1980

The influence of encoding context on the false recognition errors of third graders and adults.

Mary P. O'connor
University of Massachusetts Amherst

THE INFLUENCE OF ENCODING CONTEXT ON THE FALSE RECOGNITION ERRORS OF THIRD GRADERS AND ADULTS

A Thesis Presented

by

Mary P. O'Connor

Submitted to the Graduate School of the
University of Massachusetts in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE

February 1980

Department of Psychology

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Mary P. O'Connor

Approved as to style and content by:

Marvin W. Daehler, Chairperson of Committee

Nancy A. Myers, Member

Charles E. Clifton, Member

Bonnie R. Strickland, Department Head
Department of Psychology

ACKNOWLEDGEMENTS

The author gratefully acknowledges the assistance of the people who contributed to the completion of this thesis. I would especially like to thank my advisor, Marvin W. Daehler, for his advice and assistance during the completion of the research and the writing of this thesis. I would also like to thank Nancy A. Myers and Charles E. Clifton for serving on my thesis committee. I am also appreciative of the support provided by my husband, Paul Harper.

ABSTRACT

The present study investigated the influence of encoding context on the types of recognition errors that adults and nine-year-olds commit. Encoding context was varied through the use of different orienting questions. In general, it was found that both nine-year-olds and adults were influenced by encoding context. Nine-year-olds, however, committed more contextually related false recognition errors only when they both answered orienting questions and generated related words, while adults were influenced by context only after answering orienting questions. When adults were asked to generate words in addition to answering questions, the encoding context effect disappeared. Two hypotheses were proposed to explain these results. The first suggested that children failed to process stimuli as elaborately as adults, and were thus less likely to incorrectly recognize more contextually related foils, unless they were explicitly required to generate related words (often foils). The second hypothesis suggested that the retrieval strategies of adults and children differed. Children probably picked words on the test based on familiarity, and unless they generated foils, the context effect would not be expected to appear. Adults, however, may have employed more sophisticated test-taking strategies. After

simply answering orienting questions, they may have selected some foils based on the context of remembered orienting questions. However, after generating related words, some subjects may have avoided choosing those words (usually foils) on the recognition memory test, resulting in the disappearance of the context effect.

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CHAPTER I

INTRODUCTION

The present study attempts to determine whether the context in which a word is learned influences the types of memory errors subjects commit. The principle of encoding specificity (Tulving & Thomson, 1973) suggests that the encoding context of a word influences the types of retrieval cues that are effective. For instance, when the word _Tiger_ is encoded in the context of the word _Stripes_, then _Stripes_ or _Zebra_ will be more effective memory cues than other highly related words like _Cat_ or _Lion_. This specificity of cues probably occurs because subjects represent the word _Tiger_ in a highly defined way when provided with an encoding context. Memory cues like _Cat_ do not allow the subject to readily access this representation. If encoding context influences which retrieval cues are effective, encoding context should also influence which recognition memory errors are made. For instance, if the word _Tiger_ is encoded as an animal with stripes, then one might expect that subjects should incorrectly recognize the word _Zebra_ more often than a word such as _Lion_ (which is related but not in this context). The present study investigated whether recognition errors are, in fact, related to specific contexts of words that are encoded.

Adult and nine-year-old subjects were tested in the present study to determine whether age affects the influence of encoding context on memory errors. Encoding context has been found to influence adults and adolescents such that they committed more contextually related errors (Coltheart, 1977, Davies & Cubbage, 1976); however, it is uncertain whether encoding context has a similar influence on children's false recognition errors (Lindauer & Paris, 1976, O'Connor & Daehler, 1978). Indeed, children as young as seven can contextually encode stimuli (Ceci & Howe, 1978); however, they do not always encode as elaborately as adults (Paris & Lindauer, 1976), and thus may not be influenced by encoding context in the same manner as adults. Therefore, children could fail to commit more contextual memory errors than other types of memory errors. Also, contextual errors could be minimal because children lack the memory structures to contextually encode stimuli or because they lack motivation and/or strategy to elaborately encode stimuli.

In the following pages of introduction, research on what is known about the adult's semantic memory organization, including one model of adult semantic memory and some existing research supporting this model, is first summarized. Additionally, research on encoding specificity and semantic flexibility is examined to determine whether encoding context influences the cued recall of adults. The next section summarizes research examining semantic memory in children.

Two existing semantic memory models are reviewed, and conclusions concerning the state of the nine-year-old's semantic memory are drawn. Additionally, developmental research on encoding specificity is examined to determine whether children are influenced by encoding context in a way similar to adults. Finally, incidental learning-false recognition research is reviewed to determine what is currently known about the influence of encoding context on memory errors of children and adults. Flaws in previous false recognition research are noted, and the argument is made that encoding context should influence the types of recognition errors that adults and nine-year-olds commit. The present study is described briefly and predictions of the study are discussed.

The Semantic and Episodic Memories of the Adult

Semantic memory organization. Semantic memory was originally defined and distinguished from episodic memory by Tulving (1972). Episodic memory contains "temporally dated" information, whereas, semantic memory stores linguistic information concerning words and concepts, as well as information about the interrelationships between those words and concepts. One of the earliest attempts to outline a model of semantic memory (Collins & Quillian, 1969, 1972) describes concepts and their properties in terms of a hierarchical organization. The meaning of a given concept is the entire set of relations leading to and away from that concept. The hierarchical network represents concepts that are subsets of a given concept, as well as concepts that are superordinates of that concept, and the defining attributes or characteristics of a concept are provided in the network as well. This model has been critisized, modified, and elaborated by many researchers (see for example, Conrad, 1972, Glass & Holyoak, 1975, Kintsch, 1974, Meyer, 1970, Rosch, 1973, Schaeffer & Wallace, 1969, Smith, Shoben & Rips, 1974), however, since choice of "best" semantic model (see Smith, 1979 for a review) is not of primary concern here, only the model outlined by Glass and Holyoak (1975) will be detailed to provide a more homogenous framework and vocabulary for further discussion.

In the "Marker search model" recently advanced by Glass and Holyoak (1975), each word concept is represented by one single defining marker (or node). Markers are interrelated such that one marker implies a network of other markers. For instance, the concept Cat is represented by a "cat marker", which implies "feline", which implies "mammal", which implies "animal", etc. The "cat marker" could also imply such markers as "house pet", "carnivore", and "hunter". Additionally, subsets of the concept can be represented (e.g., Angora) in the network. Of course, superordinate and subset relationships are not all that can be represented in the marker network; for instance, properties of a concept can also be represented (e.g., has whiskers, hunts, etc.), as can relationships between a concept and other concepts (e.g., the relationship between cat and dog). In addition to the implicational network (similar to the hierarchical network of Collins & Quillian, 1969), connections between a concept node and nonadjacent markers can be shortcut by direct pathways, especially when the two concepts have a high frequency of co-occurrence in word usage. For instance, if the concepts Cat and Animal are more closely associated than Cat and Feline, a direct pathway could connect Cat with Animal, so that the Cat to Feline to Mammal to Animal network would not have to be traversed to ascertain that "A cat is an animal", and the time spent processing such a statement would thus be decreased. Information concerning contradictory relationships between concepts can also be represented on the marker network.

In a typical sentence verification experiment used to test the "Marker search model", subjects read (or hear) statements like "All cats are animals" and respond "true" or "false" as quickly as possible. The "Marker search model" assumes that when a subject must determine the truth of a statement, he or she accesses the markers for the subject and predicate terms as well as the immediate implicational network for those markers. Search terminates, in the case of a true statement, when an acceptable pathway is found that connects the two markers. The shorter the pathway from the subject marker to the predicate marker, the faster the statement will be confirmed. Statement disconfirmation is more complex, however, and is based on how quickly a contradiction can be found in the network between the subject and predicate markers.

Much sentence verification research has been conducted using adult subjects to test the model of Holyoak and Glass (1975) (e.g., Glass & Holyoak, 1975, 1975, Glass, Holyoak, & O'Dell, 1974, Holyoak & Glass, 1975), as well as the semantic models of others (e.g., Collins & Quillian, 1969, Meyer, 1970, Smith, Shoben, & Rips, 1974). This research has demonstrated that the adult's semantic memory is organized; highly related concepts tend to be stored closer together in the network, good representatives of a concept are more accessible than poorer representatives, and the defining characteristics of a concept are more available in memory than the less important features. Other tasks, including word production, priming, and same-different category tasks, have also been used to test semantic models (e.g., Lachman, Schaffer, & Hennrikus, 1974, Meyer, 1973, Rosch, 1975) and have further supported the hypothesis that semantic memory is not haphazardly organized.

In same-different category tasks, for example, subjects are asked to decide whether or not two words are from the same superordinate category. In general, the more related two concepts are, the quicker subjects make a "same category" decision. When two concepts are highly unrelated, subjects make a "different category" decision more quickly than when the concepts are related but from different categories. Furthermore, priming research has demonstrated that memory search is enhanced by cuing subjects to the general memory location at which search for subsequent information will be successful. Thus, for instance, when a subject is primed with a superordinate category and asked to determine whether two words belong to the same category, they will decide quicker when the prime cues the subject about where to begin memory search.

Episodic and semantic memory in encoding specificity and semantic flexibility tasks. The semantic knowledge an adult has about a concept should influence how well he or she is able to remember that concept. Also, the encoding context of the concept should determine how it is interpretted, and thus influence the types of retrieval cues that serve as good clues for recall. Tulving and Thomson (1973) demonstrated that when a word is paired with a weak associate during encoding, that word is likely to be recalled better when cued with the weak associate than when cued with a strong associate. In fact, they found that cued recall with the weak associate was superior to the recognition of the word on a recognition memory test. For instance, when the word Cold was learned with the input cue Ground, it was recalled better when cued with Ground than when cued with a strong associate such as Hot. Also, percent recall to the word Ground exceeded the percent correct recognition of the word Cold. Tulving and Thomson (1973) explained this phenomenon, which they labeled encoding specificity, in the following way:

> . . . we assume that what is stored about the occurrence of a word in an experimental list is information about the specific encoding of that word in that context in that situation. This information may or may not include the relation that the target word has with some other word in the semantic system. If it does, that other word may be an effective retrieval cue. If it does not, the other word cannot provide access to the stored information because its relation to the target word is not stored.
>
> Thus, the effectiveness of retrieval cues depends on the properties of the trace of the word event in the episodic system. It is independent of the sematic properties of the word except insofar as these properties were encoded as part of the trace event (p. 359).

Barclay, Bransford, Franks, McCarrell, and Nitsch (1974) borrowed the procedure of Tulving and his associates (e.g., Thomson & Tulving, 1970, Tulving & Thomson, 1973) to determine whether or not setential context influences the interpretation of and the memory for unambiguous words. Specifically, Barclay et al. (1974) presented subjects with one of two sentences, specifying different contexts for a predicate noun which was to be recalled later. For instance, some subjects heard sentences like "The secretary put the paper clips in the envelope", whereas, others heard "The secretary licked the envelope". After the subjects heard ten such sentences (out of a possible 20), they were tested for recall with ten cues of two different types. One type of cue was contextually related to each of the ten sentences while the other was contextually unrelated to those sentences . Barclay et al. (1974) predicted that if a subject heard the sentence referring to paper clips, he or she should recall Envelope better with the cue, "something that holds small objects", whereas, if the subject received the sentence referring to licking envelopes, he or she should recall the word Envelope better with the cue, "something with glue". The results of their research confirmed these predictions, and thus Barclay et al. (1974) proposed that ". . . the contextually determined relevance of each of a word's semantic properties is somehow indicated in the encoded representation of that word" (p. 479), and thus encoding context influences which retrieval cues are effective. A recent study by Anderson and Ortony (1975) yielded results and conclusions similar to those of Barclay et al. (1974). Barclay et al. (1974) point out that the phenomenon of memory which they characterized as semantic flexibility could pose a problem for current semantic network theories, unless the almost infinite shades of meaning of a common, unambiguous noun could be somehow represented. Obviously, it would not be efficient to store all possible shades of meaning of a word like Envelope at the "envelope marker".

Both Tulving and Thomson (1973) and Barclay et al. (1974) demonstrated that encoding context influences the effectiveness of retrieval cues; however, each emphasized different aspects of their results. Tulving and Thomson (1973) argued that episodic memory does often operate independently of semantic memory. Barclay et al. (1974), however, being more interested in demonstrating the many faceted nature of simple nouns, concluded that context does profoundly influence the way one represents the memory trace for a word in semantic memory. Thus, they argued that current semantic memory models fail to account for the many interpretations of common words that are possible. The conclusions of Tulving and Thomson (1973) and Barclay et al. (1974) are not conflicting since each was interested in examinimg different memory phenomena. Tulving and Thomson (1973) were interested in retrieval from episodic memory following contextual encoding. Barclay et al. (1974) were more interested in the semantic encoding processes which allow the many different shades of meaning of a word to be represented in semantic memory prior to storage in episodic memory.

Semantic and Episodic Memory Development

Semantic memory organization. Since Tulving (1972) distinguished semantic memory from episodic memory, adult semantic and episodic systems have been studied extensively. However, little is known about how the episodic and semantic memories of a child develop into the mature system of an adult. Chi (1978) believes thet three factors influence memory development: strategy, knowledge, and capacity. To demonstrate the relationship between knowledge and memory, Chi (1978) compared memories of children with knowledge of chess to adults who had no knowledge of the game. The children remembered legal chess board set ups more accurately than adults. Chi (1978) proposed that because adults usually have a more developed knowledge structure than children, memory improves with age primarily because adults know more and have a better organization for that knowledge than children. However, when a child knows more about something than an adult, the child should have a better memory for those things than the adult. Thus, when the child's chess knowledge is more advanced than the adult's, the child is able to perform better on a chess memory task, though the adult excells on other memory tasks (e.g., digit span).

Chi (1978) has essentially equated the growth of knowledge with semantic memory growth. Additionally, Chi suggests that there is growth not only in what is known, but also in how effectively it is organized, although she has devoted much less attention to this aspect of memory development. Nelson (1979) has proposed four developmental stages in the organization of semantic memory. In the first stage, a concept is defined by the functional and perceptual features of the object, and situational information about the object is also available in the child's semantic memory. Thus, for instance, the concept Car is first thought of as something that is big, something that moves, and something that daddy drives. Links are made between concepts based on functional and perceptual similarities. During the second stage, a link is forged between the concept and the label for the concept, providing a connection between the label and the functional and perceptual features of the concept. The functional features of a concept maintain importance during stage three, and the links between concepts continue to be situational; however, in stage four, the child finally begins to organize concepts along noncontextual dimensions, thus excluding episodic information from the definition of the concept. The first three stages describe early concept development, and suggest that the semantic memory organization of the child differs from that of the adult. Unfortunately, this model does not describe in depth the transition from stage three to stage four during which the semantic memory of the child becomes more adult-like. Since this transition period is probably one of the most prolonged growth periods for a child, it is surprising that Nelson (1979) does not concentrate more on it. The transition characterizes the period while the child is reorganizing memory along mature dimensions, yet little is known about why and how this change occurs.

Brown (1975) has applied the semantic-episodic distinction to four different types of memory tasks that have been given to children in experimental situations, and attempted to predict how children at various stages of development should perform on each. The tasks were categorized as nonstrategic-episodic, strategic-episodic, nonstrategic-semantic, and strategic-semantic tasks. A nonstrategic-episodic task does not require a memory strategy for effective performance, and also does not require extensive semantic analysis. Brown (1975) predicted that subjects should perform equally well on this type of task regardless of age. On the other hand, a strategic-episodic memory task does require a memory strategy for the subjects to perform well, though it still does not require semantic analysis for effective performance. As a result, older subjects who utilize strategies well will usually perform better on this type of memory task than younger subjects. Performance on strategic-semantic tasks depends on the level of semantic memory development and on the ability to utilize deliberate strategies to improve memory. Thus, older children should perform better than younger children. However, Brown (1975) believes that developmental differences on a nonstrategic-semantic task should reflect "changes in semantic memory, relatively uncontaminated by strategic intervention. The developmental trends should reflect the close correspondence between the operational level of the child and his involuntary memory for meaningful events" (p. 143). Brown (1975) stressed that the most important type of task to use when examining semantic memory development is the nonstrategic-semantic task. She notes that research centering on the nonstrategic-semantic task should ". . . prove fruitful in revealing the richness rather than the poverty of memory in early childhood" (p. 144).

Both Nelson (1979) and Brown (1975) have provided a framework to further examine memory development. However, Nelson (1979) attempted to describe changes in semantic memory organization, while Brown (1975) provided a taxonomy for examining developmental change as a function of strategy and semantic memory development. Both approaches have influenced semantic development research.

Though semantic memory is sufficiently developed in preschool children to affect recognition (Perlmutter & Myers, 1976) and recall (Goldberg, Perlmutter, & Myers, 1974), there should be changes in semantic memory organization (Nelson, 1979) as children grow older. Evidence for a change in semantic memory organization with age comes from free association research. When subjects free associate to common nouns, there appears to be an age-related shift in the types of responses made. Younger subjects usually provide more words from a different grammatical class than the stimulus (syntagmatic), while older children provide more words from the same grammatical class as the stimulus (paradigmatic). This shift was originally called the syntagmatic-paradigmatic shift; however, it might better be considered an episodic-semantic shift (Petrey, 1972). Petrey (1972) provides a strong case for this by demonstrating that the responses of the younger children are situational (episodic) and the responses of the older children are more context-free (semantic), thus supporting the model proposed by Nelson (1979).

Other semantic development researchers have utilized the paradigms that were used to examine semantic memory organization in the adult, such as sentence verification, priming, and same-different category paradigms. Many of these experiments have demonstrated that the semantic memory organization of the child is similar to the adult's organization (e.g., Loftus & Grober, 1973, McFarland & Kellas, 1975, Nelson & Kosslyn, 1975), whereas, others have argued that there are age related differences in organization (e.g., Duncan & Kellas, 1978, McCauley, Weil, & Sperber, 1976, Prawat & Cancelli, 1977).

