2013

Collaborative Memory For Serial Order

Elizabeth Lauren Foreman
University of Mississippi

COLLABORATIVE MEMORY FOR SERIAL ORDER

A Dissertation
presented in partial fulfillment of requirements for the
Doctor of Philosophy Degree in the Department of Psychology
The University of Mississippi

ELIZABETH L. FOREMAN

December 2013

/

ABSTRACT

Although the encoding, storage, and retrieval of information between groups has been examined in both recall and recognition memory; surprisingly, there is no existing data regarding collaborative memory outcomes using a reconstruction task. In an attempt to fill this gap in the literature, participants assigned to one of four retrieval conditions were asked to study the order of unrelated word-lists in preparation for a memory test. Some reconstructed the lists by alternating turns with their group members (Turn-taking). Others were forced to reconstruct the lists from the first item-position to the last item-position in addition to taking turns with group members (Restricted). Still, others were allowed to complete the reconstruction task any way they chose (Free). A fourth retrieval condition (Nominal) was created for comparison by pooling non-redundant responses from two participants who worked alone. Dyads in both the free and restricted retrieval conditions provided more accurate reconstructions than dyads in the turn-taking retrieval condition. In addition, free and restricted groups showed no differences from nominal groups with regard to serial order memory. These findings demonstrate that collaborative inhibition can be eliminated in memory for serial order using a reconstruction task and are discussed in terms of implications for existing theoretical models of collaborative memory.

DEDICATION

This dissertation is dedicated to my grandparents, Ben and Allyne Fort, whose examples of commitment and achievement encouraged me to continue this project despite its many challenges. Their love and respect for each other provides me with a continually renewed faith in the goodness of humanity and inspires me to pursue the best version of myself on a daily basis.

ACKNOWLEDGMENTS

My greatest appreciation is expressed to Dr. Matthew Reysen for his guidance throughout this project and for the many years of advice, patience, and support provided as mentor during my doctoral training. I acknowledge the extraordinary efforts of my committee members, Drs. Michael T. Allen, Douglas Davis, and Stephanie Miller; and thank them for their invaluable feedback over the course of this dissertation work. In addition, special thanks are given to Collin Webster for his assistance revising drafts of this manuscript and for his relentless encouragement. Finally, I extend the utmost gratitude to my parents, David and Amy, and to the entirety of my friends and family for their unconditional love and support of my educational pursuits; without whom this project would not have been possible.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

Take a moment to consider your happiest memory. What does it involve? Did you experience this memory with anyone else? Most likely, you imagined an important event or celebration in your life. More importantly, this memory likely involved the presence of other people who could more or less corroborate your experience on this day. Our everyday interactions make it obvious that individuals often form and reproduce memories together; however, the large majority of work on memory has focused on the individual as the unit of analysis. Failing to include social influence in experimental paradigms leaves a multitude of unanswerable questions concerning the nature of mechanisms underlying memory. For example, in what ways is memory affected when individuals work together to store and/or remember information? Are some groups of people better at remembering together? After more than a century of research on processes of individual memory, recent trends within the fields of both cognitive and social psychology have shifted to focus on aspects of memory within group contexts.

The importance of social context on memory processes has been studied using various terminologies (e.g. *shared memory, collective memory, group memory, joint remembering*). Although researchers disagree about the appropriateness of each term, this debate on semantics is beyond the scope of the current paper. With that in mind, the encoding, storage, and retrieval of information between two or more individuals will be referred to in the present work as *collaborative memory*.

If a random sample of people were asked to provide opinions concerning the relationship between groups and memory, the majority would likely report a belief that collaboration between individuals leads to the production of more accurate memories. This assumption is likely based on and reinforced by countless observations of safety and greater productivity within groups. Although limited to only one type of group, there is experimental evidence which supports this notion. For example, intimate couples and individuals who have cohabitated for long periods of time often develop a sophisticated process for storing information, which results in a *transactive memory system* that is better than that of either individual (e.g., Hollingshead, 1998; Johansson, Anderson, & Rönnberg, 2000; Wegner, Erber, & Raymond, 1991; Wegner, Giuliano, & Hertel, 1985). In a transactive system, individual members store nonoverlapping sets of information within memory, thus maximizing the amount of data available to each individual at any time. For instance, one partner might know the location of all the tools in the garage, and the other might know the names and birthdays of all the grandchildren. Although having access to all of this information would be useful, it is not necessary if the couple knows their partner is responsible for some of it. According to Wegner and colleagues,

> "individual memory stores are physically separated. Yet it is perfectly reasonable to say that one partner may know, at least to a degree, what is in the other's memory. Thus, one's memory is 'connected' to the other's, and it is possible to consider how information is arranged in the dyadic system as a whole. A transactive memory structure thus can be

said to reside in the memories of both individuals—when they are considered as a combined system" (1985, p. 257).

Therefore, intimate communication between dyads is essential to transactive memory; as it involves the couple's individual memory systems as well as their knowledge about the contents of the other person's memory (Barnier, Sutton, Harris, & Wilson, 2008; Wegner, 1986; Wegner et al., 1985).

Although transactive memory systems have the unique ability to assist close couples in recalling information or reconstructing events, such benefits are not typically observed within the collaborative memory paradigm. In contrast, a multitude of research studies have shown that individuals actually remember less when attempting to recall information while working with one or more others (see Betts & Hinsz, 2010; Sutton, Harris, Keil, & Barnier, 2010). In order to explain this finding, it may be helpful to first discuss the methods typically employed within collaborative memory research; participants are presented initially with a word list, which they are asked to study and memorize alone. Following a distractor task, participants then work either alone or in small groups to recall as many of the studied words as possible. Within this type of experimental design, research has reliably shown that the overall recall of groups is superior to that of individuals (see Hinsz, Tindale, & Vollrath, 1997; Meudell, Hitch, & Boyle, 1995; Meudell, Hitch, & Kirby; 1992; Pritchard & Keenan, 2002; Van Swol, 2008; Vollrath, Sheppard, Hinsz, & Davis, 1989; Yuker, 1955).

However, comparing group and individual outcomes in this manner does not provide an adequate view of collaborative recall. Instead, researchers are concerned with the overall recall of *nominal groups*, which are constructed by combining non-redundant individual responses from the same number of people. For instance, suppose Participants A, B, C, D, E, and F take place in a study on collaborative memory. All participants study a list of words alone before completing a series of math problems. Later, Participants A, B, and C are asked to recall the same list of words individually while D, E, and F are instructed to work together to reproduce the list. In order to create a nominal group, researchers would combine the non-redundant words recalled by A, B, and C. Typical results following these methods would reveal that Group DEF recalls more words than A, B, or C individually, but fewer than the nominal Group ABC. In other words, recalling information in groups (collaboration) reduces the overall recall potential of the individuals involved.

Weldon and Bellinger (1997) first referred to the tendency for collaborative groups to recall less than nominal groups as *collaborative inhibition*. In their first experiment, participants were presented with pictures and words of common items and were provided individual ratings for these stimuli. The ratings were used to manipulate depth of processing by instructing participants to rate the graphic quality of each picture or word for half of the presented stimuli (shallow processing task) and to rate the pleasantness of each picture or word for the other half of the stimuli (deep processing task). Following a 5 minute distractor task, participants worked either alone or in groups of three to reproduce presented items on a surprise free recall task. Results indicated that collaborative groups recalled more than individuals, but less than nominal groups. To determine whether the same pattern in memory would result, a second experiment was conducted using more realistic test stimuli; participants listened to the story “War of the Ghosts” (Bartlett, 1932) twice individually. After the distractor task, participants were instructed to reproduce the story as accurately as possible. They completed this recall either alone or in groups. Consistent with their previous findings, collaborative groups recalled more than individuals, but were outperformed by nominal groups.

Since the first observation of collaborative inhibition, this phenomenon has proven to be very robust within the memory literature and has been shown to occur for an array of stimuli. Similar to Weldon and Bellinger's (1997) results on recall for single words; Finlay, Hitch, and Meudell (2000) found inhibitory effects of collaboration for word pairs. Beyond word-related stimuli, Andersson and Rönnberg (1995) showed participants a 34 minute video on sensorimotor development, and following a distraction, tested their recall individually and in dyads via a video questionnaire. When compared to individual recall scores, collaborative recall of dyadic groups was significantly lower. In another study, Andersson and Rönnberg (1996) were able to demonstrate collaborative inhibition effects using an episodic memory task, but not a semantic task. After random assignment to an 'individual' or 'dyad' condition, participants completed a questionnaire which assessed general knowledge for Swedish history (*semantic memory task*). Participants then read a brief story and completed a distractor task. Lastly, participants' recall for the short story was assessed via questionnaire (*episodic memory task*). Results indicated that collaborative inhibition was present in episodic recall, but not in semantic recall. Shifting from the use of neutral stimuli, Yaron-Antar and Nachson (2006) were interested in the effects of emotional events on collaborative recall. Israeli students were asked to remember details concerning the assassination of their Prime Minister, Itzhak Rabin. Their recall was assessed using a questionnaire, which half of the participants completed individually and the other half completed in groups of three. Consistent with previous research on neutral stimuli, collaborative inhibition was also produced for memory of emotional stimuli.

CHAPTER II

COLLABORATIVE MEMORY

Theoretical Directions

Collaboration of individuals has been shown to produce reliable inhibition of recall when this data is compared with that of nominal groups. However, why does collaborative inhibition occur? Are there any environmental factors that influence the effects of collaboration, and are these effects always negative? A review of the collaborative memory literature shows that there are several theoretical explanations that have been offered to explain inhibition.

