

DIFFERENT ENCODING STRATEGIES AFFECT
RETRIEVAL OF INFORMATION IN COLLABORATIVE GROUPS

by

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TABLE OF CONTENTS

1. INTRODUCTION	1
2. EXPERIMENT	14
Method	14
Participants.....	14
Design and Materials	14
Six Stories	15
Recognition Test.....	15
Procedure	16
Results.....	18
Recall	18
Total Recall.....	18
Critical Segments of the Stories.....	20
Recognition.....	21
High Importance Ratings for Hits.....	22
High Importance Ratings for False Alarms	23
Reaction Times for Hits	24
Discussion	24
Limitations	26
Future Research	27
Conclusion	27
REFERENCES CITED.....	29
APPENDICES	33
APPENDIX A: List of Story Stimuli used for Recall.....	34
APPENDIX B: List of Word Stimuli used in Recognition Test.....	41

LIST OF TABLES

Table	Page
1. The Proportion of Total Recall as a Function of Collaboration and Strategy.	19
2. Critical Recall Averaged Across Stories as a Function of Strategy and Collaboration.....	21
3. Total Proportion of Importance Ratings for Hits as a Function of Strategy and Collaboration.....	21
4. Total Proportion of Importance Ratings for False Alarms as a Function of Strategy and Collaboration.	22
5. List of Word Stimuli used for Campus/Car Recognition Test.....	42

ABSTRACT

This study examined collaborative memory and encoding strategies. Participants read three different stories processed with three different encoding strategies. Each story had two encoding strategies, but participants were only given one strategy per story (Pichert & Anderson, 1977). Later participants recalled and recognized the stories in three test trials. Recall occurred either individually or collaboratively. Pairs of participants read the same stories with the same strategy (congruent condition), the same stories with different strategies (incongruent condition) or the same stories with no strategy (control condition). Participants in incongruent groups did not show an effect of collaboration or collaborative performance equaled nominal performance, whereas congruent collaborative groups showed standard collaborative inhibition effects (Wright & Klumpp, 2004). After recall, a two-part recognition test occurred individually. Prior collaboration and strategy influenced importance judgments. Participants formerly in collaborative groups rated items congruent with their strategy as more important and items incongruent with their strategy as less important than did nominal groups. When working in a collaborative group, perhaps attending to different information ameliorates retrieval strategy disruption and aides in the process of collaboration. Additionally, prior collaboration affects importance ratings on a subsequent recognition test.

CHAPTER 1

INTRODUCTION

Generally, memory research focuses on the individual, but researchers have recently begun studying the memories of individuals within groups. This is called *collaborative memory*. The reason to study groups of individuals is because most memories are shared between people in a social context. Additionally, interactions between people may affect how a single person remembers information (Roediger, Meade, & Bergman, 2001). The current study will examine the role of encoding strategy on collaborative memory performance and also examine the effect of prior collaboration on subsequent individual memory performance.

Collaborative groups consist of at least two people working together to remember information. Collaborative groups are compared to nominal groups, which are created by pooling the non-overlapping responses of individuals to estimate what they would have recalled had they worked together. For example, two participants work individually to recall items A, B, C, D, E, F, and G. Participant one recalls items A, C, and E and participant two recalls items A, B, D, and E. Therefore, the nominal group recalls items A, B, C, D, and E. These pooled items are thought to be what the participants would have recalled if they were in a collaborative group. The most typical method for creating nominal groups involves grouping individuals according to participant number. However, there are alternative methods including algorithms and taking the average across several different group combinations (Wright & Klumpp, 2004; Wright, in press).

Initially, studies on collaborative memory predicted that collaboration would facilitate performance in comparison to nominal groups through cross-cuing (Muedell, Hitch, & Boyle, 1995). The process of hearing another person's output was thought to activate more information than if the cuing had not occurred. However, many collaborative memory studies have demonstrated that although collaborative groups outperform single individuals, they do not outperform individuals pooled together to form nominal groups. The reduced output of collaborative groups relative to nominal groups is referred to as *collaborative inhibition* (Weldon & Bellinger, 1997). The major goal of this study is to examine the potential for encoding strategies to minimize or eliminate the collaborative inhibition effect.

Both cognitive and motivational factors are likely involved in collaborative inhibition (Weldon, Blair, & Heubsch, 2000). However, the research conducted on social factors has revealed only marginal effects. Weldon, Blair, and Huebsch examined the impact of social loafing on collaborative inhibition. Social loafing occurs when people working in groups reduce their individual effort (Latane, Williams, & Harkins, 1979). Social loafing was manipulated in an effort to eliminate its effects on collaborative inhibition. These collaborative memory tasks were used to ameliorate the effects of social loafing: personal accountability, dispensability of effort, equity of effort, diffusion of responsibility, and evaluation apprehension (Weldon et al., 2000). Personal accountability was increased by group members recording all individual responses for every member. Dispensability of effort was diminished using monetary incentives. Equity of effort was manipulated through the use of stringent response criteria. Diffusion of

responsibility was decreased through group cohesion. Finally, evaluation apprehension was eliminated through single gender groups. All of these experiments theoretically eliminated social loafing, but collaborative inhibition persisted. That is, nominal groups outperformed collaborative groups in all experiments, suggesting that collaborative inhibition is not solely the result of social loafing.

Research conducted on cognitive factors underlying collaborative inhibition has revealed more pronounced effects. Two cognitive factors related to collaborative inhibition are retrieval strategy disruption and production blocking. Retrieval strategy disruption occurs when other people disrupt the idiosyncratic retrieval strategies that individuals would have used if they were working alone (Basden, Basden, Bryner, & Thomas, 1997). Production blocking creates collaborative inhibition by only allowing one idea to become active at a time (Diehl & Stroebe, 1987).

The retrieval strategy disruption hypothesis of collaborative memory may be similar to the part-set cueing effects obtained in individual recall (Basden & Basden, 1995). Part-set cueing refers to using a subset of previously learned items as retrieval cues for the remaining items, which impairs the recall of the remaining information. One explanation for the effect is that the cues become more accessible than others in a memory list, strengthening that individual word, but inhibiting the remaining words (Slamecka, 1968). There are many factors involved in part-set cueing that also apply to collaborative groups such as when cues disrupt an individual's retrieval strategies. Basden and Basden (1995) presented individuals with retrieval cues that were categorically consistent or inconsistent with how the individual initially processed

categorized word lists. When individuals were cued with intact categories part-set cueing vanished, however, when individuals were cued with several different categories they abandoned their retrieval strategies for less effective ones.