Nelson & Kosslyn (1975) conducted a sentence verification experiment using children aged eight, 11, and 13, as well as college adults. They presented subjects with sentences that had animals for subjects and animal properties for predicates. They varied the association strength between the subject and predicate terms, referring to this as saliency. They also varied the specificity of the animal property, that is how specific a property is for a given animal (e.g., for a cat, having fur is more specific than breathing). In general, they found that the true sentences with highly salient properties were verified quicker than those with less salient properties. Also, they found that subjects confirmed a sentence quicker if the property was lower in specificity (contrary to the results of Collins & Quillian, 1969). Age had no influence on the patterns of results, though the older subjects were quicker at verifying sentences than the younger subjects. As a result of these findings, Nelson and Kosslyn (1975) concluded that ". . . little developmental change occurs between 8 years of age and adulthood in the processes of storing and retrieving semantic information used in sentences" (p. 812).

Prawat and Cancelli (1977) also utilized sentence verification to examine the developmental changes in the semantic memory organization of five- and eight-year-olds. Like Nelson and Kosslyn (1975), they manipulated saliency; however, they also examined the effect of property type on verification speed. The types of properties were static (e.g., has skin), dynamic (e.g., can walk), and relational (e.g., can obey). In general, they found that the high saliency properties improved verification speed only if the property was also dynamic. Also, eight-year-olds were always quicker than five-year-olds in verifying sentences, except when highly salient dynamic properties were retrieved. Prawat and Cancelli (1977) concluded that "younger children apparently are as adept as older children at storing and retrieving a particular type of functional meaning- that represented by highly salient dynamic properties" (p. 357). They believed that their experimental findings supported Nelson's (1974) (as well as Nelson, 1979) theory which stressed the importance of functional properties in basic concepts of the young child. Thus, unlike Nelson and Kosslyn (1975), Prawat and Cancelli (1977) argued that semantic memory organization does change with age; that is younger children utilize functional properties initially, and eventually are able to use all defining properties equally well in their semantic representations.

McFarland and Kellas (1975) used a semantic decision task to investigate the semantic memories of nine-, 11-, and 13-year-olds (ages similar to those investigated by Nelson & Kosslyn, 1975). In this type of task, the subjects saw a pair of superordinate categories, and were then asked to determine whether a category exemplar that followed was an instance of either category. Though the younger subjects were slower at responding than the older subjects, all subjects made their decisions faster when the categories in the pair were very similar. McFarland and Kellas (1975) concluded that there was little evidence to indicate major semantic reorganization in the age ranges examined.

Another common semantic memory paradigm is called priming. Adults benefit from priming (e.g., Rosch, 1975), but is this also true of young children? Loftus and Grober (1973) presented six-year-olds with two words, a category noun (e.g., animal) and a restricting adjective (e.g., enormous). Given the two words, the subject was to respond with an instance of the restricted category (e.g., elephant). Half of the subjects heard the category first (primed), and the other half heard the adjective first (not primed). They found that children who received the category first responded .35 seconds faster than those who received the category last. From this result, Loftus and Grober (1973) concluded that children, like adults (Freedman & Loftus, 1971), have a semantic memory that ". . . is organized primarily into noun categories, and that the process of retrieving information from this store consists of entering the appropriate category as a first step" (p. 310).

On the other hand,McCauley, Weil, and Sperber (1976) found evidence that category primes were more effectively used by eight-year-olds than six-year-olds. Subjects were asked to name pictures as quickly as possible. Pairs of pictures were related to one another in one of four ways: high association strength-high category relatedness, low association strength-high category relatedness, high association strength-low category relatedness, and low association strength-low category relatedness. They wished to determine whether the relationship between the first and second pictures affected speed of naming. In general, they found that the children of both ages named the second picture faster when they were primed with a picture that was highly related by association strength. However, when the first and second words were categorically related, only eight-year-olds had a faster naming response. The six-year-olds showed an interference pattern; when the second word was categorically related to the first, they named it more slowly. McCauley, Weil, and Sperber (1976) concluded that eight-year-olds have semantic structures which can represent both categorical and associative relationships between concepts, whereas, six-year-olds have only developed associative structures. They also suggested that semantic organization is not completely restructured with age, rather new categorical relationships are added to the existing associative structures.

One other priming study by Duncan and Kellas (1978) also argued that there is an age related change in semantic memory. They used eight-, ten-, and 12-year-olds, as well as college students to determine whether or not a prime increases the speed of making a decision about whether two category exemplars are from the same category. The subjects received a superordinate category as a prime half of the time. Following the prime (or a pause in the case of no prime), the subjects were asked to decide whether pairs of pictures belonged to the same category. Half of the pairs were typical exemplars of a category, and the other half were less typical. Duncan and Kellas (1978) found that all subjects except eight-year-olds benefited from the prime when physically identical pictures were typical category exemplars, and were inhibited by the prime when the physically identical pairs were not typical exemplars. When the pairs of pictures were either from the same category or from different categories, the prime facilitated speed for all ages when the pairs were typical exemplars, and inhibited speed when the pairs were atypical exemplars. From these results, Duncan and Kellas (1978) concluded that eight-year-olds have not ". . . yet structured their semantic representation in the same manner as adults" (p. 339). This conclusion, however, may be unwarranted. Why would the prime fail to be effective for eight-year-olds only when the pairs were physically identical if the eight-year-olds differed from older children and adults in semantic memory representation? Perhaps some other explanation for this result would be more parsimonious; the younger children may have had difficulty thinking about category relatedness when stimuli were identical, and thus failed to benefit significantly from priming.

What can be concluded from these many semantic development studies? All of the researchers agree that there is a great deal of semantic memory sophistication in children of the ages studied. This is not surprising since most of the children were eight years of age and older. However, children as young as five and six were also adept in performing the semantic tasks, and often revealed adult-like patterns of semantic memory. In some cases though, the older children demonstrated that they had a more adult-like semantic memory than the younger children (usually younger than eight) (Duncan & Kellas, 1978, McCauley, Weil, & Sperber, 1976, Prawat & Cancelli, 1977).

Nelson (1979) has argued that semantic memory organization changes with age; however, the ages at which children should differ most dramatically from adults (probably ages one to three) were not examined by developmental investigators. All of the semantic development studies that have been reviewed, examined children who were probably in transition between stages three and four. During this transition period, episodic information in semantic memory should be gradually replaced by context-free information, and this replacement should occur first for well known concepts. Petrey (1972) found that between ages six and 13, free association responses become more context-free (semantic), which is consistant with the notion that subjects in this age range are in transition between Nelson's stage three and four. When experimenters used children in this age range to study semantic memory development, two opposite conclusions were drawn. Some concluded that the semantic memory organization and semantic search processes of a child are very similar to the adult's (e.g., Loftus & Grober, 1973, McFarland & Kellas, 1975, Nelson & Kosslyn, 1975). On the other hand, Duncan and Kellas (1978), McCauley, Weil, and Sperber (1976), and Prawat and Cancelli (1977) argued that semantic memory does change with age. More research must be conducted to determine why these researchers drew such different conclusions when they examined children between the ages of six and thirteen. However, despite this necessity for more research, one can not dispute the fact that by the age of eight, children have a fairly mature semantic memory which operates similarly to the adult's.

Episodic and semantic memory in encoding specificity and semantic flexibility tasks. Using an experimantal procedure similar to Tulving and Thomson's (1973), Ceci and Howe (1978) examined the effect of encoding context on the cued recall of children. In their first experiment, they verbally presented 24 pairs of words to seven-, ten-, and 13-year-olds. Each pair consisted of an input cue and a word to be remembered (target). The relationship between the input cue and the target was varied; half of the relationships were understood by the subjects (e.g., money-bank) and half of them were not understood (e.g., gloves-kid). After hearing all of the pairs, the children were presented with a page containing output cues. The children were asked to try to recall as many targets as possible given the output cues as clues. The output cues were related to the input cues only half of the time (compatible) and were unrelated the rest of the time (incompatible). The experimental design consisted of four within-subjects conditions: knowledge of the relationship between the input cue and target and a compatible relationship between the input and output cues (knowledge, compatible), knowledge of the relationship between the input cue and target and an incompatible relationship between the cues (knowledge, incompatible), no knowledge of the relationship between the input cue and target and a compatible relationship between the cues (no knowledge, compatible), and no knowledge of the relationship between the input cue and target and an incompatible relationship between the cues (no knowledge, incompatible). Ceci and Howe (1978) expected that children should recall the most words when given the knowledge, compatible condition. These children should understand the relationships between the input cues and targets, and thus encode the targets contextually. Since the output cues in this situation would be contextually related to the targets (and input cues), the cues should improve recall (e.g., input cue: money, target: bank, output cue: saving). Subjects should recall the fewest words in the knowledge,incompatible condition, since the output cues would not be related to the contextual representations of the targets (e.g., input cue: pay, target: bill, output cue: bird). Finally, the children should recall more words in the no knowledge, incompatible condition than in the knowledge, incompatible condition. In the no knowledge condition, subjects should not contextually encode the targets because they lack knowledge of the relationships between the input cues and the targets. Thus, when the output cues are not related to the input cues, the output cues should still be somewhat effective retrieval cues (since they are related to the targets). However, when subjects understand the relationships between the input cues and targets, and they contextually encode the targets, the relationships between the incompatible output cues and the contextual representations of the targets would be obscured.

All of the predictions made by Ceci and Howe (1978) were confirmed. As a result, they concluded that ". . . the finding that KNOWLEDGE, INCOMPATIBLE TBR's [targets] were the poorest recalled at all ages, suggests that subjects' knowledge of the semantic relationship between the TBR's and their cues, and their actual encoding of this knowledge during the presentation phase, contributed to children's performance" (p.273). Ceci and Howe (1978) failed to find any age differences in recall, except when the children received the knowledge, incompatible condition. The seven-year-olds were much poorer at recalling targets than the ten-year-olds, who were poorer than the 13-year-olds. The older children may have had a more flexible test taking strategy than the younger children, that is if an output cue failed to remind them of a target, they were more apt to search for semantic links to the targets other than those provided during encoding.

Using a modified procedure, Ceci and Howe (1978) conducted a second experiment to confirm the findings of the first. In Experiment II, they varied the knowledge of the relationships between the input cues and target words with the age of the subjects. There are relationships between words that 13-year-olds know, and that younger children do not. Thus, using the same words, subjects who were 13 received a knowledge-incompatible condition, while the younger subjects received a no knowledge-incompatible condition. In fact, in this situation, the younger children recalled more target words than the older children. Thus, ignorance of the semantic relationships between targets and input cues resulted in higher recall scores for the younger children. Ceci and Howe (1978) concluded that when subjects have semantic knowledge available to contextually encode words, then encoding context does influence the recall of words by children as young as seven. The semantic memory representations of children were flexible enough to be influenced by encoding context, and this contextual representation determined whether or not retrieval cues were effective. Thus, as with adults (e.g., Barclay et al., 1974, Tulving & Thomson,1973), children can encode words contextually, and store that contextual representation of the word in episodic memory.

Not all research, however, is consistent with the view that children encode semantic information as elaborately as adults even when the information is known by the child. Paris and Lindauer (1976) presented seven-, nine-, and 11-year-old subjects with a set of eight sentences, four in which an instrument used to accomplish an act was specifically stated, and four in which such an explicit reference was not made. An example of a sentence which stated the instrument explicitly was "The truckdriver stirred the coffee with a spoon". An example of a sentence stating the instrument of action implicitly was "The truck-driver stirred the coffee in his cup". Later, following the learning task, the subjects were asked to recall the sentences they heard, and were provided with instrument cues like Spoon to aid recall. Eleven-year-olds recalled sentences well regardless of whether the cues were explicitly stated during the learning task (73.4%) or not (65.6%). Nine-year-olds, however, recalled the sentences considerably better when the cues were explicit (73.4%) rather than implicit (48.4%). Seven-year-olds also recalled sentences better with explicit cues (57.8%) than with implicit cues (31.3%). These results probably did not occur because the younger children lacked knowledge of the instruments of action or the ability to generate implicit instruments, but rather because they apparently failed to generate them under the experimental conditions described above. When Paris and Lindauer (1976) had seven-year-olds act out the sentences with toys provided for this purpose, the children recalled the sentences equally well to explicit (72%) and implicit (70%) cues. Thus, it appears that unless children were given more meaningful encoding tasks, they failed to encode sentences as elaborately as they could. Probably the most important cause for this encoding failure was that the subjects lacked learning strategies. The children failed to actively elaborate the implicit intrument sentences, thus the instrument cues were minimally effective output cues. However, when seven-year-olds were placed in an experimental situation which induced elaborative processing, they performed as well as the 11-year-olds regardless of the type of output cue (implicit or explicit).

Encoding Specificity and False Recognition

Encoding context can be controlled in many ways; by using input cues, by embedding the word in a sentence, or by using orienting questions. In an incidental learning study, the subject is usually shown a list of words, each with an associated orienting question. The subjects are simply told to answer the orienting questions accurately. Some of the orienting questions, for instance questions concerning category membership, produce a strong memory trace for the words to be encoded (targets), and thus are associated with high levels of recall or recognition of the targets. However, other questions, like acoustic or orthographic questions, produce a less enduring memory trace for the target resulting in poorer recall or recognition of the target (e.g., Craik & Tulving, 1975). Thus, depending on the "level of processing" that an orienting question induces (Craik & Lockhart, 1972), some stimuli are better remembered than others.

One might also expect that the way subjects encode a word during a learning task should also affect how well the subjects can reject foils that are contextually related to the encoded word. If a foil is contextually related to the target word by an encoding task (e.g., an orienting question), that foil should be incorrectly recognized more often than a foil that is related to the target but not contextually. For example, if a subject is shown the word _Tiger_, and simultaneously asked, "Is this a striped animal?", then he or she should have an increased probability of falsely recognizing the foil Zebra. However, if the subject is shown the same word, Tiger, and asked, "Is this an animal that roars?", then he or she should incorrectly recognize Lion more frequently. To examine whether encoding context does influence the false recognition of foils, a recognition memory test containing foils and targets must be used. There are, however, serious methodological problems associated with the use of false recognition as a dependent measure. Thus, the false recognition literature must be examined before further consideration is given to the influence of encoding context on false recognition.

False recognition: problems and solutions. Many researchers have utilized false recognition to examine the structure of the adult's memory (Underwood & Freund, 1968) and the memory of children (e.g., Bach & Underwood, 1970, Cramer, 1972, 1973, 1974, 1976, Lindauer & Paris, 1976, Perlmutter & Myers, 1976, Shepard, Cohen, Gold, & Orbino, 1976). The assumption in these studies is that when a foil is incorrectly recognized, there must be a similarity between the memory representation of the target and the representation of that foil. In an example of a fairly typical false recognition study, Underwood and Freund (1968) attempted to determine whether semantically or acoustically related foils were recognized more often by college adults. The experiment consisted of three conditions, intentional learning of words , intentional learning of words paired with semantically similar words (much like the input cues of Tulving & Thomson, 1973), and intentional learning of words paired with acoustically similar words. They found that when subjects learned words paired with a related input cue, the cue had an increased probability of being incorrectly recognized. Collapsing over experimental learning condition, they found that the most frequent false recognition errors committed were semantically related foils. Other researchers have examined whether there is any developmental change in semantic and acoustic foil recognition (e.g., Bach & Underwood, 1970, Bisanz, Pellegrino, Kail, & Siegel, 1978, Cramer, 1972, Hall & Halperin, 1972), but the results have been inconclusive concerning whether there is a developmental change in the dominance of the semantic attributes over the acoustic attributes of a word in memory representations.

Other developmental shifts in types of false recognition errors have also been investigated; for instance, the synonym-antonym shift has received attention (e.g., Cramer, 1973, Heidenheimer, 1978, Lindauer & Paris, 1976). Cramer (1973) presented eight- and 12-year-olds with a list of ten words, under one of three learning conditions: intentional learning, intentional learning with instructions to think of synonyms, and intentional learning with instructions to think of antonyms of the targets. In general, she found that eight-year-olds falsely recognized more synonym foils after being instructed to think of synonyms, and 12-year-olds incorrectly recognized more antonym foils after receiving instructions to think of antonyms of the targets. From this, she concluded that there is a developmental shift in the basis of memory organization; that is, younger children organize their memories around synonym dimensions (that is putting like with like), whereas, older children shift to organize their memories around antonym dimensions (or dichotomies). Cramer (1973) attempted to create a false recognition test that would yield many false recognition errors by selecting foils from the association word norms for children of the ages examined. However, even the eight-year-olds failed to commit many false recognition errors, and the frequency of errors decreased with age.

The experimental design used by Cramer (1973) has been extensively criticized and subsequent experiments improving on her design were conducted by Lindauer and Paris (1976). Lindauer and Paris' first criticism focused on Cramer's assumption that the eight- and 12-year-olds understood, to the same extent, instructions to think of synonyms and antonyms of the words to be learned. Since Cramer (1973) simply had her subjects think of words, rather than speak or write them, the validity of her assumption could not be ascertained. When Lindauer and Paris (1976) asked children to verbally produce such words, there was some evidence that the older children understood the instructions better than the younger children. Thus, Lindauer and Paris (1976) concluded that the eight-year-olds in Cramer's study did not follow the instructions to think of synonyms and antonyms in the same manner as the older children.

A second criticism concerned the dependent measures used by Cramer (1973) to investigate developmental changes in false recognition errors, that is percent false recognition and generalization difference scores. Generalization difference scores are obtained by simply subtracting the child's false alarm rate for unrelated foils from the false alarm rates for each of the related types of foils. Lindauer and Paris (1976) considered the two dependent measures inappropriate for the investigation of age related shifts in false recognition errors since neither accounts for response bias, a potentially serious problem in developmental research. Because younger children are more prone to incorrectly accept foils as targets than older children, children of the two age levels tested probably did not have the same degree of response bias. Thus, generalization difference scores and percent false recognition measures could have yielded a distorted picture, resulting in an incorrect interpretation of the experimental results. To determine whether there is an age related shift in the basis of memory organization, Lindauer and Paris (1976) suggested that item detectibility (d') from signal detection theory be used, since the measure does take response bias into account. However, Lindauer and Paris (1976) could not calculate individual d's in their experiments because subjects committed few false recognition errors. As a result, they had to calculate d' for groups of subjects, collapsing data over individual subjects. Lindauer and Paris (1976) also suggested another way to analyze the false recognition errors; they examined the influence of explicit associative responses made by subjects during the learing task on the false recognition errors. If Cramer (1973) could have examined the implicit associative responses made by her subjects, she would have seen that older children understood her word generation instructions better than the younger subjects. She could have also determined the extent to which her word generating instuctions influenced the false recognition of foils in eight- and 12-year-olds.

