due to the operation of several factors such as re-exposure to forgotten studied items, error pruning, social contagion errors, and socially shared retrieval-induced forgetting that occur during collaborative recall. Thus, collaborative recall promoted the formation of collective memories despite the fact that it simultaneously impaired group recall levels.

Interestingly, collaborative encoding did not significantly shape collective memories. The lack of a relationship here is surprising given the strong desire people have to create a shared perception of the world with others (Echterhoff et al., 2009), and future research should examine how specific this effect is to our paradigm. For example, it is possible that collaborative encoding leads to shared memories when the information is group-relevant (e.g., meaningful shared experiences) but not when it is group-irrelevant (e.g., the word triads in this study). However, it is important to note that collaborative retrieval influenced collective memory formation even under this study's relatively artificial settings. Thus, while there are likely situations in which collaborative encoding exerts an impact on collective memory formation, collaborative retrieval may still exert a stronger impact.

In conclusion, the present study demonstrates the key role of collaboration, and in particular collaborative retrieval, in shaping both group recall and collective memory formation. Although collaborative retrieval impaired the group memory productivity, it simultaneously ensured that group members developed overlapping, collective memories thus serving a basic need of humans to experience commonalities in their perceptions, beliefs, and memories with one another (Echterhoff et al., 2009). This process may well turn out to be important in understanding why people believe that collaboration, not only with familiar partners but also with strangers, is beneficial to memory (Dixon, Gagnon, & Crow; 1998; Henkel & Rajaram, 2011).

## REFERENCES

Andersson, J., & Ronnberg, J. (1995). Recall suffers from collaboration: Joint recall effects of friendship and task complexity. *Applied Cognitive Psychology, 9,* 199-211.

Andersson, J., & Ronnberg, J. (1997). Cued memory collaboration: Effects of friendship and type of retrieval cue. *European Journal of Cognitive Psychology, 9,* 273-287.

Baddeley, A. D., Lewis, V., Eldridge, M., & Thomson, N. (1984). Attention and retrieval from long-term memory. *Journal of Experimental Psychology: General, 113,* 518-540.

Barber, S. J., Rajaram, S., & Aron, A. (2010). When two is too many: Collaborative encoding impairs memory. *Memory & Cognition, 38,* 255-264.

Basden, B. H., Basden, D. R., Bryner, S., & Thomas, R. L., III. (1997). A comparison of group and individual remembering: Does collaboration disrupt retrieval strategies? *Journal of Experimental Psychology: Learning, Memory, and Cognition, 23,* 1176-1191.

Blumen, H. M., & Rajaram, S. (2008). Influence of re-exposure and retrieval disruption during group collaboration on later individual recall. *Memory, 16,* 231-244.

Brown, A. D., Coman, A., & Hirst, W. (2009). The role of narratorship and expertise in social remembering. *Social Psychology, 40,* 119-129.

Clark, S. E., Hori, A., Putnam, A., & Martin, T. P. (2000). Group collaboration in recognition memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26,* 1578-1588.

Cuc, A., Koppel, J., & Hirst, W. (2007). Silence is not golden: A case for socially shared retrieval-induced forgetting. *Psychological Science, 18,* 727-733.

Cuc, A., Ozuru, Y., Manier, D., & Hirst, W. (2006). On the formation of collective memories: The role of a dominant narrator. *Memory & Cognition, 34,* 752-762.

Dixon, R. A., Gagnon, L., & Crow, C. (1998). Collaborative memory accuracy and distortion: Performance and beliefs. In M. J. Intons-Peterson & D. L. Best (Eds.), *Memory distortions and their prevention* (pp. 63-88). Mahwah, NJ: Erlbaum.

Dudukovic, N. M., Marsh, E. J., & Tversky, B. (2004). Telling a story or telling it straight: The effects of entertaining versus accurate retellings on memory. *Applied Cognitive Psychology, 18,* 125-143.

Echterhoff, G., Higgins, E. T., & Levine, J. M. (2009). Shared reality: Experiencing commonality with others' inner states about the world. *Perspectives on Psychological Science, 4,* 496-521.

Finlay, F., Hitch, G. J., & Meudell, P. R. (2000). Mutual inhibition in collaborative recall: Evidence for a retrieval-based account. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26,* 1556-1567.

Gabbert, F., Memon, A., & Allan, K. (2003). Memory conformity: Can eyewitnesses influence each other's memories for an event. *Applied Cognitive Psychology, 17,* 533-543.

Harris, C. B., Paterson, H. M., & Kemp, R. I. (2008). Collaborative recall and collective memory: What happens when we remember together? *Memory, 16,* 213-230.

Henkel, L., & Rajaram, S. (2011). Collaborative remembering in older adults: Age-invariant outcomes in the context of episodic recall deficits. *Psychology and Aging, 26,* 532-545.

Hirst, W. (2010). The contribution of malleability to collective memories. In P. A. Reuter-Lorenz, K. Baynes, G. R. Mangun, & E. A. Phelps (Eds.), *The cognitive neuroscience of mind: A tribute to Michael S. Gazzaniga* (pp. 139-153). Cambridge, MA: MIT Press.