Basden and colleagues (1997) applied part-set cueing to collaborative groups and called it the *retrieval strategy disruption hypothesis*. As is the case with part-set cues, when one person recalls a word, the other person tends to adopt an alternative response strategy that is not as effective. Collaborators typically use incongruent retrieval strategies, which inhibits overall recall. However, there are differences between individuals and collaborative groups in terms of part-set cueing (Andersson, Hitch, & Meudell, 2006). For individuals, part-set cueing typically occurs through visual cues that happen one time at the beginning of the retrieval process. Part-set cueing is different for collaborative groups because the disruption is spoken and distributed throughout the test. Andersson et al. (2006) controlled for both modality and timing differences in individual and collaborative memory situations and found when participants received eight part-set cues before the retrieval process began it was more disruptive than when the same eight part-set cues were distributed over twenty second intervals. Participants were also presented with extra-list cues that differed from the part-set cues because these words were not presented in the list. They found that when the cues were presented all at once before retrieval, that extra-list cues and part-set cues were equally disruptive. However, when the cues were spread distributed over 20-second intervals, extra-list cues were not as disruptive as part-set cues.

Production blocking is another process thought to create collaborative inhibition. Production blocking involves the activation of one idea at a time. Because only one person can speak at a time, other ideas may be forgotten while waiting for the person to finish speaking (Diehl & Stroebe, 1987). The maintenance of the current information may also interfere with the generation of new ideas. Suppressing or forgetting ideas may occur because after hearing new information, people believe their idea is less relevant or original (Diehl & Stroebe, 1987). Time and the production of other ideas seem to cause production blocking.

Wright and Klumpp (2004) directly tested the retrieval strategy disruption hypothesis against production blocking in a collaborative memory study. In order to separate the product of recall (the actual word recalled that should be relevant to the retrieval strategy disruption hypothesis) and process of recall (the time spent waiting for one's turn which should be relevant to production blocking), Wright and Klumpp had individuals in one collaborative group, separated by a divider, take turns writing down responses without knowing the other person's output. Individuals in the second collaborative group passed a paper to each other after writing their responses so that they could see the other's responses. Viewing the words the other person generated significantly inhibited collaborative groups, but the process of waiting their turn did not inhibit group recall. These findings provide strong support for the retrieval strategy disruption hypothesis.

Further evidence in support of the retrieval strategy disruption hypothesis comes from work on partner familiarity. Andersson and Ronnberg (1995, 1996) found that

collaborative inhibition is reduced among friends who know each other well. Their argument is that familiar partners have more experience remembering together and so approach the collaborative memory task with retrieval strategies similar to one another. Such research is related to work on transactive memory (Wegner, Erber & Raymond, 1991). Transactive memory is a shared system for the encoding, storage, and retrieval of information. If people frequently collaborate, they will have similar retrieval strategies. Transactive memory focuses on expertise that has been established pre-experimentally via the shared experience of collaborators.

Johansson, Andersson, and Ronnberg (2005) examined the effects of transactive memory on collaborative inhibition. They focused on retrieval strategies used by older adult couples who had been married more than 40 years. These couples varied in their division of responsibility and agreement of task divisions. Division of responsibility involved one or both members of a couple claiming that they were responsible for different facts within an episodic, semantic or prospective memory task. Agreement was determined by the couple dividing the tasks in the same way. Johansson et al. (2005) found that couples who were high in division of responsibility and agreement recalled marginally more information than nominal groups. These complimentary strategies aided in collaborative memory performance.

To summarize so far, collaborative inhibition is probably mitigated by differences in partner familiarity because people who know each other well have developed complimentary strategies that minimize the disruptive aspect of collaboration. Note that collaborative studies on partner familiarity and transactive memory have relied on

strategies that were formed pre-experimentally between familiar partners. In contrast, the current study will experimentally manipulate strategy among strangers. Un-confounding partner familiarity and encoding strategy allows a stronger test of the role that encoding strategy exerts on collaborative inhibition.

The motivation for experimentally manipulating encoding strategy comes from research on individual memory performance. Encoding can be defined as the initial processing of information (Craik & Lockhart, 1972). It is well accepted that cognitive processes during encoding influence later retrieval (Craik & Tulving, 1975). Regarding verbal material (e.g., word lists); instructions on how deeply to process material (Craik & Tulving, 1975) and the organization of the material (Tulving, 1962) have been shown to affect later retrieval. Encoding strategies have also been shown to influence later retrieval of pictures. Carmichael, Hogan, and Walter (1932) told participants that an ambiguous figure resembled one of two items. For example, experimenters told half of the participants that an ambiguous shape resembled eyeglasses and half of the participants were told the same shape resembled dumb bells. During retrieval participants altered the shape of their drawings to match the description provided at encoding.

Encoding strategies can be applied to stories as well. In order to process stories, people generally use story schemas (Bartlett, 1932; Mandler & Johnson, 1977). Story schemas are sets of expectations about the internal structure of a story that facilitate encoding and retrieval. People often normalize stories into structure with a beginning, middle, and end.

Anderson and colleagues have examined different ways to encode information when given the same story (Anderson & Pichert, 1978; Anderson, Pichert & Shirey, 1983; Pichert & Anderson, 1977). For example, Pichert and Anderson (1977) had individuals read a story about two boys skipping school at the home of one of the boys. Participants were told to process the story either as a potential homebuyer or as a robber. They found that participants were more likely to recall information from the story that was congruent with their strategy. For example, participants who encoded the story from the robber perspective were more likely to recall the stereo, while participants who encoded the story from the home buyer perspective were more likely to recall the house's leaky roof. Additional studies (Anderson & Pichert, 1978; Anderson, Pichert, & Shirey, 1983) revealed that the robber perspective had a stronger effect on encoding than did the home buyer perspective.

Other researchers have tried to replicate Pichert and Anderson's (1977) results with varying success (Kardash, Royer, & Greene, 1988; Schraw & Dennison, 1994). None of these experiments used Pichert and Anderson's (1977) original materials. Instead these experiments used versions of the original materials that had been modified to account for the fact that some of the critical idea units in the Pichert and Anderson materials contained information relevant to both encoding strategies. For example, a sentence from the Pichert and Anderson passage was, "Tall hedges hid the house from the road, so the pair strolled across the landscaped yard." This sentence is relevant to both perspectives because the tall hedges are relevant to a robber and the landscaped yard is relevant to a home buyer.

Kardash et al. (1988) examined differences in recall and recognition for participants who received a strategy before the passage or before recall. Because the previous Pichert and Anderson studies (Anderson & Pichert, 1978; Anderson, Pichert & Shirey, 1983; Pichert & Anderson, 1977) found the robber strategy to be more effective, Kardash et al. only used the robber strategy. The recall results showed that participants given the burglar perspective recalled more burglar relevant information than the control group. However, during a sentence verification technique recognition test participants given the burglar perspective recognized less burglar relevant information than the control group. Kardash et al. explained that it was easier to utilize schemas during recall; however, comprehension of the passage (derived from the recognition test) was not affected by perspective.

Schraw and Dennison (1994) manipulated reader interest across three experiments by changing the Kardash et al. (1988) story to be longer and contain more interesting idea units. First they replicated Pichert and Anderson (1977), however the results of the subsequent experiments did not replicate the previous finding. Perhaps a questionnaire intervening between study and test interfered with the ability to maintain strategy consistent information.