The final criticism made by Lindauer and Paris (1976) concerned the method of foil selection for the recognition memory test. Cramer selected foils from word association norms for children of the ages studied, choosing synonyms and antonyms that were frequently produced in word association tasks. Lindauer and Paris (1976) proposed that the words generated by the individual subject during the learning task should be used as the foils on that subject's recognition memory test, thus tailoring each recognition test to the individual. This change should increase the false recognition rate for subjects. In fact, when Lindauer and Paris (1976) and Shepard, Cohen, Gold, and Orbino (1976) used this method of foil selection, the subjects did commit more false recognition errors.

Incidental learning-false recognition research. Several experiments have recently been conducted (Coltheart, 1977, Davies & Cubbage, 1976, O'Connor & Daehler, 1978) to investigate the effect of orienting questions on the correct recognition of encoded words (targets), as well as their effect on the false recognition of foils related to the targets. Coltheart (1977) conducted three experiments which investigated the influence of semantic and acoustic orienting questions on the false recognition errors made by adult subjects. In two of the experiments, the subjects performed both types of orienting tasks, whereas in a third, the subjects received either acoustic or semantic orienting questions. Subjects were asked to judge whether or not the associated target rhymed with another word, or were asked to determine whether or not the associated target word fit into a sentence frame. After the incidental learning task, an unexpected multiple choice recognition test was administered to the subjects. The recognition test alternatives consisted of the target word, a semantically related foil, an acoustically related foil, and either one or two unrelated control words. In general, Coltheart (1977) found that when subjects received rhyme orienting questions, more acoustically related foils were incorrectly recognized, whereas, when they received semantic orienting questions, more semantically related foils were incorrectly recognized. However, this result must be tempered, since the effect was reduced when subjects responded to both types of orienting questions during the incidental learning task. The strongest evidence for context effects on false recognition was obtained when orienting question was a between subjects variable. Coltheart (1977) points out that orienting questions, especially acoustic orienting questions, may not entirely control how a subject encodes a word. When the encoding of a target is not controlled, the types of false recognition errors that should be committed given encoding context would be difficult to specify.

Two other experiments (Davies & Cubbage, 1976, O'Connor & Daehler, 1978) were conducted to investigate the influence of orienting questions on the false recognition errors committed by children. Davies and Cubbage (1976) had 16-year-olds assign target words to categories or produce words acoustically related to the targets during the incidental learning phase of the study. When recognition memory was tested, Davies and Cubbage (1976) found that more rhyme foils were falsely recognized if a rhyme orienting task was given during the incidental learning phase, and more category foils were incorrectly recognized if a category orienting task was given. O'Connor and Daehler (1978) conducted a similar study using two age levels, eight- and 11-year-olds. Each subject was presented with a list of 30 target words and 30 associated orienting questions. All of the subjects received three types of orienting questions: category questions, rhyme questions, and label verification questions (e.g., "Is this the word Cat?"). Following the incidental learning task, subjects received a recognition memory test which consisted of target words, acoustically related foils, categorically related foils, and unrelated foils. Over all orienting questions, 11-year-old subjects committed more categorically related false recognition errors than rhyme or unrelated errors, while eight-year-olds incorrectly recognized category and rhyme foils equally often, but more often than unrelated foils. Additionally, 11-year-olds committed fewer false recognition errors than eight-year-olds. When false recognition errors were examined as a function of orienting question, it was found that following label orienting questions, subjects of each age committed an equivalent number of category, rhyme, and unrelated false recognition errors, though the older subjects were less prone to committing errors. Following category orienting questions, 11-year-olds committed more category errors than rhyme or unrelated errors, whereas, the eight-year-olds showed no consistent pattern of errors. And after receiving rhyme orienting questions, eight-year-olds committed more rhyme false recognition errors than category and unrelated errors, whereas, the 11-year-olds committed more category errors than rhyme or unrelated errors. Unfortunately, the false recognition rate was quite low for all of the subjects; some did not commit any false recognition errors. Thus, signal detection and statistical analyses of the false recognition errors were not readily applicable.

Many of the problems associated with Cramer's (1973) research are also potential problems for incidental learning-false recognition research. Response bias, for instance, could strongly influence results, especially when more than one age level is used. Another problem is that very few false recognition errors are committed by subjects. Though a foil word is similar in many ways to a target word, Kintsch (1974) suggests that many features of the foil may differ (e.g., context) from the features of the target, thus false recognition errors are often infrequent. When so few false recognition errors are committed, it is difficult to implement signal detection and other statistical analyses of data.

One additional problem for incidental learning-false recognition research is that orienting questions may not entirely control how a subject encodes stimuli. For instance, when a subject encodes a word in the context of a rhyme orienting question, some semantic encoding seems to occur in addition to acoustic encoding. Coltheart (1977) found that when subjects received both semantic and acoustic orienting questions during the incidental learning task, and encoded a word with an acoustic question, then semantic foils were falsely recognized as frequently as acoustic foils, and more often than unrelated ones. Subjects, not knowing what type of orienting question they were going to receive for a given word may have encoded the word both ways. However, it is also likely that since an acoustic question required little time and effort, semantic encoding was also implemented. This could be less of a problem when semantic orienting questions are used, since these questions require more time and effort to answer than acoustic questions, and additional encoding (at least for older subjects) would probably involve further semantic elaboration.

The results of the three incidental learning-false recognition studies support the belief that encoding context influences the types of false recognition errors that subjects commit. Adults and 16-year-olds (Coltheart, 1977, Davies & Cubbage, 1976) committed more acoustic errors following acoustic orienting questions and more semantic errors following semantic questions. The results from O'Connor and Daehler (1978) were more inconclusive. Eight-year-olds did not commit more semantic errors following semantic orienting questions, and 11-year-olds failed to commit more acoustic errors following acoustic orienting questions. However, since all of the problems associated with recognition memory tests apply to all three experiments, more evidence is needed to determine to what extent encoding context influences the types of recognion errors that adults and children commit.

The present study. The present study attempted to determine whether encoding context influences the false recognition errors committed by adults and children. Problems associated with the incidental learning-false recognition paradigm were considered and remedied. The solutions to these problems will be discussed as the experimental design is elaborated. Predictions of expected results will also be described.

Nine-year-olds and college students were used in the present study to determine whether there are age changes in the way encoding context influences the false recognition of foils. The orienting questions of this study addressed only the semantic aspects of words, in an attempt to better control the subjects' activity during the incidental learning task. Half of the orienting questions had affirmative responses, and half had negative responses. Since it is difficult to predict what effect a negative orienting question should have on false recognition errors, only affirmative orienting question context was manipulated to examine the effect of encoding context. Subjects received one of two possible affirmative questions for each target word which had an affirmative orienting question associated with it (target-yes word). In addition to answering orienting questions, half of the subjects were asked to list some words as specified in a word generation statement following each orienting question. For instance, subjects who were shown Tiger and asked, "Is this an animal that roars?", would be asked to "List some animals that roar". This word generation manipulation was included in an attempt to increase the frequency of false recognition errors, and to determine whether producing a word during the learning task affects false recognition. It was predicted, based on the findings of Lindauer and Paris (1976) and Underwood and Freund (1968), that when children and adults generate foils during the learning task, there should be an increased false alarm rate for those foils.

Subjects were unaware that they were going to receive a memory test following the incidental learning task. Children received the recognition memory test four hours after completing the learning task; whereas, a 24 hour delay was given for the adults. The 24 hour delay was considered necessary to assure that adults would commit false recognition errors; whereas, four hours was considered a sufficient delay for nine-year-olds. The recognition test was a random array of target words and related foils. Half of the targets had negative questions associated with them during the incidental learning task (target-no words), and the other half had affirmative questions associated with them (target-yes words). Half of the related foils were contextually related to the target-yes words via one of the affirmative orienting questions, and the others were related via the other affirmative questions. All subjects were told to circle exactly 40 words on the recognition test. This procedure was adopted to increase the likelihood that false recognition errors would be committed and to eliminate the problem of response bias. Subjects usually make few false recognition errors because they choose only those words they remember well. By making subjects search for all of the words they had been shown, it was anticipated that they would commit more false recognition errors because they would be responding to words of which they were less certain.

Based on the experimental findings of Tulving and Thomson (1973) and Coltheart (1977), as well as the interpretations of those findings, it was predicted that encoding context should influence the types of false recognition errors committed by adults. Depending on encoding context, some concepts should be more related to the encoded word than others (which in a different context could be highly related). Barclay et al. (1974) suggested that when a concept is contextually interpretted, the semantic network that is stimulated should be different than that stimulated by another contextual interpretation of the concept. If the contextual representation of a word is stored in episodic memory, then given a recognition memory test, encoding context should influence the types of false recognition errors committed.

Ceci and Howe (1978) demonstrated that children as young as seven, like adults, are able to contextually encode stimuli, and that encoding context does influence which retrieval cues improve recall. Thus, nine-year-olds could also be influenced by encoding context to commit more contextually related false recognition errors. However, Paris and Lindauer (1976) demonstrated that nine-year-old children do not always encode stimuli as elaborately as an adult would during a learning task, especially when memory strategies, like sentence elaboration, are involved. Since the present study used an incidental learning task, learning strategies should not influence the results. However, adults, having a more complex semantic network or more motivation to process stimuli thoroughly, could represent a contextually encoded word more elaborately. As a result, the false recognition errors of the adult could be more contextually influenced than the errors of the child.

Retrieval strategies could also influence the false recognition errors of adults differently than those of children. Ceci and Howe (1978) found that adolescents had more effective retrieval strategies when retrieval cues were contextually unrelated to targets than younger children. The adolescents may have searched semantic memory for links between the contextually unrelated cues and the targets. Adults, in the present experiment, may also apply more effective recognition strategies than the nine-year-olds. For instance, the adults could attempt to reinstate memory for targets by retrieving orienting questions. If this does occur, the false recognition errors of the adults could be more influenced by encoding context than the errors of the children. Thus, it is likely that encoding context should influence the types of false recognition errors that adults and children commit, however, the degree of that influence may differ with age.

Half of the subjects of the present study were asked to generate words. It was expected that when subjects generate foils during the incidental learning task, those foils should be incorrectly recognized more often than foils that were not generated. When subjects write words during the learning task, those words should become familiar. Following a delay period, subjects then should confuse these written words with the target words. Using adult subjects, Underwood and Freund (1968) found that when targets were encoded with a related word that was not to be remembered, subjects incorrectly recognized more of those related words than related words that were not paired with the target during the learning task. Lindauer and Paris (1976) found that the false recognition errors of eight-year-olds were less influenced by foil generation than the errors of 12-year-olds. Thus it is possible that foil generation could influence the false recognition errors of adults more than those committed by nine-year-olds.

In the past, researchers have demonstrated that target words are more accurately recognized when paired with an affirmative rather than a negative orienting question during the incidental learning task (Coltheart, 1977, Craik & Tulving,1975, O'Connor & Daehler, 1978). Craik and Tulving

(1975) explained this effect as follows:

> In cases where a positive response is made, the encoding question and the target word can form a coherent unit. This integration would be especially likely with semantic questions: for example, "A four-rooted animal?" (BEAR) or "The boy met a ____ on the street" (FRIEND). However, integration of the question and target word would be much less likely in the negative case: "A four-footed animal?" (CLOUD) or "The boy met a ____ on the street" (SPEECH). Greater degrees of integration (or, alternatively, greater degrees of elaboration of the target word) may support higher retention...(p.281-282).

However, choice of negative orienting questions in past research was somewhat arbitrary, resulting in questions for which integration would be quite difficult and which required little consederation of the meaning of the target words. In the present study, however, the negative questions that were chosen required that the subjects consider the meaning of the target words to respond correctly. For example, instead of asking nonsense questions like "Is this a scarey person?" for the word Triangle, the question "Is this a four sided object?" was posed. This question requires the subjects to consider the meaning of the word to be encoded, Triangle, and should produce a more enduring memory trace of the target. By choosing negative orienting questions that are more meaningful, a more adequate test of the influence of types of orienting questions (affirmative and negative) on memory for targets can be conducted. It is possible that with this modification on negative questions, the affirmative question superiority effect will disappear.

In summary, the present study investigated the influence of encoding context on the false recognition of contextually related foils and contextually unrelated foils by nine-year-olds and adults. It was predicted that contextually related foils should be incorrectly recognized more often than contextually unrelated foils, and that foil generation should increase the likelihood that a foil will be incorrectly recognized. Predictions of age differences, however, were difficult to make based on the results of previous experiments. Finally, by choosing more meaningful negative orienting questions, type of orienting question (affirmative and negative) is predicted not to influence the correct recognition of targets in this study.

CHAPTER II

EXPERIMENT I

Method

Subjects. Thirty-three third grade children from the Hatfield, MA elementary school were tested. One female was eliminated because she was unable to read. An additional eight children from the Amherst area were added to yield a total of 40 subjects. Of the 40, 19 females were from Hatfield and one was from Amherst; whereas, 13 males were from Hatfield and seven were from Amherst. The Hatfield children were seen in their classrooms in groups of 15 and 18, while the Amherst children were seen in private homes. The Amherst female was seen individually, and the males from Amherst were seen in groups of three and four. The subjects ranged in age from eight years, two months to nine years, seven months, with a mean age of eight years, eleven months. This age level was selected based on a previous study by O'Connor and Daehler (1978) in which it was found that children of this age could perform this task competently. A parental consent form as well as the assent of the child were required for a child to participate in the study. All children who received parental permission gave their assent.

TABLE 1

WORDS USED IN THE RECOGNITION MEMORY TEST

Target-No Words	Target-Yes Words	Orienting List 1-Related Foils	Orienting List 2-Related Foils
Land	Tiger	Lion	Zebra
Numbers	Sofa	Bed	Chair
Hospital	Motorcycle	Bike	Car
Year	Smile	Laugh	Frown
Triangle	Cactus	Sand	Tree
Dust	Snow	Rain	Ice
Comb	Brown	Blond	Blue
Hill	Sink	Stove	Toilet
Cotton	Wasp	Fly	Bee
Rattle	Violin	Guitar	Flute
Thief	Trailer	House	Hotel
Friend	Christmas	Birthday	Thanksgiving
Knee	Grapefruit	Orange	Banana
Robot	Thread	Needle	String
Garbage	Wood	Brick	Paper
Rock	Magazine	Book	Letter
Lawn	Knife	Fork	Scissors
Key	Juice	Milk	Coke
Cave	Baseball	Tennis	Football
Ham	Watch	Bracelet	Clock

Materials. Eighty words found in the reading of third grade children were selected from Carroll, Davies, and Richman's (1971) word frequency norms (see Table 1) for use in the recognition memory test. Forty of the words were included in the incidental learning task. Of those 40 words, 20 (target-yes words) were chosen which could be classified in at least two different ways. For example, the word Tiger was selected because a tiger could be described as a jungle cat or as a striped animal. The other 20 incidental learning task words (target-no words) were chosen so that they bore no obvious relationship to the 20 target-yes words.

Forty (20 pairs) additional words were selected as foils for inclusion in the recognition memory test. The pairs of foils were related, but in differing ways, to the target-yes words. For example, the target-yes word Tiger was presented in the incidental learning task, and the two related foils that appeared on the recognition memory test were Lion (a jungle cat) and Zebra (a striped animal). The pairs of foils are listed in Table 1; one member of each pair is an orienting list 1-related foil, and the other is an orienting list 2-related foil.

Third grade reading frequencies (means and standard errors) for the four types of words as determined from the norms of Carroll, Davies, and Richman (1971) are shown in

Table 2. The word frequency means and standard errors for target-no words, the orienting list 1-related foils, and the orienting list 2-related foils were similar. Target-yes words had a somewhat lower mean and standard error; however, *t*-tests failed to reveal significant differences between the means of the various types of words.

Two lists (orienting list 1 and orienting list 2) of 40 orienting questions were constructed for use during the incidental learning task. An orienting question was asked for each target-yes and target-no word. Both orienting lists consisted of exactly the same target-yes and target-no words; however, the two lists differed with respect to the orienting questions associated with the target-yes words. For example, the orienting question for Tiger in list 1 was "Is this an animal that roars?", whereas, the question in list 2 was "Is this an animal that has stripes?". The orienting questions for target-no words were identical in the two lists. Orienting questions for both target-yes and target-no words are shown in Table 3. Target words with their associated orienting questions were randomly ordered in the orienting lists with the constraint that not more than three target-yes or target-no words occurred consecutively. The order of target words was identical in

TABLE 2

WORD FREQUENCY MEANS AND STANDARD ERRORS DETERMINED FROM THIRD GRADE AND ADULT NORMS FOR THE TYPES OF WORDS THAT APPEARED IN THE RECOGNITION MEMORY TEST

	Third Grade Norms		Adult Norms	
Types of Words	Mean	SE	Mean	SE
Target-yes Words	72.3	18.8821	35.85	9.4858
Target-no Words	110.5	32.7566	84.85	32.8911
Orienting list 1-related foils	136.05	42.0250	64.25	29.5971
Orienting list 2-related foils	137.25	37.7041	56.70	16.6296

TABLE 3

ORIENTING QUESTIONS ASSOCIATED WITH TARGET-YES WORDS AND TARGET-NO WORDS DURING THE INCIDENTAL LEARNING TASK

QUESTIONS AND RELATED FOILS FOR TARGET-YES WORDS

Target-Yes Words	List	Orienting Questions	Related Foils
Tiger	1	Is this an animal that roars?	Lion
	2	Is this an animal that has stripes?	Zebra
Sofa	1	Is this furniture people lie on?	Bed
	2	Is this furniture people sit on?	Chair
Motorcycle	1	Does this have two wheels?	Bike
	2	Does this run on gasoline?	Car
Smile	1	Is this a way people show they are happy?	Laugh
	2	Is this a facial expression?	Frown
Cactus	1	Is this found in the desert?	Sand
	2	Is this a plant?	Tree
Snow	1	Is this something that falls from the clouds?	Rain
	2	Is this something that is frozen?	Ice
Brown	1	Is this a hair color?	Blond
	2	Is this an eye color?	Blue

TABLE 3 (Cont.)