For instance, imagine walking on a busy university campus and on the way to your building you notice a man a trip, and fall to the ground ahead of you. This man is approximately 50 yards away and there are between 70 and 100 people in front of you. What is the likelihood that you will rush to his aid? Now imagine you are having a one-on-one conference with this man in your office when this same incident occurs. Are you more or less likely to help in this new situation? Decades of research on diffusion of responsibility and social loafing (e.g., Harkins, Latané, & Williams, 1980; Karau & Williams, 1993; Latané & Nida, 1981; Latané, Williams, & Harkins, 1979; Taylor, Berry, & Block, 1958; Williams, Harkins, & Latané, 1981) point to potential theoretical explanations of collaborative inhibition in terms of motivation; however, such explanations have not found empirical support. For instance, Weldon, Blair, and Huebsch (2000) explored the role of motivational contributions in collaborative recall over a series of five experiments manipulating factors such as monetary incentives, personal accountability, group gender, recall criterion, and group cohesion. Although these researchers found that increasing motivation can sometimes lead to overall better performance (i.e. recalling more words), memory differences between collaborative and nominal groups still displayed inhibitory effects of collaboration. Based on the available data, it appears that motivational factors such as social loafing or diffusion of responsibility contribute little to explanations of collaborative inhibition.

In addition to motivational factors, researchers have also approached theoretical explanations for collaborative inhibition outcomes from a social perspective. Within the framework of group processes, a considerable body of research has demonstrated that even though individual members often possess additional knowledge of relevant information, decision-making groups tend to discuss and repeat information (e.g. memories) that is known by all members (*shared*) more than information unique to one member (*unshared*) (e.g., Stasser, Taylor, & Hanna, 1989; Stewart, Stewart, & Walden, 2007; see also Wittenbaum & Park, 2001; Wittenbaum, 2000; Wittenbaum, 2001). This tendency, referred to as the *collective information sampling bias* (Wittenbaum & Stasser, 1997), has been explained in terms of mutual enhancement. For example, Wittenbaum, Hubbell, and Zuckerman (1999) constructed curriculum vita of hypothetical academic job candidates for participants to read, and led them to believe they would be discussing these application materials with partners in another room. Participants were informed that some of the information included in their application materials would also be included in their partner's materials, and that some would not; in addition, participants were informed which information was common between the partners and which information unique to their application packet. After reading the information, participants were instructed to list pieces of information about the candidates they would like to share with their partners. Experimenters collected participants' responses and later returned with pieces of handwritten information ostensibly provided by their partners. The content of these responses was manipulated so that some participants received information that was mostly common to both partners (shared) or mostly unique to partners (unshared). Results indicated that partners who communicated shared details were rated as more competent and knowledgeable compared to partners who communicated unshared details. In addition, responses consisting of shared information were rated as more important and task-relevant than responses of unshared information. Taken together, these data suggest that the communication of shared information is related to mutual enhancement.

Therefore, the collective information sampling bias just described could be viewed as a possible explanation for collaborative inhibition. In other words, researchers from a social perspective propose that groups are motivated by mutual enhancement effects to discuss shared memories: thus, while shared memories are likely to be mentioned during collaboration, unshared memories are not, resulting in an apparent inhibition of recall for these items.

Although social processes have received some attention within the memory literature, the leading theoretical explanation for collaborative inhibition comes from a cognitive perspective. For instance, Basden et al. (1997) proposed that inhibition occurs due to retrieval interference. According to their *Retrieval Disruption Hypothesis*, Basden and colleagues posit that people employ highly personalized strategies for processing and encoding information; this idiosyncratic organization allows individuals to store studied stimuli (e.g. word lists or stories) meaningfully within memory and aids in later recall. However, when individuals attempt to remember information in collaborative groups, the output from other members disrupts the unique organization of their retrieval strategies and leads to reduced performance on recall tasks. Because each group member experiences retrieval interference, the overall output of collaborative groups is lowered when compared to that of nominal groups.

To test this hypothesis, Finlay et al. (2000) manipulated collaboration during both encoding and recall. In their Experiment 1, participants were presented with a series of puzzle pictures containing hidden animals, and were instructed to locate particular animals (target stimuli). During this initial encoding phase, participants worked either alone or in pairs to identify the targets. Following a distractor task, participants were then tested for their recall of target stimuli. During the recall phase, half of participants who encoded alone collaborated during recall; and half of participants who encoded with a partner worked alone during recall.

Results indicated that collaborative recall lead to inhibition when participants encoded alone; but not when they also encoded collaboratively. The researchers explained these findings in terms of similar idiosyncratic organization for dyads that collaborated during learning. In their Experiment 2, the researchers manipulated the type of test used to assess memory. Participants were individually presented with pairs of matched nouns. Following a distractor task, half of participants were given a free recall test for the word pairs either alone or in groups of two. The other half of participants were given a cued-recall test for the word pairs. For this task, participants (alone or in groups) received the first word in a pair sequence, and were required to provide the second word. Results of Experiment 2 revealed expected collaboration deficits for participants in the free recall condition; where nominal groups outperformed collaborative groups. However, when participants received a retrieval cue for each test stimulus (cued-recall condition), collaborative inhibition was eliminated. The rationale given for finding was that the cues provided individuals with item-specific retrieval information, thus reducing the importance of idiosyncratic organization. Finlay et al.'s (2000) findings provide evidence for the retrieval disruption hypothesis, and suggest this process significantly contributes to collaborative inhibition.

After reviewing possible explanations for collaborative inhibition, it is not surprising that current theoretical directions have shifted to approach collaborative memory from a cognitive perspective. When trying to recall information, group members pool their responses and are able to remember more than individuals. However, it is apparent that collaborative groups cannot effectively combine all of their knowledge. Within a cognitive framework, retrieval disruption adequately explains the processes that occur during collaboration with others which prevent individual group members from achieving their own recall potential, and thus reduce the overall performance of the group.

Costs and Benefits

The considerable body of research demonstrating that group collaboration leads to inferior memory for presented information is an obvious example of an undesirable cost of collaboration. However, is the end result of working together always detrimental? In addition to retrieval disruption, previous research has examined other outcomes associated with collaborative recall.

For example, one theme common to the majority of research studies presented thus far in this review (but not yet discussed) is that of a *rebounding* or *recovery effect*. In typical experimental designs investigating collaborative inhibition, an additional recall test is given to individual participants after they recall stimuli in groups. The rebounding of items occurs when information that was previously "inhibited" during collaborative recall reappears during subsequent individual recall; and this finding is well documented within the collaborative memory literature (e.g., Yaron-Antar & Nachson, 2006; Finlay et al., 2000; Stephenson, Branostätter, & Wagner, 1983; Weldon & Bellinger, 1997; Yuker, 1955). Sudden recovery of items upon individual recall is consistent with research conducted on part-list cuing (see Basden & Draper, 1973). Similar to collaboration inhibition, individuals who are given partial retrieval cues for the presented material recall fewer items than they would if the cues were absent. This phenomenon, known as *part-list cuing inhibition*, is eliminated when the partial cues are removed on subsequent recall tests (Basden & Basden, 1995; Basden & Draper, 1973; Basden et al., 1977; however, see Bäuml & Aslan, 2006). The rebounding of "blocked" items that occurs in both collaborative and part-list retrieval research is explained in terms of organizational recovery. In other words, individual group members are able to utilize their original idiosyncratic organization to remember information after the disrupting stimulus (i.e. partial cue or output from a group member) is removed from the recall phase.

Based on the available data, it appears that the deficit associated with collaborative recall is often temporary, and that recovery effects could even mitigate the initial costs of collaboration. However, recovery is not always observed in studies on collaborative memory; instead, there is research evidence which suggests that collaboration can sometimes lead to permanent forgetting. For example, Basden et al. (2000) instructed participants to study word lists alone, in groups of two, or in groups of four. Following a distractor task, participants were given a free recall test for words in the same manner they studied them (alone, two-person groups, or four-person groups). Collaborative groups gave their responses one at a time, and were not allowed to discuss their answers freely or to correct each other. Immediately following this initial recall test, all participants were given a final free recall test individually. Collaborative inhibition was observed as expected, with nominal groups outperforming collaborative groups; however, contradictory findings resulted in regard to the final recall task in this study. Within memory research paradigms, individual recall performance typically increases with successive attempts, a finding known as *reminiscence* (see Payne, 1987). However, Basden and colleagues (2000) found that collaborative groups experienced less reminiscence on the final recall task compared to participants who studied and recalled material alone. In other words, individuals who collaborated with others did not experience the same level of item recovery typically observed in subsequent recall tests. This inhibition of reminiscence could be interpreted as evidence for permanent forgetting (see also Meudell et al. 1992), although additional research involving more direct measures of forgetting is necessary before any conclusions can be made.