Interestingly, the original Pichert and Anderson (1977) study, widely viewed as a classic of cognitive psychology, has not always been successfully replicated. Nonetheless, we chose to utilize this paradigm because it allows for a clean experimental manipulation of encoding strategy.

The current study extends Pichert and Anderson's (1977) findings to a collaborative setting in an effort to explore the role of encoding strategies on the collaborative inhibition effect. Previous research on encoding strategies and collaboration (e.g. Andersson & Ronnberg, 1995, 1996; Johansson et al. 2005) has relied on friends and spouses who have practice recalling together. By experimentally manipulating encoding strategy (as did Pichert and Anderson, 1977), the current study allows an examination of the role of encoding strategy un-confounded with partner familiarity.

The current study will present participants with stories and ask that they encode them from a given perspective. Participants will then be asked to recall the stories alone or in collaboration with a partner who has encoded the stories with the same strategy as themselves (congruent strategy), a different strategy than themselves (incongruent strategy), or no strategy. Previous research by Basden et al. (1997) suggests that collaborative inhibition is mediated by having participants recall different aspects of the same stimuli. They gave participants six categories with 15 exemplars to recall collaboratively or individually. Participants either recalled all six categories (whole list) or only two of the six categories (part list). Collaborative inhibition was obtained in the whole list condition, but not the part list condition. It is important to note that participants were not informed that they would be tested on part of the list until after the lists were already encoded. The current study differs in that the strategy manipulation occurs at encoding and not retrieval, participants are presented with stories not word lists, and individual recognition is assessed subsequent to collaboration. Based on Basden et al.'s (1997) results, as well as the partner familiarity research discussed previously, it is

predicted that collaborative groups with congruent strategies should show the standard collaborative inhibition effects. However, collaborative groups with incongruent strategies should not demonstrate collaborative inhibition because they attended to different information, which should lesson strategy disruption.

Additionally, the current study will also examine collaborative inhibition for short stories rather than the more typical word lists. Several studies have obtained reliable collaborative inhibition for short story recall; however, Andersson and Ronnberg (1995, 1996) found the effect was not as strong for stories relative to word lists. We chose to rely on stories because encoding strategies have been shown to influence story recall in individuals (e.g., Pichert and Anderson, 1977). Further, stories that offer a shared structure may prove interesting to collaboration. Weldon and Bellinger (1997) found that collaborative groups' recall of a story was more organized than recall of word lists.

These story materials will be used to determine whether prior collaboration will influence subsequent individual recognition. According to the retrieval strategy disruption hypothesis, collaborative inhibition effects should disappear on subsequent individual memory tests because the disruptive partner has been removed (Finlay, Hitch, & Meudell, 2000). There is also evidence that during multiple recognition tests collaboration has a lasting impact on later individual memory (see Rajaram & Periera-Pasarin, 2007, for a review).

While most collaborative memory research uses a single free recall test to find collaborative inhibition (e.g., Basden et al., 1997) a few have relied on repeated recall. Many include an individual test first followed by a second test that is either individual or

collaborative (Andersson & Ronnberg, 1995; Basden, Basden, & Henry, 2000; Finlay et al., 2000). More relevant to the current study is research by Weldon and Bellinger (1997) in which they repeatedly tested recall of words, pictures and stories. Participants would either work individually two times (II), collaboratively two times (CC), individually first then collaboratively (IC), or collaboratively first then individually (CI). Though they found the standard collaborative inhibition effect on the first recall test, they also found that the CI groups outperformed the II or IC groups during the second test. There was a significant benefit to prior collaboration during subsequent recall possibly due to re-exposure to some words that would not have thought of otherwise.

The current study will focus on the effects of prior recall on a subsequent recognition test. If presented with a recall test followed by a recognition test, one might expect facilitated performance on the recognition test due to prior exposure (during collaborative recall) of ideas that might not have otherwise been remembered. Of course, the final recognition test is confounded by prior recall (e.g. Roediger, Jacoby, & McDermott, 1996); however, we are directly interested in the effect of prior collaboration on later individual memory.

Very few collaborative memory studies have used recognition tests (Clark, Abbe, & Larson, 2006; Rajaram & Pereira-Pasarin, 2007). These studies have shown facilitated performance on a second individual recognition test after having first collaboratively recognized the same test. These positive affects of collaboration seem to be due to the type of test. Recognition tests do not rely on the complex retrieval strategies in the same

way as recall. Also, this collaborative facilitation seems to be dependent upon consensus or participants must reach an agreement for these effects to occur.

Based on previous findings, it is expected recognition accuracy should be dependent on strategy and collaboration. Participants given congruent strategies should be more accurate when responding to strategy congruent information in comparison to other groups. However, collaborative groups with both incongruent and congruent strategies should be more accurate than nominal groups. Retrieval strategy disruption will inhibit collaborative groups from responding in recall; however, new information presented during recall may reappear during subsequent recognition. Prior collaboration may boost later individual recognition because the partner no longer provides strategy disruption and participants will have been exposed to items that they would not have recalled on their own during prior collaboration.

CHAPTER 2

EXPERIMENT

MethodParticipants

A total of 48 undergraduate students, enrolled in an introductory psychology course, participated in this experiment for course credit. The participants included 28 women and 20 men. The mean age of the participants was 20.1 years.

Design and Materials

The experiment consisted of a 2 x 3 between subjects design. Collaboration (individual or collaborative groups) and encoding strategies (congruent, incongruent, and control) were manipulated between subjects. The primary dependent variables were recall and recognition of the stories.

Six Stories. The house story from Pichert and Anderson (1977) was used in the current experiment and served as a model for creating five additional stories, each applicable to two different encoding strategies (see Appendix A). These stories were created from idea units provided by pilot data collected from 40 Montana State University undergraduates. For example, one scenario was a campus tour and participants were asked to write down 10 different items related to viewing the situation as a parent and 10 different items related to being a prospective student. Additional story themes included a bus story (Pedestrian and Driver), restaurant story (Health inspector and Chef),

art story (Janitor and Art buyer), and car story (Parent and Teen). Items listed by seven or more participants were considered high-frequency items, those listed by five to seven participants were considered middle-frequency items, and those listed by five or fewer participants were considered low-frequency items. Additionally, five neutral items were gathered from the pilot data because they were ranked as equally important to both strategies. Five additional neutral items were used as filler items. Each story contained 372 words with 30 critical idea units (10 related to each strategy and 10 neutral). There were two different sets of three stories created for counterbalancing purposes (Condition 1: campus story, bus story, and art story and condition 2: car story, house story, and restaurant story). Participants in both conditions received the same recognition test, so that the same critical items served as hits for one condition and false alarms for the other condition.

Filler Task. Participants were given a shape rotation task from Wiesen (2003) that required them to determine which rotated shape was equivalent to the target shape.