Target-Yes Words	List	Orienting Questions	Related Foils
Sink	1	Is this found in the kitchen?	Stove
	2	Is this found in the bathroom?	Toilet
Wasp	1	Is this a black insect?	Fly
	2	Is this a stinging insect?	Bee
Violin	1	Is this a musical instrument that has strings?	Guitar
	2	Is this a musical instrument used in an orchestra?	Flute
Trailer	1	Is this a place to live?	House
	2	Is this a place to stay while traveling?	Hotel
Christmas	1	Is this a day people get gifts?	Birthday
	2	Is this a holiday?	Thanksgiving
Grapefruit	1	Is this a round fruit?	Orange
	2	Is this a yellow fruit?	Banana
Thread	1	Is this something used in sewing?	Needle
	2	Is this something that can be tied in knots?	String
Wood	1	Is this something used to make buildings?	Brick
	2	Is this something that burns?	Paper

TABLE 3 (Cont.)

Target-Yes Words	List	Orienting Questions	Related Foils
Magazine	1	Is this something you can read stories in?	Book
	2	Is this something that comes in the mail?	Letter
Knife	1	Is this something used when you eat dinner?	Fork
	2	Is this something that cuts?	Scissors
Juice	1	Is this drink good for you?	Milk
	2	Is this drink sweet tasting?	Coke
Baseball	1	Is this a sport in which a ball is hit with something?	Tennis
	2	Is this a sport in which teams play against one another?	Football
Watch	1	Is this something women wear on their wrists?	Bracelet
	2	Is this something used to tell time?	Clock

QUESTIONS FOR TARGET-NO WORDS

Target-No Words	Orienting Questions[1]
Land	Is this a place to swim?
Numbers	Is this something studied in reading class?

[1] The same orienting question was used for target-no words in List 1 and List 2.

TABLE 3 (Cont.)

Target-No Words	Orienting Questions
Hospital	Is this a place to have fun?
Year	Is this a season?
Triangle	Does this have four sides?
Dust	Is this something you put on food?
Comb	Is this something used in cooking?
Hill	Is this something flat?
Cotton	Is this something that is hard?
Rattle	Is this something adults play with?
Thief	Is this an honest person?
Friend	Is this something you dislike?
Knee	Is this part of an arm?
Robot	Is this alive?
Garbage	Does this smell good?
Rock	Does this float on water?
Lawn	Is this part of a room?
Key	Is this usually made of plastic?
Cave	Is this a good place to get a tan?
Ham	Is this a vegetable?

the two orienting lists. Target words and associated orienting questions were arranged in booklets for group presentation. Examples of booklets are shown in Appendix A.

For the recognition memory test, 40 randomized lists of the 80 target and foil words were constructed. These lists were generated by a computer, and the words were printed in 20 rows of four columns. The only restriction placed on the random order was that each target-yes word and its two related foils not fill any adjacent position either vertically or horizantally. An example of a recognition memory test appears in Appendix B.

Procedure. There were two phases to the experiment, the incidental learning task and the recognition memory test. Thus, each child was seen on two different occasions. The inter-task interval for the third graders was approximately four hours.

An equal number of males and females received orienting list 1 and orienting list 2 booklets. Subjects were asked to respond "yes" or "no" to all orienting questions in their booklets. Half of the males and females receiving each orienting list were also asked to generate additional words. If these words had replaced the target words during the learning task, an affirmative response would have been given to the orienting questions. For example, when the word Tiger was paired with the question "Is this an animal that roars?", the subject was asked to "List some animals that roar". A subject might then generate the word Lion, which could replace Tiger and yield an affirmative response to the orienting question. When the word Triangle was paired with the question "Does this have four sides?", the subject was asked to "List some things that have four sides". This subject might generate the word Square, which could have replaced Triangle to yield an affirmative response to the orienting question. Space to list the words was provided in the booklets that word-generating subjects received (see Appendix A). The experimenter urged subjects to complete the incidental learning task as accurately as possible. All subjects were given as much time as they needed to complete this task. Verbatim instructions given during the incidental learning task are shown in Appendix C.

Four hours later, the experimenter returned to the classroom (or home) to test recognition memory. The subjects were asked to circle all words in the list of 80 words that they remembered seeing during the incidental learning task and about which they answered questions. They were reminded that they saw exactly 40 words during the learning task and were required to circle exactly 40 on the memory test (they were asked to count responses and the experimenter double checked). The instructions used for the recognition memory test are also shown in Appendix C. The subjects were given as much time as they needed to complete the memory task. Immediately after all of the children in the group completed the test, the experimenter explained the purpose of the study as well as the reason for the incidental learning task.

Results

Since the third grade subjects were drawn from two populations, a preliminary analysis was carried out to determine whether the data from the Amherst and Hatfield subjects should be treated separately. During the incidental learning task, the Amherst subjects responded more accurately to orienting questions ($\bar{X}$ =39.125, SD = 1.356) than the subjects from Hatfield ($\bar{X}$ = 38.3125, SD = 1.635). In addition, Amherst children were more accurate in recognizing targets ($\bar{X}$ = 35.125, SD = 2.95) than children from Hatfield ($\bar{X}$ = 32.844, SD = 3.83). However, *t*-tests carried out to determine whether the populations differed significantly on either dependent measure were nonsignificant ($t(38) = 1.38$, $p > .05$ and $t(38) = 1.74$, $p > .05$). Since there were no significant differences for either orienting question response accuracy or recognition accuracy, the data from Amherst and Hatfield subjects were combined in subsequent analyses.

Incidental orienting task.

Proportion correct orienting question responses. Overall, the accuracy of responding to both affirmative orienting questions (.95) and negative orienting questions (.97) was quite high. Both males and females performed at similarly high levels of accuracy (.96 and .97 respectively), and there was little change in accuracy over blocks of trials (.98, .96, .94, .97 respectively). When subjects generated words in addition to answering orienting questions, they responded a bit more accurately (.98) than when subjects simply responded to questions (.95). No subject incorrectly answered more than five orienting questions out of forty, and the modal number incorrect was zero. Subjects clearly had little difficulty in answering the orienting questions, thus variability was quite limited. As a result, no inferential statistics were performed on the data.

Word generation during the orienting task. Twenty third graders were instructed to generate words during the incidental learning task in addition to answering orienting questions. All of these subjects generated an average of 1.965 (SD = .434) words after each orienting question. Additionally, subjects often generated foils found on the recognition test. Depending on which orienting list a subject received, one type of foil was expected to be generated (and was contextually related to the target-yes word) more often than the other type of foil. More specifically, given orienting list 1, subjects were expected to generate more orienting list 1-related foils, and given orienting list 2,they were expected to generate more orienting list 2-related foils. In fact, the children generated an average of 70% of the expected foils during the incidental learning task, and 91% of the foils that were generated by the subjects were expected or contextually related foils.

Recognition memory test. Two analyses of variance were performed on the recognition memory data. The first examined proportion correct recognition of targets in a 2(sex) by 2(orienting list) by 2(word generation) by 5(subject) by 4 (block) by 2(orienting question-yes vs. no) analysis of variance with repeated measures on the last two factors. Orienting list determined which set of affirmative questions a subject received during the incidental learning task. Word generation pertained to whether a subject listed words in addition to answering orienting questions, or simply answered questions. Blocks of trials were included to determine whether target words encoded earlier or later in the orienting list varied in recognizeability. The first five target words associated with affirmative orienting questions and the first five target words associated with negative orienting questions constituted block 1, and successive sets of five target-yes and target-no words constituted blocks 2, 3, and 4 respectively. A correction procedure suggested by Geisser and Greenhouse (1958) was applied to the *F*-ratios in the analysis to eliminate spurious significance of repeated measures effects due to heterogeneity of covariance. If the *F*-test was significant following this correction, Newman-Keuls post-hoc tests were carried out to further examine such main effects and interactions.

The second analysis examined proportion correct rejection of foils in a 2(sex) by 2(orienting list) by 2(word generation) by 5(subject) by 4(block) by 2(type of foil) analysis of variance with repeated measures on the last two factors. Orienting list and word generation were defined in exactly the same way as in the previous analysis. Blocks of trials were also based on the order in which subjects were exposed to the target-yes words during the incidental orienting task. Since a pair of foils was associated with each target-yes word, block 1 consisted of the ten foils that were related to the first five target-yes words from the incidental learning task, block 2 consisted of the ten foils related to the next five target-yes words, and so on for blocks 3 and 4. There were two types of foils; one type of foil was contextually related to the target-yes words by the affirmative orienting questions from orienting list 1, and will be hence referred to as an orienting list 1-related foil. The other type of foil was contextually related to the target-yes words by the affirmative orienting questions from orienting list 2, and will be referred to as an orienting list 2-related foil. As can be seen in Table 3, Lion is an orienting list 1-related foil since it is contextually related to Tiger by the orienting list 1 question, "Is this an animal that roars?". Likewise, Zebra is an orienting list 2-related foil. The correction procedure described for the previous analysis was applied to appropriate *F*-ratios in this analysis as well. If following the correction, the effect was still significant, it was further analyzed using Newman-Keuls post-hoc tests.

During the recognition tests, subjects circled 40 words. Since all of the subjects selected exactly 40 words and simultaneously rejected 40 words, the analyses of both proportion correct recognition of targets and proportion correct rejection of foils must yield the same information concerning the between-subjects variables. Thus, when a between-subjects source of variance was found to be significant, it was discussed only once, in the analysis of proportion correct recognition of targets. However, since different information can be obtained from the within-subjects variables of the two analyses, both proportion correct recognition of targets and proportion correct rejection of foils should be examined to understand the factors which influence recognition memory.

Proportion correct recognition of targets. Third grade subjects were fairly accurate in recognizing target words during the memory test; the overall proportion of target words recognized was .83. However, as can be seen in Figure 1, subjects recognized more targets that were seen during the beginning and the end of the orienting list than in the middle, a primacy-recency pattern of performance fairly typical in memory tasks. The analysis of variance performed on this data (see Appendix D, Table 4) yielded a significant main effect for blocks, $F(3,96) = 6.77$, $p < .001$. After applying the correction, the effect was significant ($p < .025$). Newman-Keuls post-hoc tests indicated that subjects recognized more targets seen in block 1, 2, and 4 than in block 3 ($p < .05$). No other differences between blocks were significant.

Subjects correctly recognized more target-yes words (.85) than target-no words (.82), and the analysis of variance indicated that the type of orienting question (yes or no) did effect target recognition significantly, $F(1,32) = 4.17$, $p < .05$. However, further examination of the data revealed that orienting list (1 or 2) influenced correct recognition of targets as a function of type of

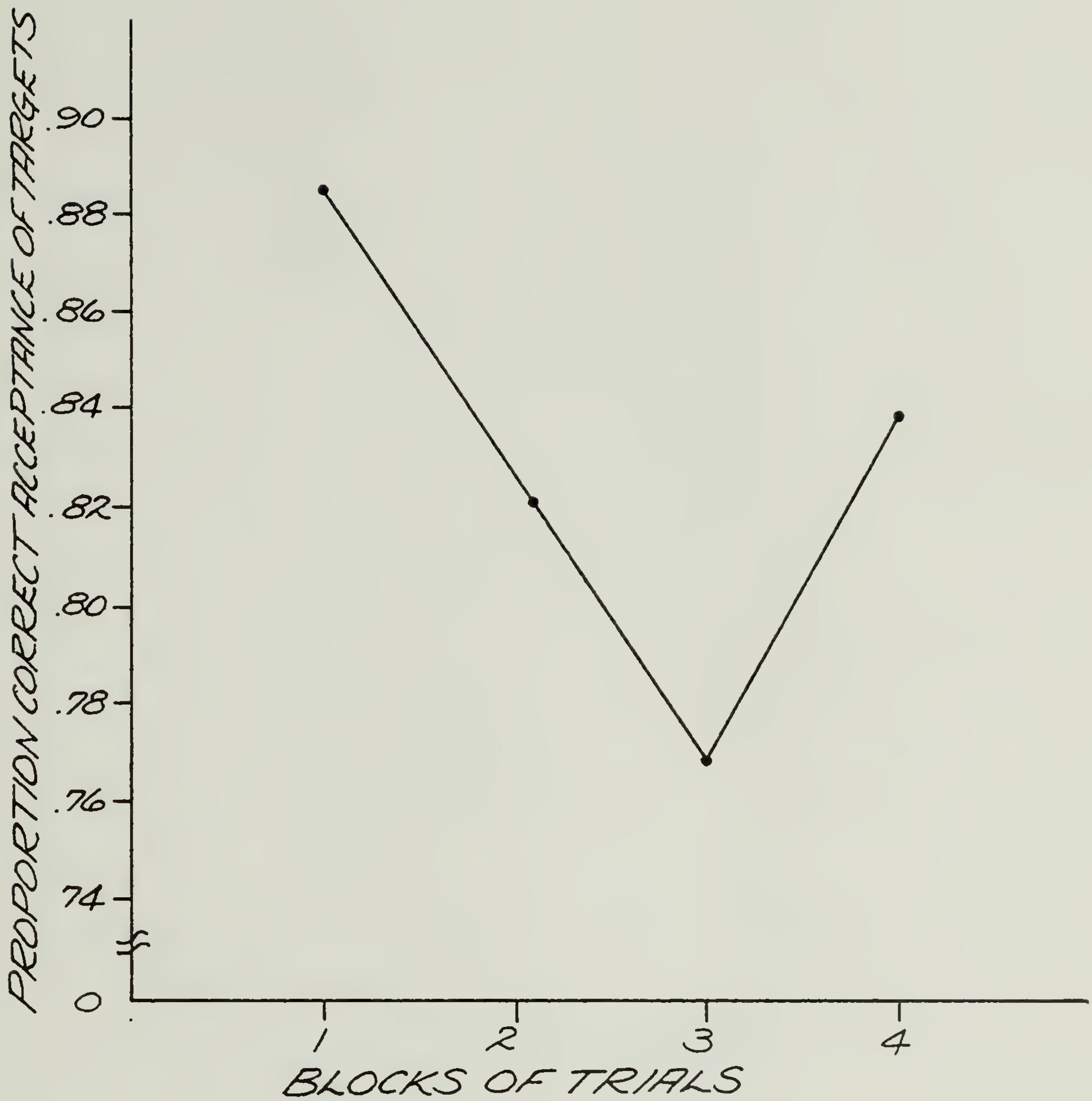

Figure 1. Proportion of target words correctly accepted by third graders as a function of blocks of trials.

orienting question. Figure 2 shows that subjects recognized target-yes words at a similar level regardless of which orienting list they received; however, subjects who received orienting list 1 recognized more target-no words than those who received orienting list 2. Subjects who received orienting list 1 during the learning phase of the study recognized target-yes and target-no words at a similar level of accuracy; however, when subjects received orienting list 2, they were more likely to recognize target-yes words than target-no words. The orienting list by type of orienting question interaction was found to be significant, $F(1,32) = 12.78$, $p < .005$. Newman-Keuls tests revealed that subjects recognized more target-no words given orienting list 1 than given orienting list 2 ($p < .05$). This result is puzzling for although list 1 and list 2 had different affirmative orienting questions, the negative orienting questions asked for lists 1 and 2 were identical. However, orienting list differences were significant only for negative orienting questions. Differences between orienting lists 1 and 2 might have been expected for target-yes words, but were not expected for the target-no words. Newman-Keuls tests further revealed that when subjects received orienting list 2, they were more likely to recognize target-yes words than target-no words ($p < .01$).

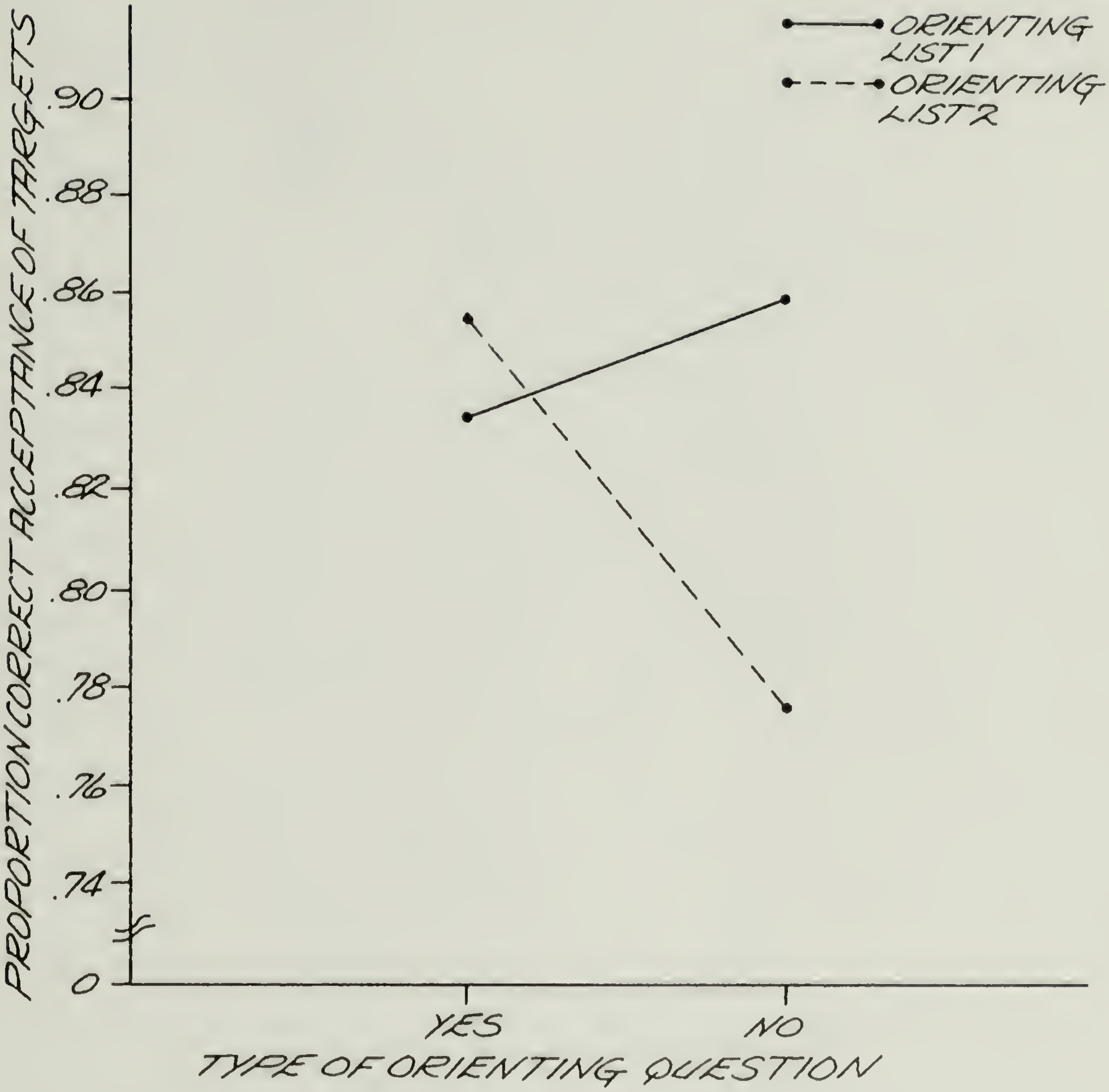

Figure 2. Proportion of target words correctly accepted by third graders as a function of type of orienting question and orienting list.