In addition to forgetting, collaboration has also been linked to the production of false memories via social contagion. Within social contagion, material discussed during collaboration has the ability to influence the later recall of individuals. For instance, when individuals interact with group members to recall a list of words, items not featured in the presentation are inevitably discussed. For social contagion to occur, it is not important whether or not the falsely-remembered words are corrected; only that they are mentioned during the process of collaboration. Indeed, there is a considerable amount of empirical evidence demonstrating that nonstudied information discussed during collaboration is often remembered by individuals during later memory tests (e.g. Basden et al., 2002; Betz, Skowronski, & Ostrom, 1996; French, Gary, & Mori, 2008; Gabbert, Memon, & Wright, 2006; Hoffman, Granhag, See, & Loftus, 2001; Meade & Roediger, 2002; Mudd & Govern, 2004; Reysen, 2003, 2005; Roediger, Meade, & Bergman, 2001). However, in Reysen's (2007) study on false memories, effects of collaboration on individual memory performance were only observed when participants were implicitly pressured to conform to the incorrect responses of confederates; suggesting that the production of false memories in subsequent individual recall is largely influenced by social pressure during the collaboration phase.

Based on the evidence presented thus far, it is clear that there are many costs associated with collaboration. However, reconstructing memories in groups can also benefit individual memory. For instance, just as group discussion can lead to false memory production in later individual recall, this same process also provides group members with the opportunity to correct each other's mistakes and, therefore, increase overall memory performance. By discussing the presented material and receiving feedback from other members during collaboration, individuals are often able to correct recall and recognition errors that may have been inevitable working alone (Barber, Rajaram, & Aron, 2010; Pereira-Pasarin & Rajaram, 2011; Rajaram & Pereira-Pasarin, 2007; Ross, Spencer, Blatz, & Restorick, 2008; Ross, Spencer, Linardatos, Lam, & Perunovic, 2004).

Therefore, it appears that collaboration both creates and prunes memory errors. After further investigation into this paradox, it was discovered that the largest contributing factor to memory errors involves the type of interaction between group members during collaboration. Within collaborative memory research, there are two methods to assessing group memory for presented stimuli. One method involves turn-taking, where each participant contributes a response in to the pool in sequential order, without the opportunity for members to correct each other. The other method involves free-flowing discussion, where group members are allowed to consult with each other and reproduce the presented material in any fashion. Although both turn-taking and free-flowing research paradigms reliably produce collaborative inhibition, these methods have differential effects on memory errors. For instance, false-memories are increased when participants follow the turn-taking method (e.g., Basden et al., 1997; Meade & Roediger, 2009; Thorley & Dewhurst, 2007). However, collaboration reduces these same errors when participants engage in free-flowing discussion (e.g., Pereira-Pasarin & Rajaram, 2010; Rajaram & Pereira-Pasarin, 2007; Ross et al., 2004; Ross et al., 2008).

In addition to error pruning, collaboration can also benefit individual memory through repeated stimulus exposure and rehearsal. Whether the method involves free-flowing discussion or turn-taking, individuals participating in any form of group collaboration are re-exposed to study materials each time a member provides a response and also rehearse known material each time they respond. As previously noted, memory typically improves with repeated recall attempts (Payne, 1987). However, prior collaboration has been shown to benefit subsequent individual recall above the effects of reminiscence. For example, Blumen and Rajaram (2009) investigated the effects of previous collaboration by manipulating the sequence of three surprise recall trials. In their study, all participants provided pleasantness ratings for a series of unrelated words. After completing a brief distractor task, participants were randomly assigned to one of four recall sequence conditions: individual-individual-individual (III); individual-collaborative-individual (ICI); collaborative-individual-individual (CII); or collaborative-collaborative-individual (CCI). Collaborative groups were comprised of three individuals, and group members were allowed to discuss word items and reach consensus however they chose (free-flowing paradigm). Consistent with findings from studies investigating forgetting, results indicated that initial collaboration (CII) led to subsequent individual memory impairments. However, both recalling material individually before collaboration (ICI) and repeated collaboration (CCI) lead to greater individual memory in the final recall test compared to repeated individual recall (III). These findings suggest that allowing individuals to strengthen their retrieval strategies, or rehearse, before collaboration (ICI) and re-exposure to studied material through multiple collaborations (CCI) benefits later individual memory. Other studies have shown similar benefits of prior collaboration using a variety of different stimuli (e.g., Blumen & Rajaram, 2008; Basden et al., 2000; Congleton & Rajaram, 2011; Gagnon & Dixon, 2008; Finlay et al., 2000; Henkel & Rajaram, 2011; Pereira-Pasarin & Rajaram, 2010; Rajaram & Pereira-Pasarin, 2007; Thorley & Dewhurst, 2007; Weldon & Bellinger, 1997).

Factors Influencing Inhibition

In order to fully address the effects of collaboration on individual and group memory, there has been recent interest in exploring situational and personal factors that may increase, attenuate, or eliminate the typical inhibitory effects of collaboration. For example, does this phenomenon occur for all age groups? Although the number of studies which investigate age as a possible contributor are few, the available data suggest that collaborative inhibition occurs across all age groups (Andersson, 2001; Johansson, Andersson, & Ronnberg, 2000; Leman & Oldman, 2005; Ross et al., 2004). One study (Meade & Roediger, 2009) compared nominal and collaborative recall for younger and older adults. After studying categorized word lists and completing a distractor task individually, participants recalled the word lists alone or in dyads. In addition, all participants were randomly assigned to a free-report cued recall condition or a forced-recall condition. In order to cue participants, the experimenter provided the category name and instructed individuals to recall only words from the specified category. In the free-report condition, participants were told to produce as many words from each list as possible, but not to guess. In the forced-report condition, participants were instructed to recall 20 words and were not allowed to move on to another category until they did so. Results indicated that collaborative inhibition occurred for both younger and older adults and across both cued recall tasks. Other studies investigating adult age differences in collaborative inhibition have produced similar findings (Henkel & Rajaram, 2009; Johansson, Andersson, & Ronnberg, 2000; Ross et al., 2008). Although the data concerning adults is limited, there have been even fewer studies examining collaborative inhibition effects in children. However, two studies suggest a similar pattern. For instance, Leman & Oldman (2005) compared recall between nominal and collaborative groups of 7-year-old children and 15-year-old children, and Andersson (2011) compared recall for 9-year-old children and 7-year-old children; collaborative inhibition occurred for all children across both studies. Based on findings from adult and child research, it appears that the inhibitory effects of collaboration occur for all ages.

After reviewing the literature on transactive memory systems, it is reasonable to question whether or not collaboration affects intimate groups (i.e. friends or couples) differently. For example, Andersson and Ronnberg (1997) suggested that collaborative inhibition might be reduced or even eliminated if group members were familiar with each other. In their study, participants were presented with unrelated word lists and then recalled these words either alone, with friend dyads, or with non-friend dyads. In comparison to nominal groups, results indicated that both friend and non-friend groups were inhibited by collaboration. However, in addition to word lists, participants also read a short story about a noble king and responded to a memory questionnaire, which they completed either alone, with friends, or with non-friends. Collaboration inhibition was reduced among friend dyads for this type of recall task (their recall was better), but not for non-friend dyads. The researchers explained their results in terms of task difficulty; suggesting that friend groups are able to cue each other more effectively when the complexity of the task is high (i.e., story recall) than when it is low (i.e., unrelated word lists). Based on these findings, Peker and Tekan (2009) predicted that collaborative friend groups would outperform collaborative non-friend groups if they processed categorized word lists, as this task could be considered less complex than story recall, but more complex than noncategorical word lists. However, following a procedure similar to that of Andersson and Ronnberg (1995; 1996) the researchers found that nominal groups outperformed both types of collaborative groups as expected, although results indicated no recall differences between friends and non-friends. These findings suggest that categorized lists are not high enough in contextual complexity to improve collaborative recall among friend groups (see also Takahashi, 2007). Other studies provide support for the reduction of collaboration inhibition among friends, but this support is limited to tasks involving story recall (Andersson, 2001; Andersson & Ronnberg, 1996). Based on the available data, it appears that friendship can sometimes attenuate collaborative inhibition, depending on the type of recall task.

Although relationships between friends are certainly more intimate than those between strangers, they generally do not compare to the intimacy between older, married couples.

Andersson and Ronnberg (1997) proposed that collaborative inhibition should be eliminated or reversed among intimate couples; however, studies conducted with married adults have not produced such favorable results. Ross, Spencer, Linardatos, Lam and Perunovic (2004) examined recall for grocery list items among elderly couples. In their field study, each couple constructed a personal grocery list consisting of 25 items. Once the lists were made, they were taken by the researcher and participants were instructed to retrieve the items from the list either independently, or with their spouses. Results indicated that nominal groups outperformed collaborative couples in their ability to recall the grocery items, indicating that intimate couples are not immune to collaborative inhibition. It should be noted, that Ross et al. (2004) did not include stranger dyads in their study, therefore a comparison of couple vs. stranger collaboration was not possible.

In another study exploring collaborative inhibition in older married couples, Johansson, Anderson, and Ronnberg (2000) included an interview concerning the couple's views of their memory systems. The researchers found no differences between recall for couple and stranger dyads. However, when couples who reported using a transactive memory system during the interview were analyzed separately, their recall was consistent with that of nominal groups, suggesting that some couples may benefit more than others from collaboration. Taken together, these findings suggest that greater intimacy between group members can sometimes reduce the negative recall effects of collaboration, but that there are no major differences between friends and couples.