Recognition Test. A 90-item recognition test was created for each story that contained 30 critical items from the story (10 from each strategy and 10 neutral items) along with 15 related items not presented in the story (5 from each strategy and 5 neutral). These neutral related items were the middle-frequency items from the pilot data. There were 8 items that overlapped between stories. These items were replaced with different neutral items. The remaining 45 items were unrelated and came from the matched story in the other counterbalancing condition.

Procedure

Three stories were presented to participants via computer to read individually. Each story was presented for 2 minutes. Participants were asked to tell the experimenter when they were done reading the story and to wait for their partner to finish if they worked in collaborative groups.

Before each story, participants were told, “Whenever someone reads a story or paragraph, some ideas stick out as being more important to the story than others.” These instructions were taken directly from Pichert and Anderson (1977). They were then given a strategy to use while reading the story (e.g., your strategy is to read the scenario from the perspective of a parent). Pairs of participants in one third of the groups were given the same perspective to process the stories (congruent strategy condition), one third of the groups were given different perspectives to process the stories (incongruent strategy condition) and one third of the groups were not given a perspective (control strategy condition). Participants in the control condition were told to read three different stories in preparation for a memory test. There were no instructions about an encoding strategy. Participants confirmed their strategy again after reading the strategy screen.

After reading all three stories participants worked on a filler task for one minute. Then they completed three successive tests consisting of recall followed by recognition. The recall and recognition tests were presented in the same order as the stories.

Participants worked individually or in collaborative groups of two to recall as much of the exact story as possible. Although there is some evidence to suggest that collaborative inhibition effects are larger with larger groups and in some cases are absent

among pairs (Basden, Basden, & Henry, 2000), many studies have also demonstrated reliable collaborative inhibition among pairs of partners working together (e.g., Andersson & Ronnberg, 1995). We chose to test participants in pairs in an effort to remain consistent with the encoding strategy work previously conducted by Pichert and Anderson (1977). Individuals wrote down all responses on a piece of paper labeled with the story heading. Collaborative groups stated all responses out loud before the randomly selected a person to write down their responses. Participants were given 6 minutes to recall each story.

After recalling each story, participants in the congruent and incongruent strategy condition were asked to write down their strategy on a piece of paper. Then, participants individually completed a two-part recognition test for the same story. For each item an old/new response was made. Participants pressed the “new” (q) key if an item was not presented in the story and pressed the “old” (p) key if the item was presented in the story. The second part of the recognition task involved judging the importance of each item to the encoding strategy. If an item was marked old, participants had to determine whether the item was highly important (“h” key) or unimportant (“g” key) to their strategy. However, if an item was marked new, the new key was pressed again to get to the next item.

After participants recalled and recognized all three of the stories they were debriefed and given course credit for participation in the experiment.

Results

Recall

Each story was divided into propositional segments. On average, each story contained 36 total propositional segments that included 10 segments that were relevant to strategy one, 10 segments that were relevant to strategy two, and 10 segments designated neutral. Idea units recalled were scored as correct if they were verbatim or if they were conceptually similar in meaning to the main idea of each propositional segment. Both total recall (the proportion recalled of all possible propositional segments) and critical recall (the proportion recalled of the 10 propositional segments relevant to each strategy) are considered in turn. All analyses include nominal group recall and collaborative group recall.

The data presented includes all stories. We also examined the stories individually including just the house story. The findings across all analyses are consistent so we reported the results collapsed across stories.

Total Recall. Table 1 presents the total recall of nominal and collaborative groups as a function of strategy. A 2 (nominal or collaborative group) x 3 (congruent, incongruent or control) between subjects ANOVA computed on the total proportion of propositional segments recalled revealed a main effect of collaboration, $F(1, 23) = 21.83$, $MSE = 0.21$, $p < .01$. A follow-up comparison indicated that participants demonstrated the standard collaborative inhibition effect with collaborative groups recalling significantly less than nominal groups, $t(22) = 3.33$, $SEM = 0.05$, $p < .01$. Note the nominal groups

vary in terms of accuracy, but the collaborative groups remain the same. The differences between the nominal groups may be explained by strategy. Strategy two may not have been as memorable as strategy one. Alternatively, the between subjects design used in the current study may have caused error. These effects may have been exaggerated due to the small sample size. Typically, collaborative memory studies use at least 16 groups, whereas, our study only used 4 groups. A power analysis would have been useful to determine if the need for more participants was necessary.

The ANOVA also revealed a main effect of strategy, $F(2, 23) = 5.07$, $MSE = 0.05$, $p = .02$. This main effect of strategy was qualified by an interaction between collaboration and strategy, $F(2, 23) = 7.54$, $MSE = 0.07$, $p < .01$. Follow-up comparisons revealed that participants in the congruent condition, $t(6) = 4.30$, $SEM = 0.04$, $p < .01$, and participants in the control condition, $t(6) = 3.05$, $SEM = 0.06$, $p < .02$, demonstrated collaborative inhibition. Interestingly, however, participants in the incongruent condition showed no collaborative inhibition, $t(6) = 0.38$, $SEM = 0.02$, $p > .05$. This suggests that giving participants different strategies ameliorated the retrieval strategy disruption that occurred when participants attended to the same information.

Table 1. The Proportion of Total Recall as a Function of Collaboration and Strategy.

Strategy	Total Recall	
	Collaborative Groups	Nominal Groups
Congruent	.50	.86
Incongruent	.54	.52
Control	.52	.74
Mean	.52	.71

Critical Segments of the Stories. Table 2 presents the mean proportion of critical segments relevant to each strategy. A 2 (nominal or collaborative group) x 3 (congruent, incongruent or control) between subjects ANOVA computed on proportion of critical segments recalled revealed no main effect of collaboration, $F(1, 23) < 2.23, p > .05$. Further, there was no main effect of strategy, $F(2, 23) < 1.42, p > .05$, nor any interactions between strategy and other variables, $F(2, 23) < 2.47, p > .05$. These findings are inconsistent with the previous findings from Pichert and Anderson (1977) which suggested that strategy influenced the items recalled. One reason for the discrepancy may be that Pichert and Anderson did not publish which idea units were related to each strategy, so the critical segments used in the current study might differ from those used by Pichert and Anderson. Also, even though there were two manipulation checks in the experiment to ensure that participants understood their strategy, not all participants remembered their strategy throughout the experiment. Some participants did not remember their strategy at all, whereas others guessed an incorrect strategy. Another reason that the current experiment did not replicate Pichert and Anderson could be that participants were not reminded what their strategy was before recalling the stories. Additionally, other researchers have also failed to replicate Pichert and Anderson (Lee-Sammons & Whitney, 1991; Schraw & Dennison, 1994).