Subjects who received orienting list 1 did not correctly recognize more targets associated with affirmative orienting questions than those associated with negative orienting questions.

Orienting list influenced the proportion correct acceptance of target words differently for males and females. Males who received orienting list 2 recognized more targets than those who received orienting list 1 (.86 and .83 respectively). Females, on the other hand, recognized more targets after receiving orienting list 1 than after orienting list 2 (.87 and .78 respectively). This sex by orienting list interaction was found to be significant, $F(1,32) = 4.65$, $p < .05$. However, a third factor, word generation, influenced the proportion correct acceptance of targets in males and females who received orienting list 1 or 2. Differences between orienting lists 1 and 2 were slight for males and females who generated words during the learning task. Whereas, when males and females simply responded to orienting questions, the pattern that was described by the sex by orienting list interaction became apparent. The three-way interaction of sex, orienting list, and word generation was also found to be significant, $F(1,32) = 5.46$, $p < .05$.

In summary, the memories of third graders were clearly influenced by the order in which target words were seen during the learning task. Words seen in the beginning and end of the task were recognized more accurately than words seen in the middle. Also, the children seemed to be influenced by the type of orienting question (yes or no) associated with a target word. However, since type of orienting question interacted with orienting list, the relationship between type of orienting question and the accuracy of target recognition was lessened. Finally, sex was found to interact with orienting list and word generation. When subjects generated words during the learning task, they correctly recognized targets at a similar level regardless of sex and orienting list, but when they did not generate words, sex and orienting list differences appeared.

Proportion correct rejection of foils. Depending on which list a subject received during the incidental learning task, one member of a pair of foils should be correctly rejected more often than the other member of the pair. More specifically, correct rejection of orienting list 1-related foils should occur more frequently for subjects who received orienting list 2, whereas, correct rejection of orienting list 2-related foils should occur more frequently after subjects received orienting list 1. The subjects who received orienting list 1 were found to correctly reject more orienting list 2-related foils than orienting list 1-related foils (.88 and .82 respectively). Additionally, subjects who received orienting list 2 questions were found to correctly reject more orienting list 1-related foils than orienting list 2-related foils (.83 and .80 respectively). The interaction between orienting list and foil type was found to be significant, $F(1,32) = 5.29$, $p < .05$ (see Appendix D, Table 5). Word generation, however, appeared to have a qualifying influence on these results. As can be seen in Figure 3, when subjects were asked to generate words in orienting list 1, they were more likely to correctly reject orienting list 2-related foils than orienting list 1-related foils. On the other hand, when subjects were asked to generate words in orienting list 2, they were more likely to reject orienting list 1-related foils than orienting list 2-related foils on the recognition memory test. Such results accord with the prediction that orienting questions should influence the types of recognition errors subjects produce. However, when subjects were only asked to respond to orienting list 1 questions, they correctly rejected just slightly more orienting list 2-related foils than orienting list 1-related foils. And contrary to prediction, subjects who simply answered questions in orienting list 2 correctly rejected more list 2-related foils than list 1-related foils. Thus, when subjects were not required to generate words, the results

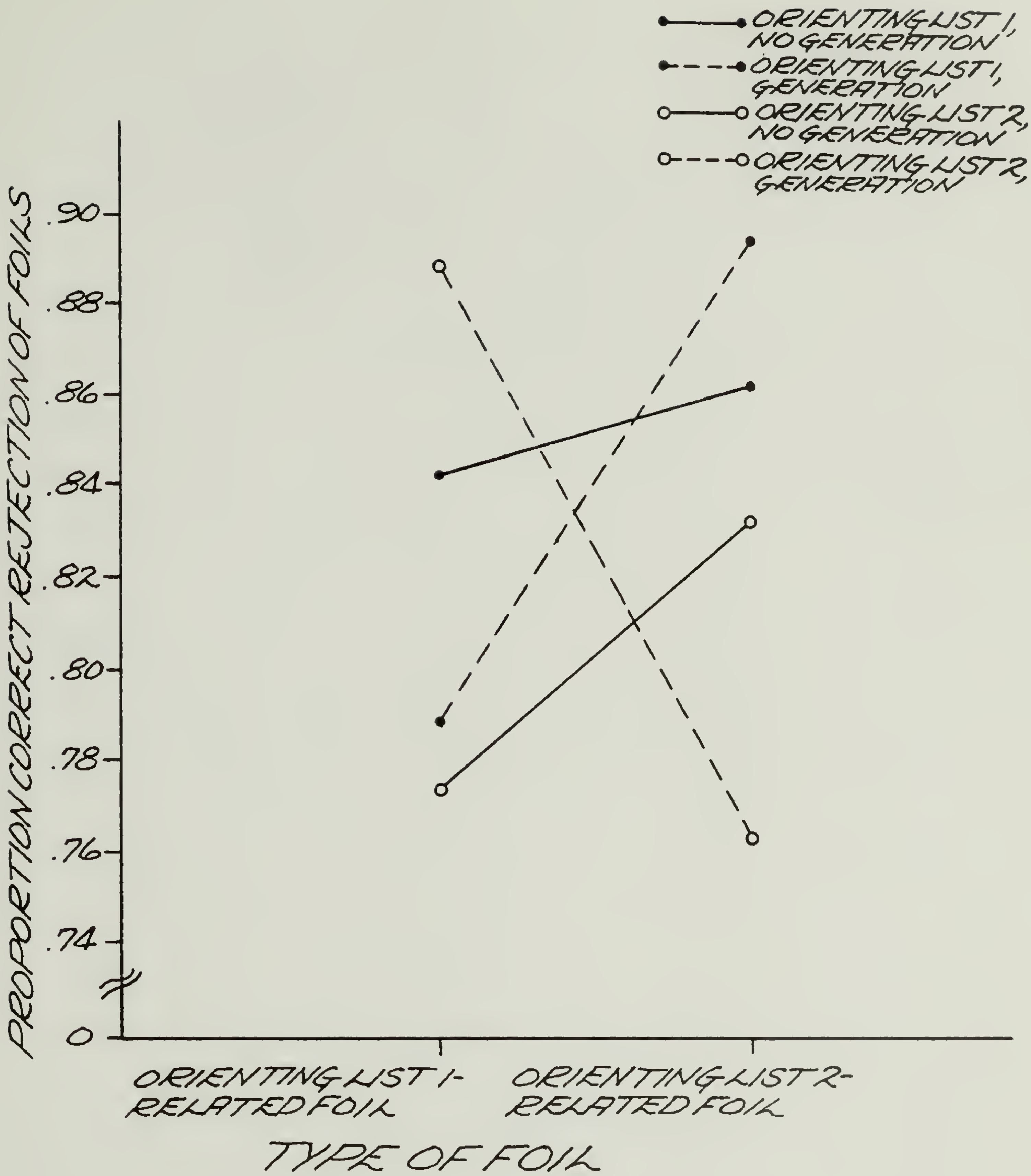

Figure 3. Proportion of types of foils correctly rejected by third graders who received orienting list 1 or 2 in word generation and no word generation conditions.

failed to support the prediction that orienting questions should influence recognition errors. The F-ratio for the three-way interaction between orienting list, word generation, and type of foil was found to be significant, $F(1,32) = 10.68$, $p < .005$. Newman-Keuls tests revealed that subjects who generated words in orienting list 1 correctly rejected more orienting list 2-related foils than orienting list 1-related foils ($p < .05$). Also, subjects who generated words in orienting list 2 correctly rejected more orienting list 1-related foils than orienting list 2-related foils ($p < .01$). There were, however, no significant differences between types of foils when subjects simply answered orienting questions during the incidental orienting task.

By examining the patterns of false recognition errors made by individual subjects, further support for the orienting list by word generation by foil type interaction is provided. When subjects simply responded to questions from orienting list 1, five subjects incorrectly recognized more orienting list 1-related foils (contextually related foils) than orienting list 2-related foils(contextually unrelated foils), three subjects incorrectly recognized more contextually unrelated foils than contextually related foils, and two incorrectly recognized contextually related and unrelated foils at the same level. In contrast, when subjects generated words in orienting list 1, seven incorrectly recognized more orienting list 1-related foils (contextually related foils) than orienting list 2-related foils (contextually unrelated foils), and three incorrectly recognized an equal number of contextually related and unrelated foils. When subjects simply responded to orienting list 2 questions, two incorrectly recognized more orienting list 2-related foils (contextually related foils) than orienting list 1-related foils (contextually unrelated foils), seven incorrectly recognized more contextually unrelated foils than contextually related foils, and one incorrectly recognized an equal number of contextually related and unrelated foils. However, of the subjects who generated words in orienting list 2, eight incorrectly recognized more contextually related foils than contextually unrelated foils, one incorrectly recognized more contextually unrelated foils than contextually related foils, and one incorrectly recognized an equal number of the two types of foils.

One other factor appeared to influence the proportion correct rejection of foils by children, that is order in which subjects saw the target-yes words during the incidental learning task. Subjects correctly rejected more foils related to block 1, 3, and 4 target-yes words than foils related to block 2 target-yes words. The block effect was significant, $F(3,96) = 3.10, p < .05$, but only before the correction was applied.

In summary, the analysis of proportion correct rejection of foils revealed that orienting question context influenced the types of false recognition errors third graders made. However, word generation appeared to influence the interaction of type of foil and orienting list. Subjects who generated words in addition to answering orienting questions correctly rejected more contextually unrelated foils than contextually related foils, whereas, subjects who simply answered orienting questions did not. Thus, third graders correctly rejected more contextually unrelated foils only if they responded to orienting questions and generated words. No other factors significantly influenced the false recognition errors of third graders.

Foil generation and proportion false recognition of foils. Since the false recognition errors of third graders were influenced by encoding context only when they generated words in addition to answering orienting questions, it was expected that there was a relationship between the generation of a foil word during the learning task and the false recognition of that foil. To determine whether or not the generation of foils influenced the proportion false recognition of those foils, a repeated measures analysis of variance was computed (see Appendix D, Table 6). In general, it was found that third graders incorrectly recognized generated foils more often than foils that they did not generate (.27 and .10 respectively). This foil generation effect was significant, $F(1,19) = 10.18$, $p < .005$. Thus, it appears that when children wrote foils during the learning task, those foils were incorrectly recognized more frequently than foils that were not generated.

By comparing the false recognition errors of subjects who simply answered orienting questions during the incidental learning task with the errors of subjects who generated words during the learning task, more can be learned about the relationship between foil generation and false recognition. In general, it was found that the proportion incorrect recognition of foils by subjects who generated those foils during the learning task was higher than the proportion incorrect recognition of foils by subjects who simply answered orienting questions (.27 and .17 respectively). Also, the proportion incorrect recognition of foils by subjects who failed to generate those foils during the learning task was found to be lower than the proportion incorrect recognition of foils by subjects who simply answered questions (.10 and .17 respectively). Both of these differences were found to be signigicant, $\underline{t}(38) = 1.87$, $\underline{p} < .05$ (one-tailed) and $\underline{t}(38) = 2.60$, $\underline{p} < .05$. Thus, when subjects generated a foil during the learning task, they had an increased likelihood of incorrectly recognizing that foil. However, when subjects did not generate a foil word, they were less likely to incorrectly recognize that foil.

Of third grade subjects who generated words during the incidental learning task, 15 incorrectly recognized more contextually related foils than contextually unrelated foils, one incorrectly recognized more contextually unrelated foils than contextually related foils, and four incorrectly recognized contextually related foils as often as contextually unrelated foils. By comparing the influence of foil generation on the false recognition errors of subjects who incorrectly recognized more contextually related foils with the influence of foil generation on the false recognition errors of subjects who failed to incorrectly recognize more contextually related foils, differences between the test-taking methods of the two groups could be revealed. Those 15 subjects who incorrectly recognized more contextually related foils falsely recognized more foils that they generated than those five who failed to incorrectly recognize more contextually related foils (.32 and .13 respectively). This difference was found to be significant,

$\underline{t}(18) = 2.72$, $\underline{p} < .05$. However, there was no difference in the false recognition rates of ungenerated foils by subjects who incorrectly recognized more contextually related foils and by subjects who did not incorrectly recognize more contextually related foils (.10 and .12 respectively), $\underline{t}(18) = -.84$, $\underline{p} > .05$. Also, subjects who incorrectly recognized more contextually related foils falsely recognized more generated foils than foils that were not generated during the learning task (.32 and .10 respectively). This difference was tested using Hotelling's $\underline{T}^2$, and was found to be significant, $\underline{T}^2 = 16.34$, distributed as $\underline{F}(1,14) = 16.34$, $\underline{p} < .05$. However, when subjects failed to incorrectly recognize more contextually related foils, there was no significant difference between the proportion false recognition of generated foils and the proportion false recognition of ungenerated foils (.13 and .12 respectively), $\underline{T}^2(1,4) = .05$, $\underline{p} > .05$. Thus, it appears that the false recognition of foils by subjects who incorrectly recognized more contextually related foils was influenced by the generation of those foils during the learning task; whereas, the false recognition of foils by sujects who did not incorrectly recognize more contextually related foils was uninfluenced by the generation of those foils.

In summary, there was a relationship between the generation of a foil during the learning task and the false recognition of that foil on the recognition test. If a subject generated a foil during the learning task, the probability of that foil being incorrectly recognized was increased. However, when a foil was not generated by the subject, the false recognition rate of that foil was decreased, Additionally, when subjects incorrectly recognized more contextually related foils on the recognition test, there was a relationship between the generation of a foil and the false recognition of that foil. However, there was no such relationship between foil generation and false recognition by subjects who did not incorrectly recognize more contextually related foils.

<u>False recognition of foils and proportion correct recognition of targets.</u> When subjects commit false recognition errors, there could be some relationship between those errors and the correct recognition of related target words. If subjects were aware of the relationships between target words and foils; then if they were applying strategies on the recognition test, they would have avoided a related foil word if they had selected the target word on the test (or vice versa). A 2 (word generation) by 20 (subject) by 3 (foil false recognition) analysis of variance with repeated measures on the last factor was calculated to determine whether the false recognition of foils influenced

the correct recognition of related targets (see Appendix D, Table 7). Word generation in this analysis referred to whether or not subjects generated words in addition to answering orienting questions. The three foil false recognition conditions were committing a contextually related error, committing a contextually unrelated error, and committing no false recognition error. Though these three conditions are not independent, they provide an interesting way of examining the results. In general, there was little difference in target recognition as a function of word generation. Subjects who generated words recognized targets as well as those who did not generate words (87% and 84% respectively), $\underline{F}(1,76) = .90$, $\underline{p} > .05$. Also, foil false recognition condition failed to influence target recognition. When subjects incorrectly recognized contextually related foils, they recognized targets 89% of the time. When subjects incorrectly recognized contextually unrelated foils, they recognized related targets 86% of the time. And when subjects did not commit false recognition errors, they correctly recognized targets 82% of the time. Foil false recognition did not significantly influence proportion correct recognition of targets, $\underline{F}(2,76) = 2.24$, $\underline{p} > .05$.

CHAPTER III

Experiment II

Method

Subjects. Forty adult subjects, half male and half female, were drawn from introductory psychology classes at the University of Massachusetts. Subjects volunteered to participate for one extra credit point. The subjects read a short letter briefly explaining the nature of the study, and then were asked to sign a consent form. The subjects ranged in age from 17 years, nine months to 32 years, with a mean age of 20 years, seven months. Three subjects (not included with the 40 subjects mentioned above) were eliminated; one male because of failure to return for the recognition test, and a male and female because of failure to circle 40 words on the recognition test.

Materials. The materials from Experiment I were also used in this experiment. The word frequencies for adults were obtained from Kučera and Nelson (1967), and the means and standard errors for each type of word are listed in Table 3. The means and standard errors for the two foil types were quite similar, while the mean and standard error for the target-no words were slightly higher and the mean and standard error for the target-yes words were slightly lower.

T-tests again failed to reveal significant differences between the means of any of the types of words.

Procedure. Subjects were all seen in groups of one to ten in a university classroom. The procedure was essentially the same as that used in Experiment I, except that the inter-task interval was 24 hours for the adults. This longer interval was selected to increase the likelihood that adult subjects would commit errors on the recognition test (see Perlmutter & Myers, 1976).

Results

Since only one adult population was used, no preliminary analysis was necessary to test population differences. All other data analyses were the same as those carried out in Experiment I for third grade subjects.

Incidental orienting task.

Proportion correct orienting question responses. The accuracy of responding to affirmative and negative orienting questions was quite high (.98 and 1.0 respectively). Both males and females performed at similarly high levels of accuracy (.99 each), and subjects also responded at similar levels of accuracy to questions from orienting lists 1 and 2 (.98 and .99 respectively). Subjects who simply responded to orienting questions were as accurate as those who also generated words during the incidental learning task (.99 each), and there was very little difference in performance across trial blocks (.99, 1.0, .98, .98). No adult made more than three errors, and the modal number of incorrect responses was zero. Adults had very little difficulty responding to orienting questions during the incidental learning task, resulting in limited variability. Thus, no inferential statistics were carried out on these data.

Word generation during the orienting task. Twenty adults were instructed to generate words during the incidental learning task, as well as answer orienting questions. All of these subjects generated an average of 2.925 (SD = .784) words per orienting question. Adults generated an average of 83.5% of the expected (or contextually related) foils, and 87% of the foils generated by the subjects were expected foils.

Recognition memory test.