Hirst, W., & Manier, D. (2008). Towards a psychology of collective memory. *Memory, 16,* 183-200.

Hollingshead, A. B. (1998). Communication, learning, and retrieval in transactive memory systems. *Journal of Experimental Social Psychology, 34,* 423-442.

Karpicke, J. D., & Roediger, H. L., III. (2007). Repeated retrieval during learning is the key to long-term retention. *Journal of Memory and Language, 57,* 151-162.

Kihlstrom, J. F. (2002). Memory, autobiography, history. *Proteus: A Journal of Ideas, 19*(2), 1-6.

Mäntylä, T., & Nilsson, L.-G. (1983). Are my cues better than your cues? Uniqueness and reconstruction as prerequisites for optimal recall of verbal materials. *Scandinavian Journal of Psychology, 24,* 303-312.

Meade, M. L., & Roediger, H. L., III. (2002). Explorations in the social contagion of memory. *Memory & Cognition, 30,* 995-1009.

Muller, F., & Hirst, W. (2010). Resistance to the influences of others: Limits to the formation of a collective memory through conversational remembering. *Applied Cognitive Psychology, 24,* 608-625.

Mulligan, N. W., & Lozito, J. P. (2006). An asymmetry between memory encoding and retrieval: Revelation, generation, and transfer-appropriate processing. *Psychological Science, 17,* 7-11.

Pereira-Pasarin, L., & Rajaram, S. (2011). Study repetition and divided attention: Effects of encoding manipulations on collabor-

ative inhibition in group recall. *Memory & Cognition, 39,* 968-976.

Rajaram, S. (2011). Collaboration both hurts and helps memory: A cognitive perspective. *Current Directions in Psychological Science, 20,* 76-81.

Rajaram, S., & Barber, S. J. (2008). Retrieval processes in memory. In H. L. Roediger, III (Ed.), *Cognitive psychology of memory. Vol. 2 of Learning and memory: A comprehensive reference* (4 vols., pp. 261-283). Oxford, UK: Elsevier.

Rajaram, S., & Pereira-Pasarin, L. (2010). Collaborative memory: Cognitive research and theory. *Perspectives on Psychological Science, 5,* 649-663.

Reese, E., & Fivush, R. (2008). The development of collective remembering. *Memory, 16,* 201-212.

Roediger, H. L., III., & Guynn, M. J. (1996). Retrieval processes. In E. L. Bjork & R. A. Bjork (Eds.), *Memory* (pp. 197-236). San Diego: Academic.

Roediger, H. L., III., Meade, M. L., & Bergman, E. T. (2001). Social contagion of memory. *Psychonomic Bulletin & Review, 8,* 365-371.

Roediger, H. L., III., Zaromb, F. M., & Butler, A. C. (2009). The role of retrieval in shaping collective memory. In P. Boyer & J. V. Wertsch (Eds.), *Memory in mind and culture* (pp. 138-170). New York: Cambridge University Press.

Ross, M., Spencer, S. J., Blatz, C. W., & Restorick, E. (2008). Collaboration reduces the frequency of false memories in older and younger adults. *Psychology and Aging, 23,* 85-92.

Stone, C. B., Barnier, A. J., Sutton, J., & Hirst, W. (2010). Building consensus about the past: Schema consistency and con-

vergence in socially shared retrieval-induced forgetting. *Memory, 18*, 170-184.

Thorley, C., & Dewhurst, S. A. (2007). Collaborative false recall in the DRM procedure: Effects of group size and group pressure. *European Journal of Cognitive Psychology, 19,* 867-881.

Wang, Q. (2008). On the cultural constitution of collective memory. *Memory, 16,* 305-317.

Weldon, M. S. (2001). Remembering as a social process. In D. L. Medin (Ed.), *The psychology of learning and motivation: Advances in research and theory, Vol. 40* (pp. 67-120). San Diego: Academic.

Weldon, M. S., & Bellinger, K. D. (1997). Collective memory: Collaborative and individual processes in remembering. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 23,* 1160-1175.

Weldon, M. S., Blair, C., & Huebsch, P. D. (2000). Group remembering: Does social loafing underlie collaborative inhibition? *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26,* 1568-1577.

Wertsch, J. V. (2002). *Voices of collective remembering.* Cambridge, UK: Cambridge University Press.

Wertsch, J. V. (2008). Collective memory. In J. H. Byrne (Ed.), *Learning and memory: A comprehensive reference.* (pp. 927-939). Oxford, UK: Elsevier.

Wertsch, J. V., & Roediger, H. L., III. (2008). Collective memory: Conceptual foundations and theoretical approaches. *Memory, 16,* 318-326.

Wilson, M. (1988). MRC Psycholinguistic database: Machine-usable dictionary, Version 2.00. *Behavior Research Methods, Instruments & Computers, 20,* 6-10.