In addition to familiarity between group members, familiarity with to-be-remembered stimuli (or expertise) has also been examined within the context of collaborative memory. For instance, Meade, Nokes, and Morrow (2009) investigated the effects of collaboration among expert pilots, novice pilots, and non-pilots. Participants studied scenarios of flight situations, and then recalled these scenarios either alone or with a fellow participant of the same expertise level. Consistent with previous findings, recall of non-pilot and novice pilot groups was impaired by collaboration such that they were outperformed by the nominal groups. Interestingly, recall of expert pilot groups exceeded that of nominal groups; indicating that collaborative inhibition was not only eliminated, but reversed for experts. Working within a retrieval-strategy disruption framework, these findings provide rare empirical evidence for facilitative effects of collaboration, and suggest that expertise in domain knowledge may make individuals less susceptible to collaborative retrieval disruption.

Therefore, it appears that the relationship between group members is more influential than their ages in terms of collaborative memory, but what about the size of the collaborating groups? According to the Retrieval Disruption Hypothesis (Basden et al., 1997), collaborative inhibition should increase as group size increases, due to greater disruption produced by group members (see Basden et al., 2000). Although collaborative inhibition has been reliably demonstrated using triads (Basden et al., 1997; Blumen & Rajaram, 2008; Congleton & Rajaram, 2010; Pereira-Pasarin & Rajaram, 2011; Weldon & Bellinger, 1997), as well as dyads (Andersson & Ronnberg, 1995, 1996, 1997; Finlay et al., 2000; Thorley & Dewhurst, 2007), there are only two known studies which provide a direct comparison of group size. Whereas Basden et al. (2000) examined the collaborative recall of dyads and tetrads, Thorley and Dewhurst (2007) compared dyads, triads, and tetrads. Consistent with a retrieval disruption account of collaboration, results from both studies revealed an increase in inhibition effects as the group size increased.

Whereas additional group members contribute to collaborative inhibition by disrupting access to established idiosyncratic retrieval strategies, researchers have also investigated the effects of group collaboration for individuals who were unable to establish strong retrieval strategies during stimulus encoding. For instance, following methods similar to previous studies in collaborative memory, Pereira-Pasarin and Rajaram (2011) presented participants with categorized word lists, then tested their recall for these words either alone or in groups of three. In addition, half of participants were also instructed to perform a secondary task while encoding the word lists (divided-attention). Consistent with the Retrieval Disruption Hypothesis (Basden et al., 1997), collaborative inhibition was observed in the full-attention groups, but eliminated in the divided-attention groups. In other words, it appears that weakly formed retrieval strategies are less susceptible to the typical disruption that occurs during collaboration.

Thus far, the current work has focused on characteristics of the groups themselves (e.g., age, size) and their unique influences on collaborative memory; however, retrieval disruption models posit that characteristics and organization of the presented stimuli should also play an important role in collaboration. For example, Basden et al. (1997) manipulated stimulus organization of word-lists by individually presenting half of participants with 6 instances of 15 categories and presenting the other half with 15 instances of 6 categories. Although the number of stimuli to be remembered is equal across groups, there are more ways to organize 15 examples of a category than 6 examples of a category. After the word list presentation, participants recalled information alone or in groups. Consistent with predictions of the retrieval disruption hypothesis, results indicated that groups with more varied stimulus organization (larger category size) produced more collaborative inhibition compared to groups with fewer organization possibilities (smaller category size). In addition, the researchers were able to eliminate collaborative inhibition by instructing participants to recall according to a particular category. In other words, the inhibitory effects of collaboration were reduced when there was a greater overlap between the organizational strategies of group collaborators.

Interestingly, while decreasing the strength of each group member's idiosyncratic organization typically leads to reduced collaborative inhibition, increasing the strength of these organizational strategies should have a similar effect on inhibition, but for different reasons. For example, it is well documented that repeated exposure to study material increases memory (see Greene 1989). If these finding are extended collaborative groups, the Retrieval Disruption Hypothesis (Basden et al., 1997) suggests that repeated exposure to study material strengthens idiosyncratic organization and retrieval strategies. To test this idea, Pereira-Pasarin and Rajaram (2011) presented participants with word lists either once, or three times prior to individual and group recall. As expected, study repetition improved overall recall for both nominal and collaborative groups. In addition, collaborative inhibition was observed in the single presentation groups, but significantly reduced in repeated presentation groups; suggesting that strong retrieval organization is less susceptible to typical collaboration effects. In a follow-up study, Pereira-Pasarin and Rajaram (2011) explored the effects of repeated exposure via recall. In this experiment, participants studied the word lists once individually, then recalled the lists twice more prior to individual and collaborative recall. Consistent with results from repeated study literature, inhibition was eliminated for groups who had engaged in repeated testing prior to collaboration.

The vast majority of studies investigating collaborative memory involve immediate memory tests, with only a short distractor task between study and recall. However, Takahashi and Saito (2004) tested for collaborative inhibition both 15 minutes after stimulus presentation, and 1 week later. In their first study, participants read a story individually and then recalled the story individually. Following this initial recall, participants recalled the story again either alone or in dyads 15 minutes later. Consistent with previous findings, collaborative inhibition was produced, with nominal groups outperforming collaborative groups. However, the researchers conducted the same experiment again, inserting 1 week between study and recall tests. Results of this second study indicated that collaborative inhibition effects disappeared after a test delay; suggesting that individuals were no longer relying on their individual organizational strategies in order to recall the story. A more recent study by Congleton and Rajaram (2011) reported similar results using a test delay of two hours. Taken together, these findings highlight the importance of retrieval organization, and show that study/test repetitions as well as study/test delays have important implications for strengthening and weakening these individual retrieval strategies.

Serial Order Memory

Although there is ample evidence for a strategy disruption account of collaborative inhibition using recall and recognition memory tests; surprisingly, there have been no previous research attempts to investigate this phenomenon using a reconstruction memory task. Rather than instructing people to reproduce or recognize encoded word-lists, a reconstruction task provides individuals with the previously viewed list-items in a randomized order, and instructs them to place these words back into their original list positions. This type of test is unique in that it allows researchers to examine memory for order information.

While there is currently no data available concerning serial order memory and group collaboration, memory for order information has been examined within the part-set cuing literature (see Kelley & Bovee, 2007). Similar to collaborative inhibition, typical results of part-set cuing research indicate that after studying a list of items, providing individuals with some of the list items during recall (only part of the entire set) often impairs performance (e.g., Bäuml & Aslan, 2006; Nickerson, 1984; Roediger, 1973). This finding, known as *part-set cuing inhibition*, has been reliably demonstrated in episodic memory (Mueller & Watkins, 1977; Roediger, 1973; Todres & Watkins, 1981) and in semantic memory (Brown, 1968; Brown & Hall, 1979; Sloman, Bower, & Rohrer, 1991).

Although inhibition from partial cuing is difficult to attenuate, Serra and Nairne (2000) actually found facilitative effects of part-set cuing using a reconstruction task over three experiments. The researchers explained their findings using an associative model for serial order memory. Consistent with current theoretical explanations of collaborative memory, Serra and Nairne (2000) posited that individuals form interitem associations between list-items during encoding; and that part-set cuing inhibition depends on the extent to which the partial cues are consistent or inconsistent with their unique retrieval strategies (see also Basden & Basden, 1995; Basden et al., 1977).

In their first experiment, participants studied an eight-item word-list, then completed a 15-second digit-tracking task. Following the distractor task, all of the list items were re-presented to participants in a new random order, but they were only instructed to place four (target items) of the eight word back into their original positions within the list. In addition, they were informed which of the four target items to position, and which of the eight possible positions they could occupy. However, half of the individuals were shown the positions of the four nontarget items (cued condition) and the other half were shown a '+' sign to indicate the positions of the nontarget items (uncued condition). Results indicated that reconstruction performance on the cued trials was much better than performance on the uncued trials.

To determine whether the same pattern in memory would result with another memory test, a second experiment was conducted using both the reconstruction task and a recall task. Consistent with their previous findings, participants in the cued conditions successfully reconstructed the lists better than participants in the uncued conditions. In addition, the typical inhibitory effects of part-set cuing were observed in the cued conditions as compared to the uncued conditions. In a final experiment, Serra and Nairne (2000) again asked participants to encode/reconstruct lists individually and gave them partial cues. However, these partial cues (nontarget items) were manipulated so that they appeared either in the same position as encoding (consistent cues) or different positions from encoding (inconsistent cues). As expected, inconsistent cues lead to part-set cuing inhibition, while consistent cues lead to part-set cuing facilitation. Taken together, the findings of these three experiments support the hypothesis that individuals rely on associative information to remember serial order.

The primary goal of the current work was to bridge a potential gap between part-set cuing and collaborative research. As previously stated, much is known about the ability to remember item-information within groups; yet there is no available data concerning the collaborative encoding, storage, or retrieval of item-*position*-information. Therefore, an experiment was designed to examine serial order memory in different collaborating groups using a reconstruction task. Individuals and dyads encoded lists of eight items followed by a distraction task. Afterward, the list-items were presented again in a new random order, and participants were asked to place the items back into their original serial positions. What differed across experimental conditions were the retrieval instructions provided during the memory task. Specifically, one third of collaborating participants were told to complete the reconstruction task by taking turns with their group members. Another third took turns with group members, but were also told to complete the task from the first item-position to the last item-position. The remaining third of participants were allowed to complete the reconstruction task any way they chose. In addition, nominal groups were created for comparison by pooling the non-redundant correct responses from two individual participants (controls) working alone.