Proportion correct recognition of targets. Adults were fairly accurate in recognizing target words during the recognition test (.75). However, as can be seen in Figure 4, accuracy of recognition memory did vary as a function of order. Subjects recognized more targets seen in the beginning and end of the orienting list than those seen in the middle of the list. The blocks of trials effect

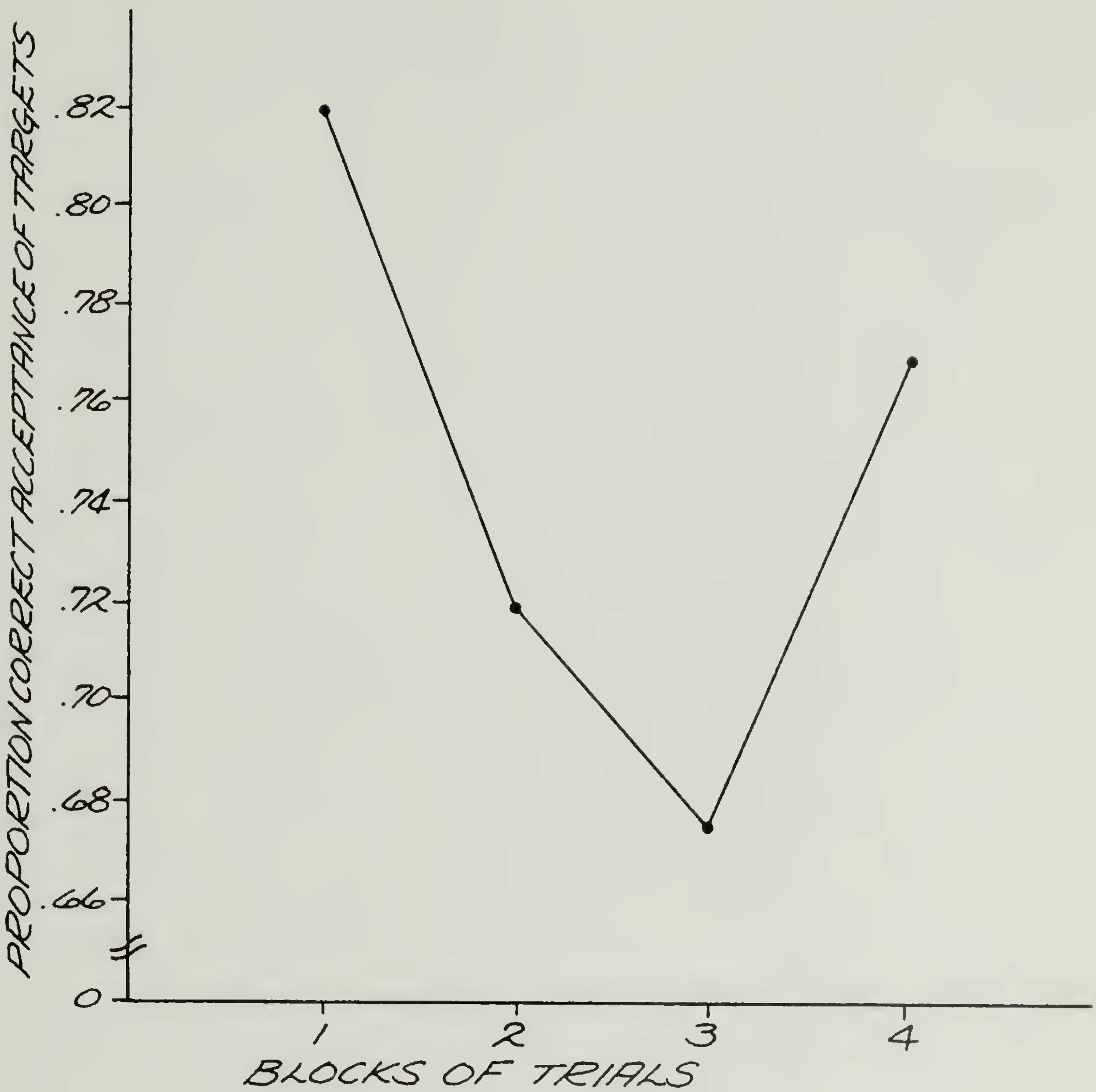

Figure 4. Proportion of target words correctly accepted by adults as a function of blocks of trials.

was found to be significant, $F(3,96) = 10.05$, $p < .001$ (see Appendix E, Table 8), and after applying the correction, the effect was significant ($p < .005$). Newman-Keuls post-hoc tests revealed that subjects recognized more words presented in block 1 than in block 2 and block 3 ($p < .01$). Also, subjects recognized more words learned in block 4 than in block 3 ($p < .01$). As was the case for third grade subjects, primacy-recency characterized the effect of order on recognition memory. Additionally, sex and word generation interacted with blocks, $F(3,96) = 3.75$, $p < .05$, although when the correction was applied, the result was insignificant.

In summary, the proportion correct recognition of target words was influenced by the order in which adults saw words during the incidental learning task. Words seen in the beginning and end of the orienting list were recognized better than words seen in the middle of the list. No other factors significantly influenced the target recognition of adult subjects.

Proportion correct rejection of foils. A major finding of interest concerning the rejection of foils was the interaction between orienting list and type of foil. When subjects received orienting list 1 during the incidental learning task, they correctly rejected more orienting list 2-related foils than orienting list 1-related foils (.79 and

.76 respectively), and when subjects received orienting list 2, they correctly rejected more orienting list 1-related foils than orienting list 2-related foils (.76 and .69 respectively). The orienting list by type of foil interaction was found to be significant, $F(1,32) = 5.47$, $p < .05$ (see Appendix E, Table 9). Word generation also influenced the correct rejection of orienting list 1-related foils and orienting list 2-related foils. Specifically, subjects who did not generate words during the learning task rejected more orienting list 2-related foils than orienting list 1-related foils (.76 and .72 respectively), while subjects who generated words during the incidental learning task rejected more orienting list 1-related foils than orienting list 2-related foils (.80 and .72 respectively). This two-way interaction was also found to be significant, $F(1,32) = 5.98$, $p < .025$.

Orienting list, word generation, and type of foil combined to influence the correct rejection of foils. As can be seen in Figure 5, subjects who did not generate words in orienting list 1 correctly rejected more orienting list 2-related foils than orienting list 1-related foils. Moreover, subjects who simply answered orienting questions in list 2 correctly rejected more orienting list 1-related foils than orienting list 2-related foils. These results support the prediction that the context specified by an

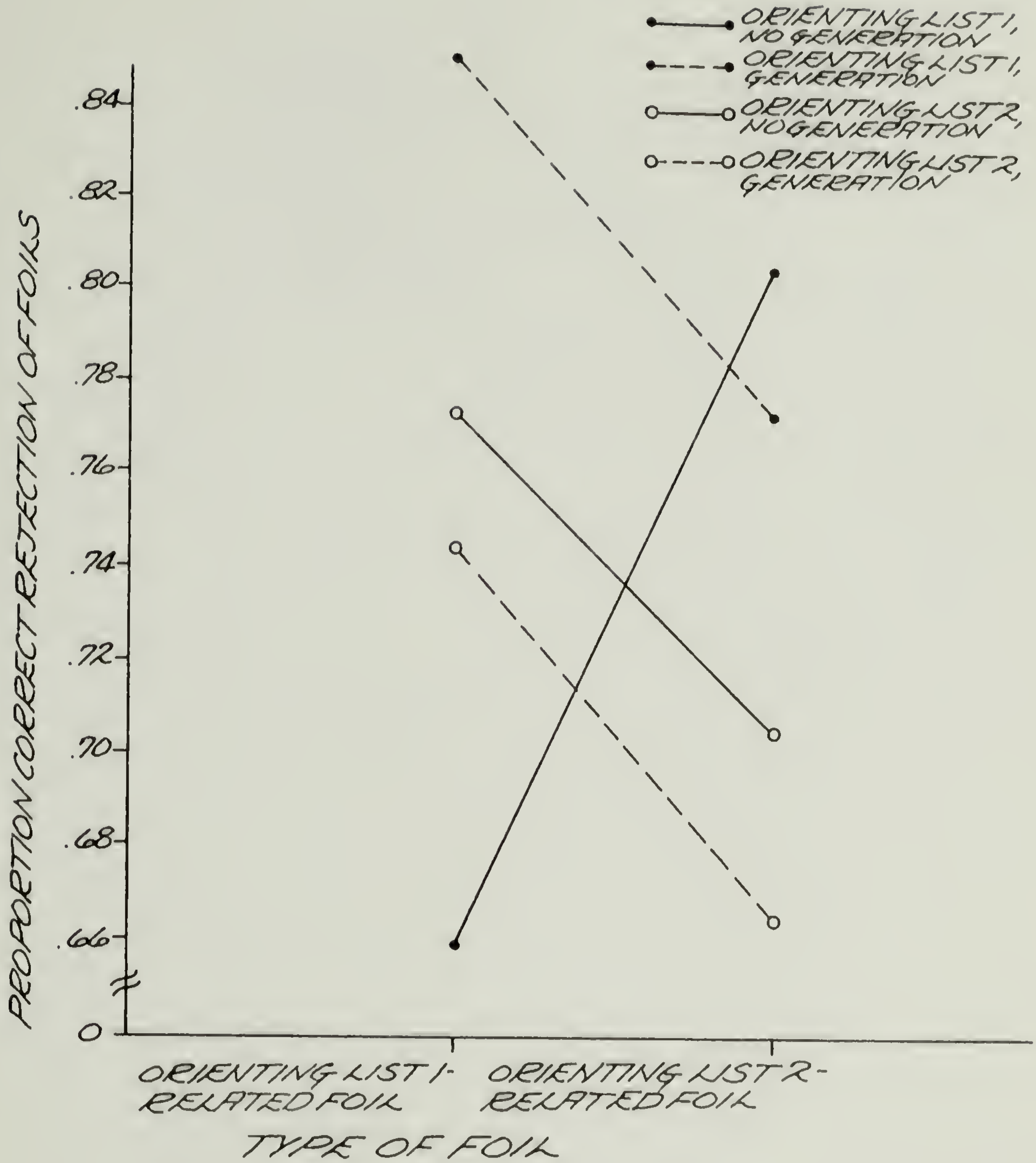

Figure 5. Proportion of types of foils correctly rejected by adults who received orienting list 1 or 2 in word generation and no word generation conditions.

orienting question should influence the types of recognition errors adults make. In contrast, subjects who generated words in either orienting list 1 or orienting list 2 correctly rejected more orienting list 1-related than orienting list 2-related foils. Thus, contrary to expectations, adults who generated words in orienting list 1 failed to correctly reject more orienting list 2-related foils than orienting list 1-related foils. The orienting list by word generation by type of foil interaction was found to be significant, $F(1,32) = 4,98$, $p < .05$. When Newman-Keuls post-hoc tests were carried out to further examine the three-way interaction, it was found that subjects who simply answered questions in orienting list 1 correctly rejected more orienting list 2-related foils than orienting list 1-related foils (14.5% more, $p < .01$). The other differences between foil types, however, failed to reach significance.

The patterns of false recognition errors committed by subjects were examined to provide further support for the interaction of orienting list, word generation, and type of foil. When adults simply answered questions in orienting list 1, eight of them incorrectly recognized more orienting list 1-related foils (contextually related foils) than orienting list 2-related foils (contextually unrelated foils), and two incorrectly recognized an equal number of orienting list 1 and orienting list 2-related foils. Also, of subjects who simply answered questions in orienting list 2, six incorrectly recognized more orienting list 2-related foils (contextually related foils) than orienting list 1-related foils (contextually unrelated foils), and four incorrectly recognized more contextually unrelated foils than contextually related foils. However, of subjects who generated words in orienting list 1, two incorrectly recognized more orienting list 1-related (contextually related) foils than orienting list 2-related foils (contextually unrelated foils), and eight incorrectly recognized more contextually unrelated foils than contextually related foils. When subjects generated foils in orienting list 2, seven falsely recognized more contextually related foils than contextually unrelated foils, and three subjects falsely recognized more contextually unrelated foils than contextually related foils.

Proportion correct rejection of types of foils also appeared to interact with trial block, $\underline{F}(3,96) = 3.12$, $\underline{p} < .05$, although following the correction procedure, the interaction was not significant. Additionally, sex interacted with block and foil type, $\underline{F}(3,96) = 3.10$, $\underline{p} < .05$; however, this interaction was not significant after the correction procedure was applied.

To summarize, the analysis of the proportion correct rejection of foils revealed that orienting question context influenced the types of false recognition errors that adults made. Also, word generation condition appeared to influence the kind of false recognition errors committed. However, since word generation, orienting list, and type of foil combined to influence false recognition, this result was the most important. False recognition errors appeared to be influenced by orienting question context when the adults were asked simply to answer orienting questions. However, when adults were instructed to generate words in addition to answering questions, the false recognition errors were no longer influenced by the context of the orienting question. No other results were significant following the correction.

Foil generation and proportion false recognition of foils. Words generated by adult subjects were also examined to determine whether or not the generation of foil words influenced the false recognition of foils. To determine this, a repeated measures analysis of variance was computed (see Appendix E, Table 10). In general, it was found that adult subjects incorrectly recognized foils that they generated during the incidental learning task as often as the foils they did not generate (.25 and .24 respectively). The foil generation effect was found to be nonsignificant, $F(1,19) = .47$, $p > .05$. Thus, it appears that foil generation did not increase the likelihood that a foil would be incorrectly recognized by adults.

When the false recognition errors of subjects who generated words were compared with those committed by subjects who simply answered orienting questions, no differences were found. The proportion incorrect recognition of foils by subjects who generated them was equivalent to the proportion false recognition of foils by subjects who simply answered questions (.25 and .26 respectively). Also, the proportion incorrect recognition of foils by subjects who failed to generate those foils during the learning task was found to be similar to the proportion false recognition of foils by subjects who simply responded to orienting questions (.24 and .26 respectively). Both differences were nonsignificant, $t(38) = .39$, $p > .05$ and $t(38) = .60$, $p > .05$. Thus, generation of foils again failed to influence the false recognition errors committed by adults.

Of the adults who generated words during the incidental learning task, nine incorrectly recognized more contextually related foils than contextually unrelated foils, and 11 falsely recognized more contextually unrelated foils than contextually related foils. By comparing the influence of foil generation on the false recognition errors committed by adults who incorrectly recognized more contextually related foils with the influence of foil generation on the false recognition errors of adults who incorrectly recognized more contextually unrelated foils, differences in the test-taking approaches of these two groups of adults could be revealed. In general, those nine subjects who incorrectly recognized more contextually related foils incorrectly recognized more foils that they generated than the 11 subjects who incorrectly recognized more contextually unrelated foils (.40 and .12 respectively). This difference was significant, $\underline{t}(18) = 5.19$, $\underline{p} < .05$. However, subjects who incorrectly recognized more contextually related foils incorrectly recognized foils that they did not generate as often as subjects who incorrectly recognized more contextually unrelated foils (.20 and .27 respectively), $\underline{t}(18) = 1.04$, $\underline{p} > .05$. Additionally, subjects who incorrectly recognized more contextually related foils falsely recognized more generated foils than foils that were not generated by them during the incidental learning task (.40 and .20 respectively). This difference was tested using Hotelling's $\underline{T}^2$, and was found to be significant, $\underline{T}^2(1,8) = 27.63$, $\underline{p} < .001$. However, when subjects incorrectly recognized more contextually unrelated foils than contextually related foils, they incorrectly recognized more foils that were not generated than foils that were generated during the learning task (.27 and .12 respectively), $\underline{T}^2(1,10) = 21.49$, $\underline{p} < .001$.

Thus, it appears that the false recognition errors committed by adults who incorrectly recognized more contextually related foils were increased by the generation of those foils during the learning task. However, the false recognition errors of adults who incorrectly recognized more contextually unrelated foils were decreased by the generation of those foils during the learning task.

In summary, the false recognition errors of adults were not influenced by the generation of those foils overall. However, when adults were divided into two groups, those who incorrectly recognized more contextually related foils and those who incorrectly recognized more contextually unrelated foils, a relationship between foil generation and false recognition became apparent. Subjects who incorrectly recognized more contextually related foils incorrectly recognized more generated foils, and subjects who incorrectly recognized more contextually unrelated foils incorrectly recognized more foils that were not generated during the learning task.

<u>False recognition of foils and proportion correct recognition of targets.</u> When adults commit false recognition errors, there could be some relationship between these errors and the correct recognition of related target words. If they were aware of the relationships between targets and foils; then if they were applying test-taking strategies,

they would have avoided the related foil if they had selected the target word on the recognition memory test (or vice versa). A 2 (word generation) by 20 (subject) by 3 (foil false recognition) analysis of variance with repeated measures on the last factor was computed to determine whether the false recognition of foils influenced the correct recognition of targets (see Appendix E, Table 11). In general, it was found that word generation failed to significantly influence target recognition. Subjects who generated words were as accurate at target recognition as those who did not generate words (72 % and 73% respectively), $F(1,76) = .03$, $p > .05$. Adults correctly recognized fewer targets when they incorrectly recognized contextually related foils (66%) than when they incorrectly recognized contextually unrelated foils (75%) or when they did not commit false recognition errors (76%). Foil false recognition did significantly influence the correct recognition of target words, $F(2,76) = 3.18$, $p < .05$. Newman-Keuls tests revealed that subjects correctly recognized more targets when they incorrectly recognized contextually unrelated foils than when they incorrectly recognized contextually related foils ($p < .05$). Also, subjects correctly recognized more targets when they did not commit any false recognition errors than when they incorrectly recognized contextually related foils ($p < .05$). Though the three false recognition conditions were not independent, they provided some evidence that adults were aware of the relationship between contextually related foils and the target words.

CHAPTER IV

DISCUSSION

The Effects of Context and Word Generation

Past research (Coltheart, 1977, Davies & Cubbage, 1976) has demonstrated that orienting question context influences the false recognition errors committed by adults and adolescents. The present study attempted to determine whether orienting question context influences the false recognition errors committed by nine-year-olds as well. In general, Experiments I and II showed that orienting question context did affect which foils were correctly rejected by adults and children. More specifically, when subjects encoded a word in the context of a given orienting question, the foil that was contextually related to the target word via that orienting question was correctly rejected less often than the contextually unrelated foil. This result was predicted based on the assumption that the memory trace retrieved from episodic memory during the recognition test contained contextual information, derived from the semantic network when the target was encoded (Barclay, Bransford, Franks, McCarrell, & Nitsch, 1974, Ceci & Howe, 1978, Tulving & Thomson, 1973). However, since word generation condition influenced the false recognition errors of adults differently than those of children, any general statement concerning context effects on false recognition errors of adults and children must be qualified. When third graders simply responded to orienting questions during the learning task, they failed to incorrectly recognize more contextually related foils. Yet, when they were asked to generate words during the learning task, they incorrectly recognized more contextually related foils. Adults, on the other hand, committed more contextual false recognition errors after simply answering orienting questions. However, when they generated words in addition to answering questions, they no longer incorrectly recognized more contextually related foils.