Table 2. Critical Recall Averaged Across Stories as a Function of Strategy and Collaboration.

strategy	<u>S 1 Items</u>		<u>S 2 Items</u>		<u>Neutral Items</u>	
	Collab	Nominal	Collab	Nominal	Collab	Nominal
Both S 1	.44	.58	.33	.58	.45	.61
S 1, S 2	.47	.47	.40	.40	.45	.48
Control	.47	.48	.39	.38	.40	.52
Mean	.46	.51	.37	.45	.43	.54

Note: S 1 = strategy one and S 2 = strategy 2

Recognition

All participants made old or new judgments to all words on the recognition test. Of the words marked old, participants also decided whether the word was of high importance or low importance to their encoding strategy. Table 3 contains hit rate data along with the proportion of old items designated as high and low importance. Looking first at accuracy rates, a 2 (prior collaboration or prior individual) x 3 (congruent, incongruent or control strategy) ANOVA conducted on the proportion correct revealed no main effect of prior collaboration, $F(1, 42) = 1.33, p > .05$, no main effect of strategy condition, $F(2, 42) = 1.56, p > .05$, and no interaction, $F(2, 42) = 1.09, p > .05$. Consistent with previous research suggesting no lasting effect of collaborative inhibition (e.g. Finlay et al., 2000), the current results suggest collaborative inhibition obtained on initial recall disappeared on subsequent testing.

Table 3. Total Proportion of Importance Ratings for Hits as a Function of Strategy and Collaboration.

	<u>Collaborative</u>			<u>Nominal</u>		
	Congruent	Incongruent	Control	Congruent	Incongruent	Control
Hits	.74	.72	.75	.78	.64	.67
High Importance	.73	.60	.60	.62	.60	.47

High Importance Ratings for Hits. Table 4 also presents the proportion of responses that were given high importance ratings. A 2 (prior nominal or prior collaborative group) x 3 (congruent, incongruent or control) between subjects ANOVA computed on the proportion of high importance judgments revealed significant main effect of prior collaboration, $F(1, 42) = 5.06$, $MSE = .08$, $p = .03$. A follow-up comparison indicated that participants in collaborative groups were significantly more likely to rank items as high importance in comparison to nominal groups, $t(46) = 2.09$, $SEM = .03$, $p = .04$.

Table 4. Total Proportion of Importance Ratings for False Alarms as a Function of Strategy and Collaboration.

	<u>Collaborative</u>			<u>Nominal</u>		
	Congruent	Incongruent	Control	Congruent	Incongruent	Control
False Alarms	.21	.29	.24	.21	.29	.26
High Importance	.47	.56	.58	.53	.50	.74

The ANOVA also revealed a main effect of strategy, $F(2, 42) = 4.63$, $MSE = 0.08$, $p = .02$. Follow-up comparisons revealed that participants in the congruent condition were significantly more likely to rank words as highly important to the story than were participants in the control condition, $t(30) = 2.57$, $SEM = 0.03$, $p = .02$. However, participants in the congruent condition marginally differed from those in the incongruent condition in terms of high importance judgments, $t(30) = 1.87$, $SEM = .04$, $p = .07$. Participants in the incongruent condition did not significantly differ from participants in the control condition, $t(30) = 1.28$, $p > .05$. Participants using congruent strategies were most likely to judge strategy relevant ideas as highly important. This finding corresponds conceptually with Pichert and Anderson (1977).

The ANOVA did not reveal an interaction between prior collaboration and strategy, $F(2, 42) < 1.11, p > .05$.

To summarize, hit rate data showed no differences in accuracy, but did reveal differences in importance ratings. Collaborative groups were more likely to rank items as highly important to their strategy. Further, participants were more likely to rate as highly important those ideas consistent with their encoding strategy.

High Importance Ratings for False Alarms. Table 4 presents the proportion of high importance ratings for false alarms. A 2 (prior nominal or prior collaborative group) x 3 (congruent, incongruent or control) between subjects ANOVA computed on importance ratings revealed no main effects of prior collaboration or strategy and no interaction between strategy and other variables, $F(2, 42) < 1.32, p > .05$.

The ANOVA computed on high importance accuracy revealed no main effect of prior collaboration, $F(1, 42) < .77, p > .05$. Further, there was no main effect of strategy, $F(2, 42) < 2.97, p > .05$, nor any interactions between strategy and other variables, $F(2, 42) < 1.80, p > .05$.

To summarize, there were no differences in false alarms while making high importance ratings. This may be a participant error. Perhaps participants accidentally hit the old key and then randomly pressed high or low importance. Participants may have found strategy congruent information familiar enough to mark it old, but not familiar enough to be above chance.

Reaction Times for Hits. A 2 (prior nominal or prior collaborative group) x 3 (congruent, incongruent or control) between subjects ANOVA for reaction time revealed no main effects and no interactions, all $F_s < 2.03$.

Discussion

The current study was the first to explore the role of encoding strategies on the collaborative inhibition effect for stories. Importantly, by experimentally manipulating encoding strategy, we were able to un-confound the effects of encoding strategy from partner familiarity. The current study was also one of the few to examine individual memory performance following collaboration. The most interesting result to emerge from this study was that participants given incongruent strategies did not show differences between nominal group and collaborative group performance. This change was a result of nominal group differences. However, collaborative groups with congruent strategies showed the standard collaborative inhibition effects. The experiment demonstrated the validity of inducing encoding strategies like the ones used during transactive memory studies (Johansson, Andersson, & Ronnberg, 2005). Creating different experts by way of employing different encoding strategies may be useful for groups to help encode the same amount of information as nominal groups.

Interestingly, the effect of strategy did not apply to the critical items (those relevant to one encoding strategy) as predicted by Pichert and Anderson (1977), though note that others also failed to replicate (e.g., Schraw & Dennison, 1994).

No lasting effect of collaboration was obtained on the subsequent recognition test. Consistent with previous research suggesting collaborative inhibition does not persist to subsequent individual tests (e.g. Finlay et al., 2000), hit and false alarm rates on the recognition test did not vary as a function of prior individual or collaborative recall. Participants in collaborative groups were more likely to rate strategy congruent items as highly important than participants who had previously worked alone. Although retrieval strategy disruption created collaborative inhibition initially, prior collaboration improved importance judgment accuracy on subsequent recognition. More items may have become active during recall were initially detrimental, but boosted recognition later. This is consistent with Rajaram and Pereira-Pasarin (2007). Perhaps congruent strategies helped participants to remember the words related to their strategy. Being given an incongruent strategy or no strategy may lead collaborative and nominal groups to rank items equally because more information is activated.

The results of the current study are consistent with retrieval strategy disruption. Basden et al. (1997) minimized collaborative inhibition when participants attended to different categories of words as opposed to attending to the same categories. This is consistent with the current study, which reduced collaborative inhibition by having participants attend to different information within the same story.

Weldon and Bellinger (1997) found recall decrements when participants collaborated initially and then recalled information individually. The current study used both recall and recognition, which has not previously been examined in collaborative memory research. Recognizing information is different from recalling because

recognition relies more on familiarity (Clark, Abbe, & Larson, 2006). Though retrieval strategy disruption was evident during recall, when participants were later tested individually retrieval strategy disruption disappeared. Participants in collaborative groups were more likely to rank words as highly important in comparison to nominal groups. Potentially information that was initially detrimental during recall was useful during the subsequent recognition test. As a result of prior collaboration, more information became active and participants were able to make familiarity judgments quickly. All information recalled by group members, correct or incorrect, became more familiar to all members of the group.