If collaborative inhibition is explained by the Retrieval Disruption Hypothesis (Basden et al., 1977), then increasing the similarity between collaborators' encoding and retrieval strategies (i.e., forcing group members to study and reconstruct word-lists in a particular order) should provide fewer disruptions to their idiosyncratic organizations, and should thus attenuate the typical inhibitory effects found in the group memory literature. In addition, it is possible that reducing disruption during serial reconstruction could allow individuals to benefit from working with others (collaborative facilitation).

CHAPTER III

EXPERIMENT

The current work sought to extend previous research on collaborative inhibition by comparing group memory for serial order using a reconstruction task. Participants encoded 8-item, non-categorized word lists and were tested on their ability to correctly place the items back into their original list positions while working in either nominal or collaborative groups. Of interest was whether collaboration would differentially affect people using unique retrieval strategies while trying to reconstruct the word-lists. Therefore, retrieval strategies were manipulated by varying the instructions given to collaborating individuals before completing the memory tasks. One-third of participants working together were simply instructed to place the words back into their original positions (free condition). Another one-third were given the additional instruction to take turns with their partners while completing the reconstruction task (turn-taking condition). The remaining participants assigned to collaborative groups took turns with their partners, but were also instructed to reproduce the lists from the first item to the last item (restricted condition).

According to the Retrieval Disruption Hypothesis (Basden et al., 1997) the magnitude of any inhibition resulting from collaboration should depend on the similarity between individual's retrieval strategies. Thus, if collaborative inhibition is explained by retrieval disruption accounts, groups allowed to reconstruct word-lists anyway they choose should be more adversely effected by collaboration, followed by groups forced to take turns, with the least inhibition occurring for groups who reconstruct the lists in the same order they were encoded. Lastly, based on Serra and Nairne's (2000) findings with part-set cues, it is possible that streamlining participant's retrieval strategies in the present study may go beyond attenuation, and could instead lead to collaborative facilitation for serial order.

Method

Participants

A total of 240 undergraduate students enrolled at the University of Mississippi received partial course credit in exchange for their participation in this experiment. Participants arrived at the lab individually or in pairs, and were tested in sessions lasting approximately 30 minutes.

Design

A 4 X 8 mixed-design was employed with group (nominal vs. free vs. turn-taking vs. restricted) as a between-subjects factor and serial position (1 through 8) as a within-subjects factor. The primary dependent measure was the participants' ability to remember the order of the list items.

Materials

Study items included eight 8-item lists (Appendix A) consisting of four-to six-letter nouns selected from Clark and Paivio's (2004) update of the Paivio, Yuille, and Madigan (1968) word norms; which ranged from medium to high with regards to imagery (5.58), meaningfulness (6.37), and concreteness (5.59). Random list sequences were created and all study materials were presented via personal computer monitors.

Procedure

Each participant was asked to provide informed consent upon arrival to the laboratory. After being assigned to conditions in accordance with a prearranged random sequence, participants were tested individually or with one other person. Each participant or group of participants was seated in front of a computer monitor, with the experimenter in the same room; and was instructed to study several lists and to remember the word-positions within each list in preparation for a reconstruction memory test.

The experimental trials began with the word READY presented in the center of the computer screen. This word remained on the screen for 2 seconds and served to focus the participant's attention on the center of the screen and also to indicate that the session was about to begin. Immediately after the word READY was presented, the study list items began appearing on the center of the computer screen. List items were presented sequentially, with each item displayed for 2 seconds. After the eighth word-item was shown, participants completed a 15-second arithmetic task intended to reduce recency effects.

A serial order reconstruction test immediately followed the distractor task. The eight study-items from the encoded list were re-presented all at once in a single horizontal line across the center of the computer screen, and in a new random order from the one seen previously. A separate answer sheet comprised of eight horizontal rows (each containing eight blank spaces) was provided to participants including the following instructions as determined by random assignment to conditions:

Nominal*: Using the spaces provided, please place the words back into their original list positions. Please do not leave any spaces blank.*

Free: *Using the spaces provided, please work with your group member to place the words back into their original list positions. Please do not leave any spaces blank.*

Turn-Taking: *Using the spaces provided, please take turns with your group member (one response from you followed by a response from your group member) and place the words back into their original list positions. In addition, be sure to take turns providing the first response for each list. Please do not leave any spaces blank.*

Restricted: *Working from left to right and using the spaces provided, please take turns with your group member (one response from you followed by a response from your group member) and place the words back into their original list positions. In addition, be sure to take turns providing the first response for each list. In other words, you should fill in the first space first, followed by the second, then the third – continuing until all of the spaces are filled. Please do not leave any spaces blank.*

Following the initial reconstruction task, participants were directed back to their personal computer monitors, where they were prompted to begin encoding the next list presentation. This entire procedure was repeated until all participants encoded/reconstructed order information for a total of 8 word-lists (64 items). Finally, individuals and groups were awarded credit for their participation and dismissed upon completion of the experiment.

Results

The mean proportions of correct item placement for the four groups as a function of serial position are displayed in Table 1 (Appendix B). Nominal groups were created by combining the correct non-redundant reconstructions from two participants into a single score. Traditional methods to compute nominal groups involve pooling the responses of two individual participants randomly or based on their location in the data set. However, Wright (2007) cautions that such arbitrary pairings introduce unnecessary sampling error. Therefore, the current study utilized an approach developed by Kelley & Wright (2010), which generates 10,000 different possibilities for pair grouping and calculates a mean and standard deviation for this large set. The program then runs a Chi-square test against this mean and standard deviation and provides the grouping that best fits with the large data set mean. These pairings were used to compute reconstruction scores for the nominal group.

To explore retrieval disruption and collaboration during reconstruction, the mean proportions of correct item placement were placed into a 4 (nominal vs. free vs. turn-taking vs. restricted) X 8 (serial position) mixed-design analysis of variance (ANOVA). Extending previous research, it was expected that collaborative inhibition for item order would decrease as the similarity of participant's retrieval strategies increased. Specifically, more collaborative inhibition was expected to result in the free and turn-taking conditions than in the restricted condition. Based on Serra and Nairne's (2000) findings using part-set cues, it was also speculated that collaboration in the restricted instruction condition could result in facilitation for serial position memory; although no specific predictions were made for the current study.

The omnibus *F* test revealed a significant main effect for serial position, $F(7, 812) = 124.55$, $MS_e = 0.017$, $p < .001$, which is consistent with the serial position curve typically found in reconstruction memory research (e.g., Nairne, 1991; Serra & Nairne, 1993). The analysis of variance also revealed a main effect of condition or group, $F(3, 116) = 5.21$, $MS_e = 0.152$, $p < .001$. Pairwise comparisons adjusted using Fischer's Least Significant Difference procedure indicated that serial order memory in the turn-taking condition (M = .64, SD = .03) was significantly lower than in the nominal (M = .77, SD = .03), free (M = .76, SD = .03), and restricted (M = .74, SD = .03) group conditions (*p*s < .05). These means are displayed in Figure 1 (Appendix B). As expected, collaborative inhibition was observed when participants were instructed to take turns with their partners during serial order reconstruction. However, no other significant differences among conditions were found. There was no evidence that participants in the restricted *or* free conditions differed from participants in the nominal condition in terms of serial position reconstruction (*p*s > .05). Thus, it appears that participants in these groups were able to overcome the typical detrimental effects of collaboration so often found in memory research. The interaction between group and serial position was not significant, $F(21, 812) = 1.26$, $p = .196$.

Discussion

The present experiment was designed to test hypotheses generated from both retrieval disruption accounts of collaborative inhibition (e.g., Basden et al., 1997) and associative models of part-set cuing inhibition (e.g., Bäuml & Aslan, 2006). The results obtained were generally consistent with predictions, and support the conclusion that collaborative inhibition for serial order can be eliminated using a reconstruction memory task. This elimination, however, depended on the instructions given to collaborating groups at the time of reconstruction.

Dyads in the turn-taking retrieval condition performed significantly less well on the reconstruction task compared to all other groups (collaborative and nominal). Because all groups studied the same lists with the intent to remember order, their encoding strategies should have been identical. According to Retrieval Disruption Hypothesis (Basden et al., 1997), differences between encoding and retrieval strategies should produce collaborative memory deficits. As expected, ability to reconstruct serial order was negatively impacted by collaboration when participants received turn-taking instructions. It is reasonable to argue that cues provided during the reconstruction task were inconsistent with group members' original encoding strategies and that these discrepancies contributed to the net memory loss observed. The collaborative inhibition produced in this condition is consistent with previous memory research involving turn-taking procedures (e.g., Basden et al., 1997; Meade & Roediger, 2009; Thorley & Dewhurst, 2007) and provides further support for a retrieval disruption account of collaborative memory processes.

Based on the idea that remembering information in the same order as encoding would provide individuals with greater access to interitem associations during reconstruction, the restricted group was expected to outperform the turn-taking group in terms of order memory. In addition to this expected advantage, no significant differences were found between serial order reconstruction for participants working in restricted or nominal groups. This finding is particularly noteworthy because dyads working together to reconstruct lists from the first item position to the last item position were able to remember order information equally as well as nominal groups; demonstrating a clear elimination of collaborative inhibition for this retrieval condition. Because these participants were required to provide responses in the same order as they were presented during encoding, it is reasonable to argue that the cues provided by group members were more consistent with each person's encoding strategy. As in Serra and Nairne's (2000) part-set cuing condition involving consistent cues, it appears that participants working together in the restricted collaboration condition were able to better use the cues provided by group members during the reconstruction task when they were consistent with their original encoding strategies.