Two hypotheses are suggested to explain why word generation influenced the recognition errors of nine-year-olds differently than those of adults. The first proposes that the age differences occurred because adults were more elaborate processors than the children, and were thus more likely to be influenced by encoding context when asked simply to answer orienting questions. The other hypothesis suggests that adults utilized test-taking strategies which were unavailable to the nine-year-olds. Also, since the only procedural difference between Experiments I and II was delay time, the influence of this variable on the false recognition errors of adults and children will be considered.

When nine-year-olds simply answered orienting questions during the incidental learning task, they did not incorrectly recognize more contextually related foils; whereas, adults who only answered orienting questions were influenced by encoding context to incorrectly recognize more contextually related foils. This result may have occurred because adults processed target words more elaborately than the children during the learning task, and were thus more influenced by encoding context on the recognition memory test. Paris and Lindauer (1976) found that nine-year-olds often failed to thoroughly process stimuli in an experimental setting; not because they lacked the knowledge to encode the stimuli thoroughly or the ability to completely process the stimuli, but rather because they lacked the strategy or the motivation to encode as elaborately as an adult would. The nine-year-olds of the present study, when simply asked to answer orienting questions, may have encoded stimuli only elaborately enough to answer orienting questions accurately. However, when children generated words during the learning task, they may have encoded targets more thoroughly because they had to spend more time thinking about the target and contextually related words, and thus incorrectly recognized more contextually related foils on the recognition test. Since children who generated words answered orienting questions more accurately than those who did not (.98 and .95 respectively), it is likely that when children were asked to generate words, they processed the target words more elaborately than those who simply answered questions. Since the word generators were more likely to contextually encode the targets, they were also likely to incorrectly recognize contextually related foils more frequently than contextually unrelated foils.

Because the current study utilized an incidental learning task, intentional learning strategy differences probably do not account for the age differences in elaborateness of encoding. Rather, age differences may have occurred for two other reasons; that is differences in semantic memory development or differences in motivation (perhaps caused by the adult's awareness of the possibility of a memory test and thus may have involved strategy differences). With respect to the latter, adults were significantly more accurate at answering orienting questions than children (.99 and .96 respectively), $\underline{t}(78) = 3.60$, $\underline{p} < .05$, and they also generated more words during the learning task when they were asked to (2.93 and 1.97 words per question respectively), $\underline{t}(38) = 4.67$, $\underline{p} < .05$. Thus, it is likely that the adults were more motivated to perform well during the incidental learning task, and were also more motivated to encode the target words elaborately. Additionally, the adults may have been more aware of the impending memory test because they had some knowledge of basic psychology; whereas, the children lacked such knowledge. In contrast, third graders could have failed to incorrectly recognize more contextually related foils because they lacked appropriate semantic knowledge. This explanation, however, seems unlikely since children in the present study had the knowledge necessary to answer orienting questions and to generate words when asked to. On the other hand, since they did not generate expected foils as often as the adults during the incidental learning task (70% and 83.5% respectively), these children may have had a less well developed semantic system. However, since the children did generate more expected foils than other types of foils, it seems more likely that the nine-year-olds contextually encoded stimuli when they were asked to generate words during the incidental learning task. When they simply answered questions, they probably failed to contextually encode stimuli because they processed the stimuli only elaborately enough to answer the questions. Adults, on the other hand, being more motivated to perform well during the learning task, did process the target words contextually when simply asked to answer orienting questions. Yet this hypothesis does not account for why adults, when asked to generate words in addition to answering orienting questions, failed to incorrectly recognize more contextually related foils.

The second hypothesis suggests that third graders and adults used different test-taking strategies during the recognition memory test. Third graders probably chose words based on some sort of familiarity criterion. Thus, when asked to simply answer orienting questions, they were not any more familiar with the contextually related foils than the contextually unrelated foils since neither were seen during the learning task. However, children who generated words during the learning task incorrectly recognized more contextually related foils than contextually unrelated foils. If these children selected words on the recognition test based on familiarity, generated foils should have been incorrectly recognized more frequently than ungenerated foils. In fact, it was found that when children generated foils, they incorrectly recognized those words more often than foils that they did not generate. Since most of the foils generated by children were expected or contextually related foils (91% of the generated foils), it is easy to understand why the children who generated words incorrectly recognized more contextually related foils based on the familiarity of those words.

Adults, on the other hand, may have employed more sophisticated test-taking strategies. For instance, if an adult could not recognize any more targets on the recognition memory test, he or she could have attempted to recall orienting questions to aid in word selection. This should have increased the likelihood that an adult who simply answered orienting questions would incorrectly recognize more contextually related foils, since he or she would be selecting words based on encoding context. However, because adults who generated words during the incidental learning task failed to incorrectly recognize more contextually related foils than contextually unrelated foils, this orienting question retrieval strategy does not adequately account for all of the results. Other test-taking strategies may account for this finding.

Ceci and Howe (1978) have proposed that adolescents (and thus adults) are more likely than children under ten to apply sophisticated test-taking strategies to perform well on a memory test. Evidence that adults applied more sophisticated strategies than nine-year-olds comes from examining the relationship between foil false recognition and target recognition. Adults correctly recognized fewer targets after incorrectly recognizing contextually related foils; whereas, children's target recognition was uninfluenced by foil false recognition (though there was a tendency to correctly recognize more targets after incorrectly recognizing contextually related foils). Thus, there is some evidence that the adults were aware of the relationships between words on the recognition test, and thus were more likely to apply sophisticated test-taking strategies during the memory test. Children, however, appeared to choose words based on familiarity, without concern for the possible relationship between foils and targets.

Adults who generated words during the learning task did not incorrectly recognize more contextually related foils than contextually unrelated foils. Also, unlike nine-year-olds who generated foils, the false recognition errors of adults were not influenced by foil generation. Some adults may have remembered generating foils found on the recognition test, and to increase the likelihood of selecting only the 40 targets, eliminated those generated (and usually contextually related) foils as recognition choices. In fact, several of the adults in the present study reported using this strategy. Other adults may not have actively avoided words that were generated, and were influenced by encoding context to incorrectly recognize more contextually related foils. If these two test-taking approaches were used by adults, the lack of relationship between foil generation and the false recognition of those foils would be expected. There is some evidence that adults used either one or the other of these two strategies after generating words. Of the adults who generated words during the learning task, nine incorrectly recognized more contextually related foils than contextually unrelated foils and 11 incorrectly recognized contextually unrelated foils more frequently. If one examines the relationship between foil generation and the false recognition of those foils in subjects who committed more contextual false recognition errors and in subjects who committed more noncontextual false recognition errors, evidence for two test-taking approaches becomes apparent. Adults who committed more contextual errors were more likely to incorrectly recognize generated foils than foils that they did not generate. However, when adults incorrectly recognized contextually unrelated foils more frequently than contextually related foils, they were more likely to incorrectly recognize foils that were not generated than generated foils. Thus, it is reasonable to assume that adults who generated words failed to commit more contextually related errors because some employed a strategy which minimized contextual errors while others employed a strategy which made contextual errors more likely.

In summary, two possibly complementary explanations were offered to explain the findings that recognition errors of adults and children were influenced by word generation conditions in different ways. The first proposed that adults, being more motivated in experimental tasks, encoded stimuli more elaborately than children. The other suggested that the age differences occurred because adults utilized test-taking strategies which were unavailable to the nine-year-olds. Either approach explains why children who generated words were more likely to commit contextual errors, why children who simply answered orienting questions failed to commit more contextual errors, and why adults who simply answered orienting questions were more likely to commit contextually related false recognition errors. However, the performance of the adults who generated words can best be explained by a test-taking strategy notion.

Additional experimental research is needed to further determine the contributions of test-taking strategy and/or elaborative encoding differences to explain age differences in performance. To determine whether encoding elaboration is responsible for the differences between adults and children who simply answered orienting questions, a similar experiment could be conducted in which the processing time of the adults would be constrained while the children would be encouraged to encode the targets contextually (given as much time as necessary). To examine the influence of test-taking strategies, some sort of strategy questionnaire could be given after the recognition test. This could reveal age differences in the use of test-taking strategies and could determine whether the recognition errors of adults who generated words were influenced in different ways by the use of certain test-taking approaches.

Other Findings

Third grade children were more accurate in correctly recognizing target words than the college students (.83 and .75 respectively), $t(78) = 3.82$, $p < .05$. This result was probably obtained because the adults had a delay of 24 hours between the incidental learning task and the recognition memory test, while the nine-year-olds had only a four hour delay. Thus, the adult's memory traces for the target words were probably more deteriorated than those of the children. Decay in the episodic trace could have resulted in a memory trace which contained the contextual meaning of the target without a clear representation of the actual target word. Thus, adults were more likely to commit false recognition errors than children, and also the adult's errors were more likely to be contextually related to the target words.

In the present study, it was predicted that the type of orienting question (affirmative or negative) should not influence whether or not a target word is correctly recognized. The negative questions that were selected required that subjects consider the meaning of the target words to respond correctly. It was believed that this should minimize the differences between the effectiveness of affirmative and negative orienting questions. Adult subjects correctly recognized targets equivalently following negative and affirmative orienting questions. In contrast, children were influenced by the type of orienting question; they rcognized more targets following affirmative questions than following negative questions. However, when the children encoded targets with orienting list 1, there were no differences between the memory of target-yes and target-no words. Subjects recognized targets better when they were encoded with affirmative questions only after receiving orienting list 2. Since the third graders were not consistently influenced by the type of orienting question, it may be concluded that this factor did not strongly influence the target recognition of children and adults. However, further experimental investigation of this issue must be conducted before firm conclusions can be drawn. In the present study, the same words were always associated with negative questions and other words were always associated with affirmative questions (no counterbalancing of the word-question pairings). By counterbalancing word-question associations, a clearer picture of positive versus negative question effects could be obtained. Levels of meaningfulness of negative orienting questions could also be manipulated. By investigating more than one type of negative question, the mechanism which determines the accuracy of recognition memory could be better understood.

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APPENDIX A

ORIENTING LIST BOOKLETS

This appendix contains two sets of orienting list booklets. The first set consists of orienting list 1 and orienting list 2 booklets for subjects who were instructed to simply respond to orienting questions. The other set consists of orienting list 1 and orienting list 2 booklets for subjects who generated words in addition to answering orienting questions.

Number________________________________ Age__________________

Birthdate_________________ Sex ___________Orienting List 1

ROCK	Does this float on water?	yes	no
TIGER	Is this an animal that roars?	yes	no
KNIFE	Is this something used when you eat dinner?	yes	no
SINK	Is this found in the kitchen?	yes	no
THIEF	Is this an honest person?	yes	no
GRAPEFRUIT	Is this a round fruit?	yes	no
HOSPITAL	Is this a place to have fun?	yes	no
HILL	Is this something flat?	yes	no
SNOW	Is this something that falls from the clouds?	yes	no
BASEBALL	Is this a sport in which a ball is hit with something?	yes	no
CAVE	Is this a good place to get a tan?	yes	no
WATCH	Is this something women can wear on their wrists?	yes	no
SMILE	If this a way people show they are happy?	yes	no
KEY	Is this usually made of plastic?	yes	no
ROBOT	Is this alive?	yes	no
THREAD	Is this sometimes used in sewing?	yes	no
DUST	Is this something you put on food?	yes	no
SOFA	Is this furniture people lie on?	yes	no
KNEE	Is this part of an arm?	yes	no
LAND	Is this a place to swim?	yes	no

COMB	Is this something used in cooking?	yes	no
WOOD	Is this sometimes used to make buildings?	yes	no
NUMBERS	Is this something studied in reading class?	yes	no
JUICE	Is this drink good for you?	yes	no
LAWN	Is this part of a room?	yes	no
RATTLE	Is this something adults play with?	yes	no
MOTORCYCLE	Does this have two wheels?	yes	no
YEAR	Is this a season?	yes	no
VIOLIN	Is this a musical instrument that has strings?	yes	no
BROWN	Is this a hair color?	yes	no
TRIANGLE	Does this have four sides?	yes	no
CHRISTMAS	Is this a day people get gifts?	yes	no
HAM	Is this a vegetable?	yes	no
TRAILER	Is this a place to live?	yes	no
FRIEND	Is this something you dislike?	yes	no
CACTUS	Is this found in the desert?	yes	no
MAGAZINE	Is this something you can read stories in?	yes	no
COTTON	Is this something that is hard?	yes	no
WASP	Is this a black insect?	yes	no
GARBAGE	Does this smell good?	yes	no

Number______________________________ Age______________________

Birthdate______________________ Sex_________ Orienting List 2

ROCK	Does this float on water?	yes	no
TIGER	Is this an animal that has stripes?	yes	no
KNIFE	Is this something that cuts?	yes	no
SINK	Is this found in the bathroom?	yes	no
THIEF	Is this an honest person?	yes	no
GRAPEFRUIT	Is this a yellow fruit?	yes	no
HOSPITAL	Is this a place to have fun?	yes	no
HILL	Is this something flat?	yes	no
SNOW	Is this something that is frozen?	yes	no
BASEBALL	Is this a sport in which teams play against one another?	yes	no
CAVE	Is this a good place to get a tan?	yes	no
WATCH	Is this something used to tell time?	yes	no
SMILE	Is this a facial expression?	yes	no
KEY	Is this usually made of plastic?	yes	no
ROBOT	Is this alive?	yes	no
THREAD	Is this something that can be tied in knots?	yes	no
DUST	Is this something you put on food?	yes	no
SOFA	Is this furniture people sit on?	yes	no
KNEE	Is this part of an arm?	yes	no
LAND	Is this a place to swim?	yes	no
COMB	Is this something used in cooking?	yes	no

WOOD	Is this something that burns?	yes	no
NUMBERS	Is this something studied in reading class?	yes	no
JUICE	Is this drink sweet tasting?	yes	no
LAWN	Is this part of a room?	yes	no
RATTLE	Is this something adults play with?	yes	no
MOTORCYCLE	Does this run on gasoline?	yes	no
YEAR	Is this a season?	yes	no
VIOLIN	Is this a musical instrument used in an orchestra?	yes	no
BROWN	Is this an eye color?	yes	no
TRIANGLE	Does this have four sides?	yes	no
CHRISTMAS	Is this a holiday?	yes	no
HAM	Is this a vegetable?	yes	no
TRAILER	Is this a place to stay while traveling?	yes	no
FRIEND	Is this something you dislike?	yes	no
CACTUS	Is this a plant?	yes	no
MAGAZINE	Is this something that comes in the mail?	yes	no
COTTON	Is this something that is hard?	yes	no
WASP	Is this a stinging insect?	yes	no
GARBAGE	Does this smell good?	yes	no

Number ______________________________ Age________________

Birthdate ________________ Sex ___________ Orienting List 1

ROCK	Does this float on water?	yes no
	List some things that float on water.	
	______________________________	
TIGER	Is this an animal that roars?	yes no
	List some animals that roar.	
	______________________________	
KNIFE	Is this something used when you eat dinner?	yes no
	List some things used when you eat dinner.	
	______________________________	
SINK	Is this found in the kitchen?	yes no
	List some things found in the kitchen.	
	______________________________	
THIEF	Is this an honest person?	yes no
	List some honest people.	
	______________________________	

GRAPEFRUIT	Is this a round fruit? List some round fruit. ________________________________	yes no
HOSPITAL	Is this a place to have fun? List some places to have fun. ________________________________	yes no
HILL	Is this something flat? List some flat things. ________________________________	yes no
SNOW	Is this something that falls from the clouds? List some things that fall from the clouds. ________________________________	yes no
BASEBALL	Is this a sport in which a ball is hit with something? List some sports in which a ball is hit with something. ________________________________	yes no
CAVE	Is this a good place to get a tan? List some good places to get a tan. ________________________________	yes no

WATCH	Is this something that women can wear on their wrists?	yes	no
	List some things that women can wear on their wrists. ______		
SMILE	Is this a way people show they are happy?	yes	no
	List some ways people show they are happy. ______		
KEY	Is this usually made of plastic?	yes	no
	List some things usually made of plastic. ______		
ROBOT	Is this alive?	yes	no
	List some things that are alive. ______		
THREAD	Is this sometimes used in sewing?	yes	no
	List some things sometimes used in sewing. ______		
DUST	Is this something you put on food?	yes	no
	List some things you put on food. ______		

SOFA	Is this furniture people lie on?	yes	no
	List some furniture people lie on.		
	________________________________		
KNEE	Is this part of an arm?	yes	no
	List some parts of an arm.		
	________________________________		
LAND	Is this a place to swim?	yes	no
	List some places to swim.		
	________________________________		
COMB	Is this something used in cooking?	yes	no
	List some things used in cooking.		
	________________________________		
WOOD	Is this something used to make buildings?	yes	no
	List some things sometimes used to make buildings.		
	________________________________		
NUMBERS	Is this something studied in reading class?	yes	no
	List some things studied in reading class.		
	________________________________		

JUICE	Is this drink good for you?	yes no
	List some drinks that are good for you.	
	______________________________	
LAWN	Is this part of a room?	yes no
	List some parts of a room.	
	______________________________	
RATTLE	Is this something adults play with?	yes no
	List some things adults play with.	
	______________________________	
MOTORCYCLE	Does this have two wheels?	yes no
	List some things that have two wheels.	
	______________________________	
YEAR	Is this a season?	yes no
	List some seasons.	
	______________________________	
VIOLIN	Is this a musical instrument that has strings?	yes no
	List some musical instruments that have strings.	
	______________________________	

BROWN	Is this a hair color? List some hair colors. ______________________	yes no
TRIANGLE	Does this have four sides? List some things that have four sides. ______________________	yes no
CHRISTMAS	Is this a day people get gifts? List some days that people get gifts. ______________________	yes no
HAM	Is this a vegetable? List some vegetables. ______________________	yes no
TRAILER	Is this a place to live? List some places to live. ______________________	yes no
FRIEND	Is this something you dislike? List some things you dislike. ______________________	yes no

CACTUS	Is this found in the desert?	yes	no
	List some things found in the desert.		
	________________________________		
MAGAZINE	Is this something you can read stories in?	yes	no
	List some things you can read stories in.		
	________________________________		
COTTON	Is this something that is hard?	yes	no
	List some things that are hard.		
	________________________________		
WASP	Is this a black insect?	yes	no
	List some black insects.		
	________________________________		
GARBAGE	Does this smell good?	yes	no
	List some things that smell good.		
	________________________________		