Interestingly, strategy did play a role in importance judgments on the final recognition test. Participants were more likely to judge strategy relevant items as highly important. Note that participants were given a reminder of their encoding strategy immediately before the recognition test. Although this was intended as a manipulation check, it most likely also influenced the importance judgments.

Limitations

One limitation of the current study involves recording recall data. Individual participants may have not written down all they remembered. This problem was more pronounced for collaborative groups. Collaborative groups did not write down all of what they recalled aloud to one another. One solution to this problem is to tape record all participants recalling the stories. Another solution is to have experimenters check off information that is stated on a response sheet.

Finally, this study should have used the same materials throughout the experiment. There were four recognition words that were changed between the first 32 participants and the remaining participants. This was another flaw in the methodology of the study.

Future Research

A future direction for this study is to use older adults. Potentially, older adults using different strategies to process the same story may show this same pattern. This would be an interesting extension of the Johansson, Andersson, and Ronnberg (2005) study in order to determine whether or not older adults work more effectively when using differing strategies in general.

This study should be re-run using the current materials and adding additional manipulation checks to ensure that participants are using the encoding strategy to process the stories.

Conclusion

The goal of this experiment was to explore the use of encoding strategies as a means for reducing or eliminating collaborative inhibition and retrieval strategy disruption. Collaborative inhibition was eliminated for groups using different encoding strategies because participants attended to different information. Collaborative inhibition persisted for participants who were given the same strategy to process the stories. There has been previous research on individuals using encoding strategies, but few researchers have used different encoding strategies to process the same information. Additionally,

this study un-confounds partner familiarity from collaboration. The incongruent strategy condition provides the most insight into how individuals should process information.

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APPENDICES

APPENDIX A

LIST OF STORY STIMULI USED FOR RECALL

THE CAMPUS STORY STRATEGIES: STUDENT/PARENT

Two frat brothers left their home on the way to campus. They walked past the football stadium, the basketball stadium, and into the Student Union Building. James was hungry so they stopped at one of the many food services on campus. The morning ritual was to sit at a big booth, eat burgers, and count the ladies walking past. The male/female ratio at the University made this a very difficult task.

When they finished, James wanted to play pool at the rec center, but Joe was still feeling sick. "You don't look so good. Maybe you should go to the health center," said James. "I'm fine. It's just a cold," said Joe.

"Well, I guess we should go to class because it's the first day," James sighed. They walked past many tall buildings on their way. There were about twenty other people in their class. This was the typical student/teacher ratio.

The academic standards of the University were high. Most classes were difficult and the boys would get a good education. Additionally, top professors went out of their way to help students understand the material. Not to mention that this was a very safe campus. There were several help centers available to all students and a police station on campus.

The boys had decided to come to the college because of the downhill skiing. Their decision was also based on the financial aid checks they received each term. Most students had internships during school, which made them more eligible for better jobs.

After class the boys went to the small dorms where Joe's car was located. "For such a small campus, there's a ton of parking," Joe stated. This was the perfect location. It was close to town and had great community access. But, the boys were lazy and decided to drive anyway. The boys hardly noticed the "Welcome to Campus" sign because they had passed it so many times. As Joe pulled into the gas station one block away, he thought about how lucky he was to be close to home. They decided to go to the grocery store and pick up some snacks.

"Do you want to go to Spring Fest tomorrow?" said James. "Sure that sounds good," said Joe.

THE BUS STORY STRATEGIES: DRIVER/PEDESTRIAN

Two students stepped over the small curb and stopped at the bus stop. They would only have to wait a few moments before being picked up. This form of transportation seemed fairly reliable, but Cindy and Sarah were usually impatient during their morning wait, but the first day of spring was different.

Today the cloudless sky was huge. The hot sidewalk was warm from the sun. Flowers were starting to bloom filling every patch of grass with tiny daisies. Even the distant mountains looked different without snow on them. Three kids were playing on the grassy hill behind the bus stop. The little ones were all taking turns jumping off a bike rack. There was a loose dog running next to them. It didn't stray far from them.

The road conditions around this time of year were perfect. All the pot-holes had been patched up. The lane lines were freshly painted. The roads were clean ever since the new neighbors moved in down the street. They cleaned the road every day, which were now garbage free.

There was a lull in the usually busy traffic at this time because everyone had already gone to work. This was the best time to travel because all the crazy drivers got up in the late afternoon. Very few cars were driving or parked. There were a few pedestrians walking along the road, but not many.

Sarah and Cindy really enjoyed riding the bus because of the bus driver. She played the radio loudly. The bus started its usual route. There were many different restaurants where the bus stopped. Many people got off the bus at these stops. Sarah and Cindy looked out the window and saw deer on the side of the road. The speed limit was 35, but the bus typically went about 30. The bus went through several stop signs. A police car followed them for a few miles before turning at the station.

There were several apartment buildings along the route. They were usually one story, but sometimes two stories. There were many women walking to work in elaborate outfits. The last step before school was going over several bumps. The bus stopped at the final destination and everyone exited single file.

THE ART STORY STRATEGIES: ART BUYER/JANITOR

The school took a trip to the art gallery. Billy and Steve walked quietly across the spotless floor towards the art pieces. One of the first things they noticed was not art. There were giant clocks in every room of the building. The second thing they noticed was the high standards of cleanliness. There was no dust or any grime anywhere in the building. The class had been warned about leaving finger prints and tossing garbage on the ground. Everyone was extra careful not to make a mess.

There were many eye-catching displays and the boys didn't know where to begin. The aesthetic presentation of the art was flawless. There were no broken items anywhere. Nothing was out of place. There were no flaws or marks on the paintings. There would be no way to tell if these works were prints or productions. Everything in the gallery was high quality.

There were many potential art buyers weaving between the groups of children. They seemed more concerned with the price tags than the art. The boys had fun mimicking the conversations of others.

"Look at all the bright colors on this one! It's the best one here" said Billy. Steve disagreed and called Billy over to another more extravagant painting. "No way, this one has cooler shapes! It's the best" said Steve. Before they could fight about the best painting, they saw it.

The size of the painting alone was massive. All the rough textures were jumping off of the canvas. At any moment, the boys might be engulfed by the giant tsunami waves. "What year was this made," asked Steve. Billy wasn't sure, but the fishing scene looked ancient.

The next room contained long tables with sculptures on them. They were extremely fragile. This room was divided by artist name.

The class made one final stop to the gallery bathroom. To get there they ducked behind a giant red curtain. Inside there were several mirrors. This gave it a funhouse feel. This made it difficult to get the children to leave. But, the teacher pointed out that the gallery closed at noon for lunch time. None of the students wanted to be locked in a gallery forever, so they agreed to leave.