Similar to the turn-taking condition, inconsistent cues provided during free collaboration (incorrect responses) were expected to disrupt group members' retrieval strategies and lead to overall inhibition on the reconstruction task. Surprisingly, serial order memory was no different for these dyads compared to nominal groups. Contrary to predictions, groups allowed to reconstruct word-lists any way they desired (free condition) were not adversely affected by collaboration. Although these findings are intriguing, meaningful interpretation is difficult due to the lack of experimental control in the free collaboration condition. One possible explanation involves each group member's ability to provide consecutive responses during the reconstruction test. For example, one participant could potentially write down all of the correct serial positions he/she remembered immediately following the distraction task; whereas participants in the other collaborating groups were forced to provide singular responses. Therefore, if a participant listed all known responses prior to interruption from a group member, he/she would have no additional memories to inhibit during any subsequent collaboration.

Within the current design, the free collaboration condition may have been more similar to the nominal condition than originally intended; such that group members may have had a tendency to pool their own responses before processing any potential input from others. In other words, the option to provide successive responses may have enabled the groups to overcome collaborative inhibition by reducing the frequency of strategy disruption during retrieval. It should also be noted that participants in this condition seemed more likely to suggest that each group member be responsible for encoding and remembering only half of the serial positions within each list. Therefore, it is possible that participants working together in the free retrieval condition could have devised their own strategies to distribute the workload of the reconstruction task. In these instances, group responses would actually be more representative of individual memory for 4 list-items as opposed to collaborative memory for 8 list-items. However, it is impossible to address these potential explanations within the present study, as no systematic attempts to record specific group approaches to the reconstruction memory task (beyond those involved in the instructional manipulations) were made.

CHAPTER IV

GENERAL DISCUSSION

Over the last decade, collaborative memory has been studied extensively within memory research paradigms using both recall and recognition memory tasks. It is well established that remembering information in groups typically reduces the overall potential of the individuals involved (e.g., Yaron-Antar & Nachson, 2006; Finlay et al., 2000; Stephenson & Wagner, 1989; Weldon & Bellinger, 1997; Wright & Klumpp, 2004; Yuker, 1955). However, not much is known about collaborative serial order memory. The present experiment was designed to examine the effects of differential retrieval instructions on nominal and collaborative group ability to remember position information. Of interest was whether a reconstruction task could reduce collaborative inhibition when compared to nominal group memory.

Participants assigned to one of four instruction conditions (nominal, free collaboration, turn-taking collaboration, or restricted collaboration) were asked to study the order of several unrelated word-lists in preparation for a memory test. When asked to work with another participant to reconstruct the order of these lists, collaborative memory was affected by the nature of the reconstruction task. Specifically, dyads in both the free and restricted retrieval conditions remembered more serial positions than dyads in the turn-taking retrieval condition. In addition, the free and restricted collaborating groups were no different from nominal groups with regard to accuracy of list reconstruction.

The present experiment demonstrated that instructional manipulations affecting the quality of cues presented to groups at test can eliminate collaborative inhibition. These findings are in line with predictions from a retrieval strategy disruption account of collaborative inhibition (Basden et al., 1997) and are generally consistent with part-set cuing literature on serial position memory (Basden et. al., 2002; Kelley & Bovee, 2007; Serra & Nairne, 2000). In addition, the current work highlights some of the overlap between existing frameworks of part-set cuing and collaborative inhibition, and suggests a need for further investigations into the relationship between social and non-social cues. Although it was considered a possibility, facilitative effects of collaboration were not observed in the present study. Future research might investigate differences between the consistent cues provided in the present study and the consistent cues provided by Serra and Nairne (2000) in order to better predict the circumstances under which partial cues can facilitate serial order memory.

A limitation of this design involved a lack of experimental control associated with reconstruction in the free collaboration condition. Additional research examining the specific reconstruction strategies employed by the free collaboration groups is needed in order to better understand the processes involved in attenuating/eliminating collaborative inhibition. Future studies might also include a subsequent memory test where participants reconstruct the lists alone in order to determine how individual memory for serial order is impacted by collaboration and whether or not the inhibition observed in the turn-taking condition would be reversed with the removal of inconsistent cues from group members.

In contrast to the large body of research showing robust effects of collaborative inhibition within recall and recognition research paradigms (e.g., Blumen & Rajaram, 2009; Yaron-Antar

& Nachson, 2006; Finlay et al., 2000; Stephenson & Wagner, 1989; Weldon & Bellinger, 1997), the current findings provide strong evidence that collaborative inhibition can be eliminated using a reconstruction memory task. The Retrieval Disruption Hypothesis (Basden et al., 1997) provides a plausible explanation for the memory improvement observed in the restricted condition; where groups that are encouraged or required to use similar encoding/retrieval strategies are less inhibited by interference from collaborators. Similar encoding between pairs in all conditions was achieved by asking participants to remember the order of the presented items. Subsequent research on this topic might also test the underlying notion that individuals use associative strategies (which are susceptible to retrieval disruption) to organize and reconstruct serial order. For instance, it was simply assumed that directing participants to encode the serial order of items would promote their use of interitem associations in the current study. Future research could address this issue by incorporating more direct manipulations of encoding and retrieval strategies into studies of collaborative and serial order memory.

LIST OF REFERENCES

Andersson, J. (2001). Recall Suffers From Collaboration: Joint Recall Effects of Friendship and Task Complexity. *Applied Cognitive Psychology*, *9*(3), 199-211.

Andersson, J. (1996). Collaboration and Memory: Effects of Dyadic Retrieval on Different Memory Tasks. *Applied Cognitive Psychology*, *10*(2), 171-181.

Andersson, J. (2001). Net effect of memory collaboration: How is collaboration affected by factors such as friendship, gender and age? *Scandinavian Journal of Psychology*, *42*(4), 367.

Andersson, J., & Rönnberg, J. (1995). Recall Suffers From Collaboration: Joint Recall Effects of Friendship and Task Complexity. *Applied Cognitive Psychology*, *9*(3), 199-211. doi:10.1002/acp.2350090303

Andersson, J., & Ronnberg, J. (1997). Cued Memory Collaboration: Effects of Friendship and Type of Retrieval Cue. *European Journal Of Cognitive Psychology*, *9*(3), 273-287. doi:10.1080/095414497382824

Barber, S. J., Rajaram, S., & Aron, A. (2010). When two is too many: Collaborative encoding impairs memory. *Memory & Cognition*, *38*(3), 255-264. doi:10.3758/MC.38.3.255

Barnier, A. J., Sutton, J., Harris, C. B., & Wilson, R. A. (2008). A conceptual and empirical framework for the social distribution of cognition: The case of memory. *Cognitive Systems Research*, *9*(1-2), 33-51. doi:10.1016/j.cogsys.2007.07.002

Bartlett, S. C. (2003). Remembering: A study in experimental and social psychology. In *The history of psychology: Fundamental questions* (pp. 430-446). New York, NY US: Oxford University Press.

Basden, B. H., Basden, D. R., & Henry, S. (2000). Costs and benefits of collaborative remembering. *Applied Cognitive Psychology*, *14*(6), 497-507.

Basden, B. H., Basden, D. R., Bryner, S., & Thomas, R. (1997). A comparison of group and individual remembering: Does collaboration disrupt retrieval strategies? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *23*(5), 1176-1189. doi:10.1037/0278-7393.23.5.1176

Basden, B. H., Reysen, M. B., & Basden, D. R. (2002). Transmitting false memories in social groups. *American Journal Of Psychology*, *115*(2), 211.

Basden, D. R., & Basden, B. H. (1995). Some tests of the strategy disruption interpretation of part-list cuing inhibition. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *21*(6), 1656-1669. doi:10.1037/0278-7393.21.6.1656

Basden, D. R., & Draper, J. S. (1973). Effect of cueing with list members in free recall as a function of number of categories, taxonomic frequency, and presentation order. *Canadian Journal Of Psychology/Revue Canadienne De Psychologie*, *27*(3), 327-333. doi:10.1037/h0082483

Basden, D. R., Basden, B. H., & Galloway, B. C. (1977). Inhibition with part-list cuing: Some tests of the item strength hypothesis. *Journal of Experimental Psychology: Human Learning and Memory*, *3*(1), 100-108. doi:10.1037/0278-7393.3.1.100

Bäuml, K., & Aslan, A. (2006). Part-list cuing can be transient and lasting: The role of encoding. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *32*(1), 33-43. doi:10.1037/0278-7393.32.1.33

Betts, K. R., & Hinsz, V. B. (2010). Collaborative group memory: Processes, performance, and techniques for improvement. *Social And Personality Psychology Compass*, *4*(2), 119-130. doi:10.1111/j.1751-9004.2009.00252.x

Betz, A. L., & Skowronski, J. J. (1996). Shared realities: Social influence and stimulus memory. *Social Cognition*,*14*(2), 113.

Blumen, H., & Rajaram, S. (2008). Influence of re-exposure and retrieval disruption during group collaboration on later individual recall. *Memory*, *16*(3), 231-244.

Blumen, H. M., & Rajaram, S. (2009). Effects of repeated collaborative retrieval on individual memory vary as a function of recall versus recognition tasks. *Memory*, *17*(8), 840-846. doi:10.1080/09658210903266931

Brown, A. S., & Hall, L. A. (1979). Part-list cueing inhibition in semantic memory structures. *The American Journal of Psychology*, *92*(2), 351-362. doi:10.2307/1421929

Brown, J. (1968) Reciprocal facilitation and impairment of free recall. *Psychonomic Science*,*10*(2), 41-42.