Number__________________________ Age_________________________

Birthdate_________________ Sex____________ Orienting List 2

ROCK	Does this float on water?	yes	no
	List some things that float on water.		
	______________________________________		
TIGER	Is this an animal that has stripes?	yes	no
	List some animals that have stripes.		
	______________________________________		
KNIFE	Is this something that cuts?	yes	no
	List some things that cut.		
	______________________________________		
SINK	Is this found in the bathroom?	yes	no
	List some things found in the bathroom.		
	______________________________________		
THIEF	Is this an honest person?	yes	no
	List some honest people.		
	______________________________________		

GRAPEFRUIT	Is this a yellow fruit? List some yellow fruit. ____________________________________	yes	no
HOSPITAL	Is this a place to have fun? List some places to have fun. ____________________________________	yes	no
HILL	Is this something flat? List some flat things. ____________________________________	yes	no
SNOW	Is this something that is frozen? List some things that are frozen. ____________________________________	yes	no
BASEBALL	Is this a sport in which teams play against one another? List some sports in which teams play against one another. ____________________________________	yes	no
CAVE	Is this a good place to get a tan? List some good places to get a tan. ____________________________________	yes	no

WATCH	Is this something used to tell time?	yes	no
	List some things used to tell time.		
	______________________________		
SMILE	Is this a facial expression?	yes	no
	List some facial expressions.		
	______________________________		
KEY	Is this usually made of plastic?	yes	no
	List some things usually made of plastic.		
	______________________________		
ROBOT	Is this alive?	yes	no
	List some things that are alive.		
	______________________________		
THREAD	Is this something that can be tied in knots?	yes	no
	List some things that can be tied in knots.		
	______________________________		
DUST	Is this something you put on food?	yes	no
	List some things you put on food.		
	______________________________		

SOFA	Is this furniture people sit on?	yes	no
	List some furniture people sit on.		
	______________________________		
KNEE	Is this part of an arm?	yes	no
	List some parts of an arm.		
	______________________________		
LAND	Is this a place to swim?	yes	no
	List some places to swim.		
	______________________________		
COMB	Is this something used in cooking?	yes	no
	List some things used in cooking.		
	______________________________		
WOOD	Is this something that burns?	yes	no
	List some things that burn.		
	______________________________		
NUMBERS	Is this something studied in reading class?	yes	no
	List some things studied in reading class.		
	______________________________		

JUICE	Is this drink sweet tasting?	yes	no
	List some sweet tasting drinks.		
	___________________________		
LAWN	Is this part of a room?	yes	no
	List some parts of a room.		
	___________________________		
RATTLE	Is this something adults play with?	yes	no
	List some things adults play with.		
	___________________________		
MOTORCYCLE	Does this run on gasoline?	yes	no
	List some things that run on gasoline.		
	___________________________		
YEAR	Is this a season?	yes	no
	List some seasons.		
	___________________________		
VIOLIN	Is this a musical instrument used in an orchestra?	yes	no
	List some musical instruments used in an orchestra.		
	___________________________		

BROWN	Is this an eye color?	yes	no
	List some eye colors.		
	______________________________		
TRIANGLE	Does this have four sides?	yes	no
	List some things that have four sides.		
	______________________________		
CHRISTMAS	Is this a holiday?	yes	no
	List some holidays.		
	______________________________		
HAM	Is this a vegetable?	yes	no
	List some vegetables.		
	______________________________		
TRAILER	Is this a place to stay while traveling?	yes	no
	List some places to stay while traveling.		
	______________________________		
FRIEND	Is this something you dislike?	yes	no
	List some things you dislike.		
	______________________________		

CACTUS	Is this a plant?	yes	no
	List some plants.		
	______________________________		
MAGAZINE	Is this something that comes in the mail?	yes	no
	List some things that come in the mail.		
	______________________________		
COTTON	Is this something that is hard?	yes	no
	List some things that are hard.		
	______________________________		
WASP	Is this a stinging insect?	yes	no
	List some insects that sting.		
	______________________________		
GARBAGE	Does this smell good?	yes	no
	List some things that smell good.		
	______________________________		

APPENDIX B

SAMPLE RECOGNITION MEMORY TEST

This appendix contains an example of one of the 40 randomized recognition memory tests used in Experiments I and II.

Number________________ Sex________________ Age________________

Test List

CACTUS	RAIN	BLOND	COKE
KNEE	HAM	PAPER	TREE
FRIEND	TRIANGLE	HOUSE	CLOCK
DUST	FROWN	GUITAR	COTTON
LAUGH	THANKSGIVING	FLY	NUMBERS
BRICK	SINK	HOSPITAL	THREAD
BIRTHDAY	SNOW	SCISSORS	CAVE
RATTLE	GRAPEFRUIT	MAGAZINE	TRAILER
FORK	WASP	BRACELET	MILK
LION	KEY	CAR	CHRISTMAS
BLUE	COMB	WATCH	FOOTBALL
SMILE	GARBAGE	BEE	BROWN
NEEDLE	BANANA	ICE	KNIFE
STOVE	ROCK	ROBOT	HILL
BED	MOTORCYCLE	SAND	THIEF
BASEBALL	BOOK	LAWN	LAND
ZEBRA	HOTEL	TOILET	BIKE
JUICE	STRING	TIGER	YEAR
VIOLIN	ORANGE	WOOD	CHAIR
TENNIS	LETTER	SOFA	FLUTE

APPENDIX C

INCIDENTAL LEARNING AND RECOGNITION MEMORY INSTRUCTIONS

This appendix contains the instructions given to subjects during the incidental learning task and the recognition memory test. Subjects in Experiments I and II were given the same instructions.

Incidental learning task instructions. As soon as all subjects were seated and the task booklets were distributed, subjects were told: "Write your birthdate and sex on the top of your booklets. Please notice the number on the top of your booklet, and try to remember it for later. All of you will be answering questions about words. I want you to answer these questions as accurately as you can. For instance, if you read the word Shoe and the question, "Is this something you wear on your feet?", you would correctly respond by circling a yes response. Some of you must write words in addition to answering questions. You should answer the questions first, and then read the sentence following the question. This sentence will tell you what kinds of words to write on the line provided. Write the words that immediately come to mind; do not spend a lot of time trying to come up with many words, a few words will do. For instance, if you read the word Shoe and the question "Is this something you wear on your feet?", you would circle the yes response and then read, "List some things you wear on your feet". Words which you might write on the line provided are Sock, Boot, Sandal, etc. Please answer the questions and list words as accurately as you can. All of you will be allowed as much time as you need to finish the items in your booklet. If you have any questions, you may ask them now.

Also, when you are finished, please turn in your booklet. Thank you."

Recognition memory test. As soon as all the subjects were seated and the recognition tests were distributed, subjects were told: "Write your number, birthdate, and sex on the top of the paper you just received. Notice that the sheet of paper in front of you has a list of 80 words on it. During the first task you completed, you saw 40 words and answered questions about them. Well, I want you to try to find and circle those 40 words on your paper. Those of you who wrote words should only circle words you answered questions about, not words that you wrote. Since you saw exactly 40 words, you must circle exactly 40 words on the test. Count the words you circled to make sure there are 40. When you are finished, pass in your sheet of paper. Do your best, but don't worry too much about how well you did since there was a lot of time between the first task and this recognition test."

APPENDIX D

ANALYSIS OF VARIANCE TABLES FOR THE THIRD GRADERS

This appendix contains four analysis of variance tables for the data collected in Experiment I. The first, Table 4, contains the analysis of variance table for the proportion correct recognition of target words by third grade subjects. The second, Table 5, consists of the analysis of variance table for the proportion correct rejection of foil words by third grade subjects. The third, Table 6, examines the relationship between foil generation and proportion false recognition of foil words by third graders. And the fourth, Table 7, examines the relationship between false recognition of foils and proportion correct recognition of target words by third graders. Probabilities are specified in these tables only if a source of variance was found to be significant (that is $p < .05$).

TABLE 4

PROPORTION CORRECT RECOGNITION OF TARGETS FOR THIRD GRADERS

Source of Variance	Sum of Squares	Df	Mean Squares	F	P
Sex(X)	.6125	1	.6125	.40	
Orienting List(0)	2.1125	1	2.1125	1.37	
Word Generation(G)	.0500	1	.0500	.03	
X x O	7.2000	1	7.2000	4.65	.05
X x G	.0125	1	.0125	.01	
O x G	.6125	1	.6125	.40	
X x O x G	8.4500	1	8.4500	5.46	.05
S(XOG)	49.5000	32	1.5469	----	
Block(B)	14.0750	3	4.6917	6.77	.001
X x B	5.6125	3	1.8708	2.70	
O x B	1.8125	3	.6042	.87	
G x B	3.3750	3	1.1250	1.62	
X x O x B	3.0250	3	1.0083	1.46	
X x G x B	1.6125	3	.5375	.78	
O x G x B	1.7125	3	.5708	.82	
X x O x G x B	2.2750	3	.7583	1.09	
SB(XOG)	66.5000	96	.6927	----	
Type of Orienting Question(R)	1.8000	1	1.8000	4.17	.05
X x R	.0125	1	.0125	.03	
O x R	5.5125	1	5.5125	12.78	.005
G x R	1.2500	1	1.2500	2.90	
X x O x R	.2000	1	.2000	.46	
X x G x R	.6125	1	.6125	1.42	
O x G x R	.1125	1	.1125	.26	
X x O x G x R	.2000	1	.2000	.46	
SR(XOG)	13.8000	32	.4312	----	
B x R	4.6250	3	1.5417	2.24	
X x B x R	1.1125	3	.3708	.54	
O x B x R	1.5125	3	.5042	.73	
G x B x R	.4750	3	.1583	.23	
X x O x B x R	.3250	3	.1083	.16	
X x G x B x R	1.5125	3	.5042	.73	
O x G x B x R	2.7125	3	.9042	1.31	
X x O x G x B x R	1.0250	3	.3417	.50	
SBR(XOG)	66.2000	96	.6896	----	

TABLE 5

PROPORTION CORRECT REJECTION OF FOILS FOR THIRD GRADERS

Source of Variance	Sum of Squares	Df	Mean Squares	F	P
Sex(X)	.6125	1	.6125	.40	
Orienting List(O)	2.1125	1	2.1125	1.37	
Word Generation(G)	.0500	1	.0500	.03	
X x O	7.2000	1	7.2000	4.65	.05
X x G	.0125	1	.0125	.01	
O x G	.6125	1	.6125	.40	
X x O x G	8.4500	1	8.4500	5.46	.05
S(XOG)	49.5000	32	1.5469	----	
Block(B)	7.0250	3	2.3417	3.10	.05
X x B	.4125	3	.1375	.18	
O x B	.0625	3	.0208	.03	
G x B	3.7750	3	1.2583	1.67	
X x O x B	.5250	3	.1750	.23	
X x G x B	.9625	3	.3208	.42	
O x G x B	2.6125	3	.8708	1.15	
X x O x G x B	.1250	3	.0417	.06	
SB(XOG)	72.5000	96	.7552	----	
Type of Foil(F)	.4500	1	.4500	.53	
X x F	.0125	1	.0125	.01	
O x F	4.5125	1	4.5125	5.29	.05
G x F	1.2500	1	1.2500	1.47	
X x O x F	.0500	1	.0500	.06	
X x G x F	.1125	1	.1125	.13	
O x G x F	9.1125	1	9.1125	10.68	.005
X x O x G x F	.2000	1	.2000	.23	
SF(XOG)	27.3000	32	.8531	----	
B x F	4.4750	3	1.4917	2.42	
X x B x F	1.6625	3	.5542	.90	
O x B x F	1.0125	3	.3375	.55	
G x B x F	2.4250	3	.8083	1.31	
X x O x B x F	.8250	3	.2750	.45	
X x G x B x F	1.9125	3	.6375	1.04	
O x G X B x F	1.4625	3	.4875	.79	
X x O x G x B x F	1.1250	3	.3750	.61	
SBF(XOG)	59.1000	96	.6156	----	

TABLE 6

FOIL GENERATION AND PROPORTION FALSE RECOGNITION OF FOILS FOR THIRD GRADERS

Source of Variance	Sum of Squares	Df	Mean Squares	F	P
Subjects(S)	.5798	19	-----	----	
Foil Generation(G)	.3380	1	.3380	10.18	.005
SG	.6304	19	.0332	----	

TABLE 7

FOIL FALSE RECOGNITION AND PROPORTION CORRECT RECOGNITION OF TARGET WORDS FOR THIRD GRADERS

Source of Variance	Sum of Squares	Df	Mean Squares	F	P
Word Generation(G)	.0417	1	.0417	.90	
S(G)	1.7642	38	.0464	----	
Foils(F)	.1139	2	.0570	2.24	
GF	.0114	2	.0057	.22	
SF(G)	1.9385	76	.0255	----	

APPENDIX E

ANALYSIS OF VARIANCE TABLES FOR ADULT SUBJECTS

This appendix contains four analysis of variance tables for the data collected in Experiment II. The first, Table 8, contains the analysis of variance table for the proportion correct recognition of target words by adult subjects. The second, Table 9, consists of the analysis of variance table for proportion correct rejection of foil words by adult subjects. The third, Table 10, examines the relationship between foil generation and proportion false recognition of foil words by adults. And the fourth, Table 11, examines the relationship between false recognition of foils and proportion correct recognition of target words by adults. Probabilities are specified in these tables only if a source of variance was found to be significant (that is $p < .05$).

TABLE 8

PROPORTION CORRECT RECOGNITION OF TARGETS FOR ADULTS

Source of Variance	Sum of Squares	Df	Mean Squares	F	P
Sex(X)	6.0500	1	6.0500	3.51	
Orienting List(O)	5.0000	1	5.0000	2.90	
Word Generation(G)	1.0125	1	1.0125	.59	
X x O	5.0000	1	5.0000	2.90	
X x G	2.8125	1	2.8125	1.63	
O x G	6.6125	1	6.6125	3.84	
X x O x G	.6125	1	.6125	.36	
S(XOG)	55.1000	32	1.7219	----	
Block(B)	23.0750	3	7.6917	10.05	.001
X x B	2.4250	3	.8083	1.06	
O x B	3.6750	3	1.2250	1.60	
G x B	4.1625	3	1.3875	1.81	
X x O x B	.3250	3	1.0830	.14	
X x G x B	8.6125	3	2.8708	3.75	.025
O x G x B	2.5125	3	.8375	1.09	
X x O x G x B	4.4625	3	1.4875	1.94	
SB(XOG)	73.5000	96	.7656	----	
Type of Orienting Question(R)	0.0000	1	0.0000	0.00	
X x R	1.2500	1	1.2500	.86	
O x R	.4500	1	.4500	.31	
G x R	2.1125	1	2.1125	1.45	
X x O x R	1.8000	1	1.8000	1.23	
X x G x R	2.8125	1	2.8125	1.93	
O x G x R	2.1125	1	2.1125	1.45	
X x O x G x R	.0125	1	.0125	.01	
SR(XOG)	46.7000	32	1.4594	----	
B x R	2.8750	3	.9583	1.25	
X x B x R	2.0750	3	.6917	.90	
O x B x R	1.5750	3	.5250	.69	
G x B x R	2.0125	3	.6708	.88	
X x O x B x R	5.5750	3	1.8583	2.43	
X x G x B x R	1.2625	3	.4208	.55	
O x G x B x R	2.7625	3	.9208	1.20	
X x O x G x B x R	4.1125	3	1.3708	1.79	
SBR(XOG)	73.5000	96	.7656	----	

TABLE 9

PROPORTION CORRECT REJECTION OF FOILS FOR ADULTS

Source of Variance	Sum of Squares	Df	Mean Squares	F	P
Sex(X)	6.0500	1	6.0500	3.51	
Orienting List(O)	5.0000	1	5.0000	2.90	
Word Generation(G)	1.0125	1	1.0125	.59	
X x O	5.0000	1	5.0000	2.90	
X x G	2.8125	1	2.8125	1.63	
O x G	6.6125	1	6.6125	3.84	
X x O x G	.6125	1	.6125	.36	
S(XOG)	55.1000	32	1.7219	----	
Block(B)	2.0750	3	.6917	.67	
X x B	.3250	3	.1083	.11	
O x B	2.0250	3	.6750	.66	
G x B	1.9125	3	.6375	.62	
X x O x B	2.7750	3	.9250	.90	
X x G x B	2.3625	3	.7875	.77	
O x G x B	3.4125	3	1.1375	1.11	
X x O x G x B	2.1625	3	.7208	.70	
SB(XOG)	98.7000	96	1.0281	----	
Type of Foil(F)	.8000	1	.8000	.72	
X x F	.2000	1	.2000	.18	
O x F	6.0500	1	6.0500	5.47	.05
G x F	6.6125	1	6.6125	5.98	.025
X x O x F	.4500	1	.4500	.41	
X x G x F	.6125	1	.6125	.55	
O x G x F	5.5125	1	5.5125	4.98	.05
X x O x G x F	.6125	1	.6125	.55	
SF(XOG)	35.4000	32	1.1062	----	
B x F	7.6750	3	2.5583	3.12	.05
X x B x F	7.6250	3	2.5417	3.10	.05
O x B x F	.6250	3	.2083	.25	
G x B x F	2.5625	3	.8542	1.04	
X x O x B x F	1.0750	3	.3583	.44	
X x G x B x F	3.3125	3	1.1042	1.35	
O x G x B x F	2.6625	3	.8875	1.08	
X x O x G x B x F	1.4125	3	.4708	.57	
SBF(XOF)	78.8000	96	.8208	----	

TABLE 10

FOIL GENERATION AND PROPORTION FALSE RECOGNITION OF FOILS FOR ADULTS

Source of Variance	Sum of Squares	Df	Mean Squares	F	P
Subjects(S)	.9295	19	-----	----	
Foil Generation(G)	.0268	1	.0268	.47	
SG	1.0921	19	.0575	----	

TABLE 11

FOIL FALSE RECOGNITION AND PROPORTION CORRECT RECOGNITION OF TARGET WORDS FOR ADULTS

Source of Variance	Sum of Squares	Df	Mean Squares	F	P
Word Generation(G)	.0021	1	.0021	.03	
S(G)	2.9374	38	.0773	----	
Foils(F)	.2705	2	.1353	3.18	.05
GF	.1935	2	.0968	2.28	
SF(G)	3.2295	76	.0425	----	