THE CAR STORY STRATEGIES: TEEN/PARENT

Jack put on his plaid jacket and looked at his reflection in his tea cup. "Lookin' sharp!" he exclaimed as he straightened his blonde toupee. There were two reasons this was a great day to sell a car. First, many people were only interested in the company brand name. Secondly, a new make of car had just arrived on the lot. The Dodge Lion was going to sell like wildfire.

It was his first day as a car salesperson and he had high hopes for his new career. Jack opened the grey door and stepped into the showroom. He really didn't know where to begin. He must have paced the entire lot three times before settling on the newest addition.

If he could sell this, he could sell anything. Jack hardly noticed the flickering light above him as he went through the rehearsed speech he had learned earlier. "This sporty red car has all the standard safety features," said Jack. He hopped into the small car, sat down on the comfortable leather seats and buckled his seat belt. "It has a five star crash-test rating and snow tires with shiny new rims," Jack exclaimed.

Jack wanted to make sure that the claims made by the manufacturer were correct. Specifically, he was interested in the new sound system. It was supposed to be very powerful. He turned it on and almost deafened himself.

Jack couldn't remember how to open the tinted sunroof. He found the correct button and returned to his rehearsed speech. "Not only is the Lion extremely fast, but it's also very reliable. That's right; this beauty handles like a dream. And, it is very dependable," said Jack.

Jack knew he was selling on commission, but didn't find this car to be very practical. The Dodge Lion had a long history of stranding people in the snow. Jack thought that this was fairly common with two-wheel drive vehicles. It was surprising that this happened because it had a lot of horsepower. The extra power decreased the gas mileage dramatically.

Returning to his sales pitch, Jack decided to state the price. For a sports car, this was amazingly affordable. Jack circled around the car one more time before looking for a customer.

THE HOUSE STORY STRATEGIES: HOMEBUYER/ROBBER

The two boys ran until they came to the driveway. "See, I told you today was good for skipping school," said Mark. "Mom is never home on Thursday," he added. Tall hedges hid the house from the road so the pair strolled across the finely landscaped yard. "I never knew your place was so big," said Pete. "Yeah, but it's nicer now than it used to be since Dad had the new stone siding put on and added the fireplace."

There were front and back doors and a side door which led to the garage which was empty except for three parked 10-speed bikes. They went in the side door, Mark explaining that it was always open in case his younger sisters got home earlier than their mother.

Pete wanted to see the house so Mark started with the living room. It, like the rest of the downstairs, was newly painted. Mark turned on the stereo, the noise of which worried Pete. "Don't worry, the nearest house is a quarter of a mile away," Mark shouted. Pete felt more comfortable observing that no houses could be seen in any direction beyond the huge yard.

The dining room, with all the china, silver, and cut glass, was no place to play so the boys moved into the kitchen where they made sandwiches. Mark said they wouldn't go to the basement because it had been damp and musty ever since the new plumbing had been installed.

"This is where my Dad keeps his famous paintings and his coin collection," Mark said as they peered into the den. Mark bragged that he could get spending money whenever he needed it since he'd discovered that his Dad kept a lot in the desk drawer.

There were three upstairs bedrooms. Mark showed Pete his mother's closet which was filled with furs and the locked box which held her jewels. His sisters' room was uninteresting except for the color TV which Mark carried to his room. Mark bragged that the bathroom in the hall was his since one had been added to his sister's room for their use. The big highlight in his room, though, was a leak in the ceiling where the old roof had finally rotted.

THE RESTAURANT STORY STRATEGIES: HEALTH INSPECTOR/CHEF

Bruce and Sally got off the subway close to the restaurant. They followed the red carpet inside the rustic building. This restaurant was in a great location. As they walked inside, Bruce noticed two important documents, a liquor license and FDA approval. The approval listed all of the health codes had been met.

They walked up to the wooden table and asked to be seated. There was at least a 30 minute wait. They sat patiently on the plush chairs in the waiting area.

The building was amazingly clean. There was not a spec of dust in the entire place. Sally decided to go to the ladies restroom to wash her hands. She passed the kitchen where the kitchen staff was busy putting fresh ingredients and exotic spices into their original dishes.

Some of the most skilled workers in the city were at this restaurant. They were renowned for their food preparation techniques as well as aesthetic presentation. All of them wore neatly pressed white outfits with black buttons and hair nets. Personal hygiene was clearly valued.

Upon reaching her destination, Sally found the décor inside created a pleasant atmosphere that matched the rest of the building. There was a curtain in the back of the room. Sally lifted it up to see what was secret was hidden behind it. It was a closet filled with cleaning supplies. Disappointed, Sally decided to return to Bruce.

On her way back to Bruce, Sally almost ran into a large refrigerator. Then she noticed that the cuts of meat had thermometers in them. They really didn't forget any details here. Sally was pleased that the staff paid so much attention to sanitation. Sally would have been surprised by anything that remotely looked like bacterial growth even in the darkest corners of the building.

They were finally seated and began to look through the menu. Sally thought about how tremendously expensive this restaurant was. Then she decided to focus on a more important factor. The type of food she wanted to eat. Bruce stated, "I love this place because I can order items that are rarely available in other parts of the city and the food quality is unbeatable!" They enjoyed the meal and returned home.

APPENDIX B

LIST OF WORD STIMULI USED IN RECOGNITION TEST

Table 5. List of Word Stimuli used for Campus/Car Recognition Test.

<i>Very reliable</i>	<i>Cd player</i>	<i>Small dorms</i>
<i>Snow tires</i>	<i>Fully loaded</i>	<i>Food services</i>
<i>Safety features</i>	<i>Automatic locks/windows</i>	<i>Better jobs</i>
<i>Seat belt</i>	<i>Automatic transmission</i>	<i>Ton of parking</i>
<i>Very dependable</i>	<i>Mint condition</i>	<i>Tall buildings</i>
<i>Crash test rating</i>		<i>Welcome to campus</i>
<i>Two wheel drive</i>	<i>Vehicle damage</i>	<i>Grocery store</i>
<i>Handles like a dream</i>	<i>Air bags</i>	<i>Eat burgers</i>
<i>Long history</i>	<i>Four doors</i>	<i>Big booth</i>
<i>Very practical</i>	<i>Engine size</i>	<i>Joe's car</i>
	<i>Year made</i>	
<i>Sporty red</i>		<i>Interesting architecture</i>
<i>Extremely fast</i>	<i>Financial aid</i>	<i>Nice housing</i>
<i>Looks</i>	<i>Close to home</i>	<i>Easy accessibility</i>
<i>New rims</i>	<i>Safe campus</i>	<i>Urban campus</i>
<i>Sound system</i>	<i>Top professors</i>	<i>Resident assistants</i>
<i>Horse power</i>	<i>Academic standards</i>	
<i>Leather seats</i>	<i>Help centers</i>	<i>Flag pole</i>
<i>New make</i>	<i>Community access</i>	<i>Bars</i>
<i>Extra power</i>	<i>Police station</i>	<i>Coffee shops</i>
<i>Tinted sunroof</i>	<i>Health center</i>	<i>Hang-outs</i>
	<i>Teacher/student ratio</i>	<i>College sports</i>
<i>Gas mileage</i>		
<i>Small car</i>	<i>Downhill skiing</i>	<i>College bookstore</i>
<i>Amazingly affordable</i>	<i>Close to town</i>	<i>Quiet library</i>
<i>Comfortable</i>	<i>Male/female ratio</i>	<i>Gym equipment</i>
<i>Dodge lion</i>	<i>Student union building</i>	<i>Cost of living</i>
<i>Blonde toupee</i>	<i>Basketball stadium</i>	<i>High-speed internet</i>
<i>Grey door</i>	<i>Rec center</i>	
<i>Tea cup</i>	<i>Spring fest</i>	
<i>Flickering light</i>	<i>Gas station</i>	
<i>Plaid jacket</i>	<i>Football stadium</i>	
	<i>Frat brothers</i>	
<i>Good brakes</i>		
<i>Premium insurance</i>		
<i>Nice appearance</i>		
<i>Low speed</i>		
<i>First aid kit</i>		