Congleton, A. R., & Rajaram, S. (2011). The influence of learning methods on collaboration: Prior repeated retrieval enhances retrieval organization, abolishes collaborative inhibition, and promotes post-collaborative memory. *Journal of Experimental Psychology: General*, *140*(4), 535-551. doi:10.1037/a0024308

Clark, M., & Paivio, A. (2004). Extensions of the Paivio, Yuille, and Madigan (1968) norms. *Behavior Research Methods, Instruments, & Computers, 36*(3), 371-383. doi:10.3758/BF03195584

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*(6), 1556-1567. doi:10.1037/0278-7393.26.6.1556

French, L., Garry, M., & Mori, K. (2008). You say tomato? Collaborative remembering leads to more false memories for intimate couples than for strangers. *Memory*, *16*(3), 262-273. doi:10.1080/09658210701801491

Gabbert, F., Memon, A., & Wright, D. B. (2006). Memory conformity: Disentangling the steps toward influence during a discussion. *Psychonomic Bulletin & Review*, *13*(3), 480-485. doi:10.3758/BF03193873

Gagnon, L. M., & Dixon, R. A. (2008). Remembering and retelling stories in individual and collaborative contexts. *Applied Cognitive Psychology*, *22*(9), 1275-1297.

Greene, R. L. (1989). Spacing effects in memory: Evidence for a two-process account. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *15*(3), 371-377. doi:10.1037/0278-7393.15.3.371

Harkins, S. G., Latané, B., & Williams, K. (1980). Social loafing: Allocating effort or taking it easy? *Journal of Experimental Social Psychology*, *16*(5), 457-465. doi:10.1016/0022-1031(80)90051-7

Henkel, L. A., & Rajaram, S. (2011). Collaborative remembering in older adults: Age-invariant outcomes in the context of episodic recall deficits. *Psychology and Aging*, *26*(3), 532-545. doi:10.1037/a0023106

Hinsz, V. B., Tindale, R., & Vollrath, D. A. (1997). The emerging conceptualization of groups as information processors. *Psychological Bulletin*, *121*(1), 43-64. doi:10.1037/0033-2909.121.1.43

Hoffman, H. G., Granhag, P., See, S., & Loftus, E. F. (2001). Social influences on reality-monitoring decisions. *Memory & Cognition*, *29*(3), 394-404. doi:10.3758/BF03196390

Hollingshead, A. B. (1998). Retrieval processes in transactive memory systems. *Journal of Personality and Social Psychology*, *74*(3), 659-671. doi:10.1037/0022-3514.74.3.659

Johansson, O., Andersson, J., & Rönnberg, J. (2000). Do elderly couples have a better prospective memory than other elderly people when they collaborate? *Applied Cognitive Psychology*, *14*(2), 121-133.

Karau, S. J., & Williams, K. D. (1993). Social loafing: A meta-analytic review and theoretical integration. *Journal of Personality and Social Psychology*, *65*(4), 681-706. doi:10.1037/0022-3514.65.4.681

Kelley, M. R., & Wright, D. B. (2010). Obtaining representative nominal groups. *Behavior Research Methods*, *42*(1), 36-41. doi:10.3758/BRM.42.1.36

Kelley, M. R., & Bovee, J. C. (2007). Part-set cuing and memory for order. In A. Columbus (Ed.), Advances in Psychology Research. (Vol. 51, pp. 133-148). Hauppauge, NY: Nova Science.

Latané, B., & Nida, S. (1981). Ten years of research on group size and helping. *Psychological Bulletin*, *89*(2), 308-324. doi:10.1037/0033-2909.89.2.308

Latané, B., Williams, K., & Harkins, S. (1979). Many hands make light the work: The causes and consequences of social loafing. *Journal of Personality and Social Psychology*, *37*(6), 822-832. doi:10.1037/0022-3514.37.6.822

Leman, P. J., & Oldham, Z. (2005). Do children need to learn to collaborate?: The effect of age and age differences on collaborative recall. *Cognitive Development*, *20*(1), 33-48. doi:10.1016/j.cogdev.2004.07.002

Maki, R. H., Weigold, A., & Arellano, A. (2008). False memory for associated word lists in individuals and collaborating groups. *Memory & Cognition*, *36*(3), 598-603. doi:10.3758/MC.36.3.598

Meade, M. L., & Roediger III, H. L. (2002). Explorations in the social contagion of memory. *Memory & Cognition*,*30*(7), 995.

Meade, M. L., & Roediger III, H. L. (2009). Age differences in collaborative memory: The role of retrieval manipulations. *Memory & Cognition*, *37*(7), 962-975. doi:10.3758/MC.37.7.962

Meade, M. L., Nokes, T. J., & Morrow, D. G. (2009). Expertise promotes facilitation on a collaborative memory task. *Memory*, *17*(1), 39-48. doi:10.1080/09658210802524240

Meudell, P. R., Hitch, G. J., & Boyle, M. M. (1995). Collaboration in recall: Do pairs of people cross-cue each other to produce new memories? *The Quarterly Journal of Experimental Psychology A: Human Experimental Psychology*, *48A*(1), 141-152.

Meudell, P. R., Hitch, G. J., & Kirby, P. (1992). Are Two Heads Better than One? Experimental Investigations of the Social Facilitation of Memory. *Applied Cognitive Psychology*, *6*(6), 525-543.

Mudd, K., & Govern, J. M. (2004). Conformity to Misinformation and Time Delay Negatively Affect Eyewitness Confidence and Accuracy. *North American Journal of Psychology*, *6*(2), 227-238.

Mueller, C. W., & Watkins, M. J. (1977). Inhibition from part-set cuing: A cue-overload interpretation. *Journal of Verbal Learning & Verbal Behavior*, *16*(6), 699-709. doi:10.1016/S0022-5371(77)80029-7

Nairne, J. S. (1991). Positional uncertainty in long-term memory. *Memory & Cognition*, *19*(4), 332-340. doi:10.3758/BF03197136

Nickerson, R. S. (1984). Retrieval inhibition from part-set cuing: A persisting enigma in memory research. *Memory & Cognition*, *12*(6), 531-552. doi:10.3758/BF03213342

Payne, D. G. (1987). Hypermnesia and reminiscence in recall: A historical and empirical review. *Psychological Bulletin*, *101*(1), 5-27. doi:10.1037/0033-2909.101.1.5

Peker, M., & Tekcan, A. İ. (2009). The role of familiarity among group members in collaborative inhibition and social contagion. *Social Psychology*, *40*(3), 111-118. doi:10.1027/1864-9335.40.3.111

Pereira-Pasarin, L., & Rajaram, S. (2011). Study repetition and divided attention: Effects of encoding manipulations on collaborative inhibition in group recall. *Memory & Cognition*, *39*(6), 968-976. doi:10.3758/s13421-011-0087-y

Pritchard, M. E., & Keenan, J. (2002). Does jury deliberation really improve jurors' memories? *Applied Cognitive Psychology*, *16*(5), 589-601. doi:10.1002/acp.816

Rajaram, S. (2011). Collaboration Both Hurts and Helps Memory: A Cognitive Perspective. *Current Directions In Psychological Science (Sage Publications Inc.)*, *20*(2), 76-81. doi:10.1177/0963721411403251

Rajaram, S., & Pereira-Pasarin, L. P. (2007). Collaboration can improve individual recognition memory: Evidence from immediate and delayed tests. *Psychonomic Bulletin & Review*, *14*(1), 95-100. doi:10.3758/BF03194034

Reysen, M. (2005). The effects of conformity on recognition judgements. *Memory*, *13*(1), 87-94.

Reysen, M. B. (2003). The effects of social pressure on group recall. *Memory & Cognition*, *31*(8), 1163-1168.

Reysen, M. B. (2007). The effects of social pressure on false memories. *Memory & Cognition*, *35*(1), 59-65.

Roediger, H. L. (1973). Inhibition in recall from cueing with recall targets. *Journal of Verbal Learning & Verbal Behavior*, *12*(6), 644-657. doi:10.1016/S0022-5371(73)80044-1

Roediger, H., Meade, M. L., & Bergman, E. T. (2001). Social contagion of memory. *Psychonomic Bulletin & Review*, *8*(2), 365-371. doi:10.3758/BF03196174

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*(1), 85-92. doi:10.1037/0882-7974.23.1.85

Ross, M., Spencer, S. J., Linardatos, L., Lam, K. H., & Perunovic, M. (2004). Going shopping and identifying landmarks: does collaboration improve older people's memory? *Applied Cognitive Psychology*, *18*(6), 683-696. doi:10.1002/acp.1023

Serra, M., & Nairne, J. S. (1993). Design controversies and the generation effect: Support for an item-order hypothesis. *Memory & Cognition*, *21*(1), 34-40. doi:10.3758/BF03211162

Serra, M., & Nairne, J. S. (2000). Part-set cuing of order information: Implications for associative theories of serial order memory. *Memory & Cognition*, *28*(5), 847-855. doi:10.3758/BF03198420

Sloman, S. A., Bower, G. H., & Rohrer, D. (1991). Congruency effects in part-list cuing inhibition. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *17*(5), 974-982. doi:10.1037/0278-7393.17.5.974

Stasser, G., Taylor, L. A., & Hanna, C. (1989). Information sampling in structured and unstructured discussions of three- and six-person groups. *Journal of Personality and Social Psychology*, *57*(1), 67-78. doi:10.1037/0022-3514.57.1.67

Stephenson, G. M., Branostätter, H., & Wagner, W. (1983). An experimental study of social performance and delay on the testimonial validity of story recall. *European Journal of Social Psychology*, *13*(2), 175-191.

Stewart, D. D., Stewart, C. B., & Walden, J. (2007). Self-reference effect and the group-reference effect in the recall of shared and unshared information in nominal groups and interacting groups. *Group Processes & Intergroup Relations*, *10*(3), 323-339. doi:10.1177/1368430207078693

Sutton, J., Harris, C. B., Keil, P. G., & Barnier, A. J. (2010). The psychology of memory, extended cognition, and socially distributed remembering. *Phenomenology and the Cognitive Sciences*, *9*(4), 521-560. doi:10.1007/s11097-010-9182-y

Takahashi, M. (2007). Does collaborative remembering reduce false memories?. *British Journal of Psychology*,*98*(1), 1-13. doi:10.1348/000712606X101628

Takahashi, M., & Saito, S. (2004). Does test delay eliminate collaborative inhibition? *Memory*, *12*(6), 722-731. doi:10.1080/09658210344000521

Taylor, D. W., Berry, P. C., & Block, C. H. (1958). Does group participation when using brainstorming facilitate or inhibit creative thinking. *Administrative Science Quarterly*, *3*23-47. doi:10.2307/2390603

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*(6), 867-881. doi:10.1080/09541440600872068

Todres, A. K., & Watkins, M. J. (1981). A part-set cuing effect in recognition memory. *Journal of Experimental Psychology: Human Learning and Memory*, *7*(2), 91-99. doi:10.1037/0278-7393.7.2.91

Van Swol, L. M. (2008). Performance and process in collective and individual memory: The role of social decision schemes and memory bias in collective memory. *Memory*, *16*(3), 274-287.

Vollrath, D. A., Sheppard, B. H., Hinsz, V. B., & Davis, J. H. (1989). Memory performance by decision-making groups and individuals. *Organizational Behavior and Human Decision Processes*, *43*(3), 289-300. doi:10.1016/0749-5978(89)90040-X

Wegner, D. M. (1986). Transactive memory: A contemporary analysis of the group mind. In B.Mullen & G. R. Goethals (Eds.), *Theories of group behavior* (pp. 185–205). New York: Springer-Verlag.

Wegner, D. M., Erber, R., & Raymond, P. (1991). Transactive memory in close relationships. *Journal of Personality and Social Psychology*, *61*(6), 923-929. doi:10.1037/0022-3514.61.6.923

Wegner, D. M., Giuliano, T., & Hertel, P. (1985). Cognitive interdependence in close relationships. In W. J. Ickes (Ed.), *Compatible and incompatible relationships* (pp. 253-276). New York: Springer-Verlag.

Weldon, M., & Bellinger, K. D. (1997). Collective memory: Collaborative and individual processes in remembering. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *23*(5), 1160-1175. doi:10.1037/0278-7393.23.5.1160

Weldon, M., Blair, C., & Huebsch, P. (2000). Group remembering: Does social loafing underlie collaborative inhibition? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *26*(6), 1568-1577. doi:10.1037/0278-7393.26.6.1568

Williams, K., Harkins, S. G., & Latané, B. (1981). Identifiability as a deterrant to social loafing: Two cheering experiments. *Journal of Personality and Social Psychology*, *40*(2), 303-311. doi:10.1037/0022-3514.40.2.303

Wittenbaum, G. M. (2000). The bias toward discussing shared information: Why are high-status group members immune? *Communication Research*, *27*(3), 379-401. doi:10.1177/009365000027003005

Wittenbaum, G. M., & Park, E. S. (2001). The Collective Preference for Shared Information.*Current Directions In Psychological Science (Wiley-Blackwell)*, *10*(2), 70-73.

Wittenbaum, G. M., & Stasser, G. (1996). Management of information in small groups. In J. L. Nye, A. M. Brower (Eds.). *What's social about social cognition? Research on socially shared cognition in small groups* (pp. 3-28). Thousand Oaks, CA US: Sage Publications, Inc.

Wittenbaum, G. M., Hubbell, A. P., & Zuckerman, C. (1999). Mutual enhancement: Toward an understanding of the collective preference for shared information. *Journal of Personality and Social Psychology*, *77*(5), 967-978. doi:10.1037/0022-3514.77.5.967

Wittenbaum, G. S. (2001). The Collective Preference for Shared Information. *Current Directions In Psychological Science (Wiley-Blackwell)*, *10*(2), 70-73.

Wright, D. B. (2007). Calculating nominal group statistics in collaboration studies. *Behavior Research Methods*, 39(3), 460-470. doi:10.3758/BF03193015

Wright, D. B., & Klumpp, A. (2004). Collaborative inhibition is due to the product, not the process, of recalling in groups. *Psychonomic Bulletin & Review*, *11*(6), 1080-1083. doi:10.3758/BF03196740

Yaron-Antar, A., & Nachson, I. (2006). Collaborative remembering of emotional events: The case of Rabin's assassination. *Memory*, *14*(1), 46-56. doi:10.1080/09658210444000502

Yuker, H. E. (1955). Group atmosphere and memory. *The Journal of Abnormal and Social Psychology*, *51*(1), 17-23. doi:10.1037/h0046464

LIST OF APPENDICES

APPENDIX A: WORD LISTS

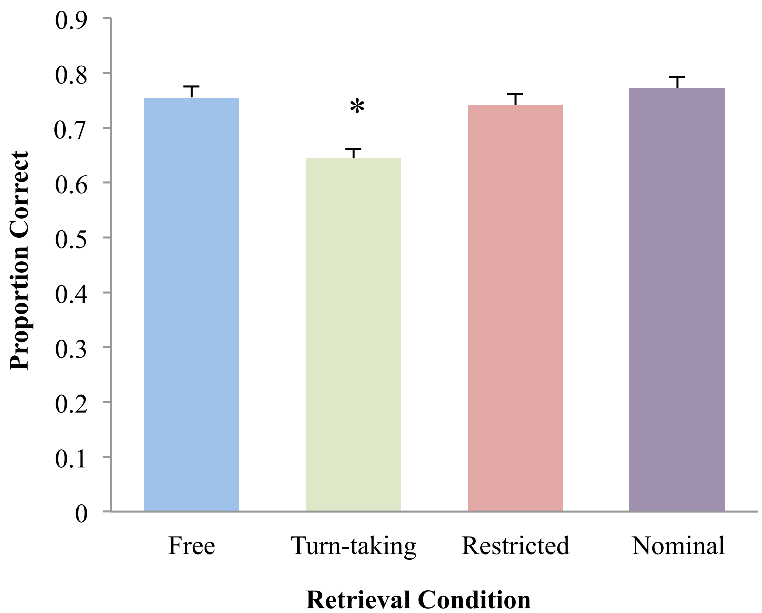
1.	ENGINE	BOTTLE	HOTEL	OCEAN	GOLD	COTTON	SKIN	BIRD
2.	FOREST	COAST	BOARD	STONE	CATTLE	IRON	LAKE	SEAT
3.	STREET	WATER	CASH	BRAIN	FIRE	PALACE	SOIL	AVENUE
4.	VALLEY	DOCTOR	EARTH	HOUSE	CITY	SHIP	BOOK	TREE
5.	DOLLAR	LETTER	METAL	COFFEE	GRASS	SHOES	CORN	ROCK
6.	MEAT	HALL	RIVER	PLANT	DRESS	SUGAR	CHAIR	BABY
7.	CORNER	GARDEN	MONEY	SHORE	PAPER	FLESH	DUST	WINE
8.	DOOR	WINDOW	PENCIL	QUEEN	HORSE	CHILD	TABLE	BODY

APPENDIX B : RECONSTRUCTION DATA

Table 1 *Reconstruction Proportions as a Function of Serial Position and Retrieval Condition*

	Serial Position																
	1		2		3		4		5		6		7		8		
Group	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	Total
Free	.98	.05	.90	.11	.86	.12	.74	.17	.65	.22	.59	.22	.64	.18	.68	.16	.76
Turn-taking	.91	.18	.80	.19	.70	.23	.60	.23	.49	.22	.55	.22	.52	.20	.59	.22	.64
Restricted	.93	.12	.87	.18	.79	.17	.74	.23	.68	.22	.64	.24	.61	.22	.68	.23	.74
Nominal	.99	.03	.93	.08	.87	.13	.75	.15	.63	.21	.65	.20	.63	.18	.74	.17	.77

Figure 1 *Nominal and Collaborative Group Reconstructions*



VITA

Elizabeth Lauren Foreman was born December 30, 1985 in Baton Rouge, Louisiana. She attended Southeastern Louisiana University from 2004 to 2008 and graduated Summa Cum Laude with a Bachelor of Arts in psychology and a minor in criminal justice. Elizabeth was accepted to the experimental psychology graduate program at the University of Mississippi, where she pursued research in social psychology under the direction of Dr. Carol Gohm until receiving a Master of Arts in 2010. Elizabeth then began researching aspects of cognitive psychology under Dr. Matthew B. Reysen within the same program at the University of Mississippi. Originally drawn to the field of psychology out of a desire to conduct meaningful research, Elizabeth discovered a strong passion for education during her experience as a graduate instructor, and will pursue a teaching career in academia upon the completion of her doctorate.