Table 5. List of Word Stimuli used for Campus/Car Recognition Test (continued).

<i>Landscaped yard</i>	<i>dark shadows</i>	<i>few cars</i>
<i>Stone siding</i>	<i>baseball bat</i>	<i>few pedestrians</i>
<i>Added the fireplace</i>	<i>video games</i>	<i>stop signs</i>
<i>Newly painted</i>	<i>digital camera</i>	<i>final destination</i>
<i>The basement</i>	<i>alarm system</i>	<i>several bumps</i>
<i>Damp and musty</i>		<i>bus driver</i>
<i>New plumbing</i>	<i>dirty clothes</i>	<i>grassy hill</i>
<i>Upstairs bedrooms</i>	<i>hand towels</i>	<i>bike rack</i>
<i>Leak in the ceiling</i>	<i>lava lamp</i>	<i>late afternoon</i>
<i>Roof rotted</i>	<i>large couch</i>	<i>new neighbors</i>
	<i>window blinds</i>	
<i>10-speed bikes</i>		
<i>door always open</i>	<i>distant mountains</i>	<i>Elaborate sculptures</i>
<i>the stereo</i>	<i>hot sidewalk</i>	<i>drinking fountain</i>
<i>no houses</i>	<i>cloudless sky</i>	<i>guard rail</i>
<i>cut glass</i>	<i>crazy drivers</i>	<i>sidewalk cracks</i>
<i>famous paintings</i>	<i>apartment buildings</i>	<i>strong wind</i>
<i>coin collection</i>	<i>tiny daisies</i>	
<i>filled with furs</i>	<i>loose dog</i>	<i>stop lights</i>
<i>locked box</i>	<i>small curb</i>	<i>gas gauge</i>
<i>color TV</i>	<i>many women</i>	<i>riding bicycles</i>
	<i>garbage free</i>	<i>weather conditions</i>
<i>two boys</i>		<i>speedometer</i>
<i>skipping school</i>	<i>lane lines</i>	
<i>younger sisters</i>	<i>police car</i>	<i>cute animals</i>
<i>made sandwiches</i>	<i>radio loudly</i>	<i>big crosswalk</i>
<i>the noise</i>	<i>road conditions</i>	<i>icy roads</i>
<i>mother's closet</i>	<i>speed limit</i>	<i>street lights</i>
<i>the driveway</i>	<i>busy traffic</i>	<i>tall trees</i>
<i>desk drawer</i>	<i>different restaurants</i>	
<i>the house</i>	<i>kids were playing</i>	
<i>quarter of a mile</i>	<i>saw deer</i>	
	<i>pot-holes</i>	
<i>swing set</i>		
<i>sky light</i>		
<i>solar panels</i>		
<i>gas heat</i>		
<i>wood pile</i>		

Table 5. List of Word Stimuli used for Campus/Car Recognition Test (continued).

<i>Food quality</i>	<i>Pots and pans</i>	<i>Art pieces</i>
<i>Aesthetic presentation</i>	<i>Cook books</i>	<i>Art buyers</i>
<i>Fresh ingredients</i>	<i>Cooking time</i>	<i>Standards of cleanliness</i>
<i>Amazingly clean</i>	<i>Fresh vegetables</i>	<i>Aesthetic presentation</i>
<i>Great location</i>	<i>Cutting board</i>	<i>Price tags</i>
<i>Hair nets</i>		<i>Long tables</i>
<i>Health codes</i>	<i>Table tops</i>	<i>Red curtain</i>
<i>Attention to sanitation</i>	<i>Fancy dishes</i>	<i>Several mirrors</i>
<i>Tremendously expensive</i>	<i>Fancy menu</i>	<i>Tsunami waves</i>
<i>Bacterial growth</i>	<i>Fancy utensils</i>	<i>Fishing scene</i>
	<i>Tile floors</i>	
<i>Kitchen staff</i>		<i>Smudged glass</i>
<i>Cleaning supplies</i>	<i>Gallery bathroom</i>	<i>Push brooms</i>
<i>Large refrigerator</i>	<i>No dust</i>	<i>White walls</i>
<i>Liquor license</i>	<i>Spotless floor</i>	<i>Garbage cans</i>
<i>Original dishes</i>	<i>Toss garbage</i>	<i>Track lighting</i>
<i>Personal hygiene</i>	<i>Any grime</i>	
<i>Pleasant atmosphere</i>	<i>Extremely fragile</i>	<i>Big appeal</i>
<i>Plush chairs</i>	<i>Finger prints</i>	<i>Heavy frames</i>
<i>Cuts of meat</i>	<i>Lunch time</i>	<i>Deep meaning</i>
<i>Rarely available</i>	<i>Giant clocks</i>	<i>Certain style</i>
	<i>Broken items</i>	<i>Type of art</i>
<i>Red carpet</i>		
<i>Skilled workers</i>	<i>Artist name</i>	<i>Fancy benches</i>
<i>Spec of dust</i>	<i>Bright colors</i>	<i>Big window</i>
<i>Ladies restroom</i>	<i>Prints or productions</i>	<i>Guest book</i>
<i>Exotic spices</i>	<i>High quality</i>	<i>Pill-box hat</i>
<i>Food preparation</i>	<i>Size</i>	<i>Upcoming exhibits</i>
<i>The subway</i>	<i>Rough textures</i>	
<i>Type of food</i>	<i>Year</i>	
<i>White outfits</i>	<i>Cooler shapes</i>	
<i>Wooden table</i>	<i>Eye-catching displays</i>	
	<i>Flaws or marks</i>	
<i>Improper presentation</i>		
<i>Good service</i>		
<i>Food storage</i>		
<i>Heavy duty appliances</i>		
<i>Bus boys</i>		
