DEVELOPMENT OF MEMORY FOR NARRATIVES: EFFECTS OF ENCODING VARIABILITY AND AGE

by

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We accept this thesis as conforming
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ABSTRACT

Recall of narrative content was studied in a sample of 170 children ranging from 5 to 11 years of age. Age range was divided into three equal intervals. The children within each interval were randomly assigned to four encoding conditions (symbolic, iconic, enactive, and symbolic-rehearsal) so that any effects of interactions between age-affected cognitive capacities and different encoding conditions could be gauged at 30 seconds and one week (after encoding). Between-ages (within condition) and between conditions (within age) comparisons revealed that age increase was generally, though not uniformly, accompanied by significant recall advantage. Analyses revealed that effects of different encoding conditions were sufficiently variable across the ages that age advantage was diminished when free recall performances of 5-7 year old children in enactive and iconic encoding conditions were compared to free recall performances of older children (9-11 years of age) in symbolic conditions of encoding. The results are discussed in relation to theoretical issues and educational questions.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>List of tables</td>
<td>v</td>
</tr>
<tr>
<td>List of figures</td>
<td>vi</td>
</tr>
<tr>
<td>Acknowledgement</td>
<td>vi</td>
</tr>
<tr>
<td>I Introduction and literature review</td>
<td>1</td>
</tr>
<tr>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td>Literature Review</td>
<td></td>
</tr>
<tr>
<td>II Derivation of research questions and hypotheses</td>
<td>15</td>
</tr>
<tr>
<td>III Design and methodology</td>
<td>23</td>
</tr>
<tr>
<td>Design</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>24</td>
</tr>
<tr>
<td>Encoding</td>
<td>24</td>
</tr>
<tr>
<td>Descriptive data</td>
<td>26</td>
</tr>
<tr>
<td>Intellectual ability</td>
<td>27</td>
</tr>
<tr>
<td>Social status</td>
<td>28</td>
</tr>
<tr>
<td>Method</td>
<td>28</td>
</tr>
<tr>
<td>Sample</td>
<td>28</td>
</tr>
<tr>
<td>Apparatus</td>
<td>30</td>
</tr>
<tr>
<td>The narrative</td>
<td>31</td>
</tr>
<tr>
<td>Procedure</td>
<td>32</td>
</tr>
<tr>
<td>Preliminary preparation</td>
<td>32</td>
</tr>
<tr>
<td>Procedural flow chart</td>
<td>33</td>
</tr>
<tr>
<td>&quot;Warmup&quot;</td>
<td>33</td>
</tr>
<tr>
<td>&quot;Training session&quot;</td>
<td>34</td>
</tr>
<tr>
<td>&quot;Habituation period&quot;</td>
<td>35</td>
</tr>
<tr>
<td>Experimental condition and purposes</td>
<td>36</td>
</tr>
<tr>
<td>Experimental condition and procedures</td>
<td>38</td>
</tr>
<tr>
<td>Post-test procedures</td>
<td>41</td>
</tr>
<tr>
<td>Post-Test-1</td>
<td>41</td>
</tr>
<tr>
<td>Post-Test-2</td>
<td>42</td>
</tr>
<tr>
<td>Scoring measures</td>
<td>43</td>
</tr>
<tr>
<td>Rubin's units of measurement</td>
<td>47</td>
</tr>
<tr>
<td>Rumelhart's story categories</td>
<td>47</td>
</tr>
<tr>
<td>Memory under interrogation (or cued recall measurement)</td>
<td>49</td>
</tr>
<tr>
<td>Scoring procedures</td>
<td>49</td>
</tr>
<tr>
<td>Analysis</td>
<td>51</td>
</tr>
</tbody>
</table>
# Table of Contents

## IV Results
- Part A: Age and treatment effects ........................................... 53
- Part B: Within age-span comparisons between the conditions .. 56
  - Y age-span comparisons (between conditions) .................. 58
  - M age-span comparisons (between conditions) ............... 61
  - O age-span comparisons (between conditions) ............... 65
- Part C: Other observed differences: exploratory post-hoc analysis ....... 69
- Ability (IQ), SES, and gender variables .................................... 78
  - Ability (IQ) ........................................................................ 78
  - Gender and SES .................................................................... 78
- Reliability of the Free Recall Measurement .............................. 79

## V Discussion
- Evaluation of hypotheses ......................................................... 82
  - Part A: age and treatment effects ....................................... 82
  - Part B: condition variability within age-span groups .......... 83
    - Youngest (Y) age-span group ...................................... 83
    - Middle (M) age span group ......................................... 83
    - Oldest (O) age-span group .......................................... 84
  - Part C: exploratory analysis ............................................... 84
    - Summary evaluation ..................................................... 85
- Discussion and educational implications of this investigation ...... 91
- Instructional considerations .................................................... 100
- Limitations and caveat ........................................................... 103
  - Age sample ....................................................................... 103
  - Free recall technique ....................................................... 104
  - Rehearsal effects ............................................................. 104
- Directions for further research ............................................... 106
- Conclusion ............................................................................. 107

## Bibliography............................................................................ 109

## Appendix A: Rationale for the narrative content ................. 121
## Appendix B: rational for directions for elicitation of free recall ................................................................. 122
## Appendix C: Questions asked about the story ..................... 124
## Appendix D: Word units from story ........................................ 125
## Appendix E: Categories ......................................................... 127
## Appendix F: Figure 2B ............................................................ 128
LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>29</td>
</tr>
<tr>
<td>II</td>
<td>30</td>
</tr>
<tr>
<td>III</td>
<td>59</td>
</tr>
<tr>
<td>IV</td>
<td>61</td>
</tr>
<tr>
<td>V</td>
<td>62</td>
</tr>
<tr>
<td>VI</td>
<td>65</td>
</tr>
<tr>
<td>VII</td>
<td>66</td>
</tr>
<tr>
<td>VIII</td>
<td>75</td>
</tr>
<tr>
<td>IX</td>
<td>76</td>
</tr>
<tr>
<td>X</td>
<td>77</td>
</tr>
</tbody>
</table>

I  Means and standard deviations of ages (in months) for each age-span group
II Means and standard deviations of ability (IQ) scores by age-span group and gender
III Means and standard deviations of each measure at PT-1 and PT-2 of the Y age-span group in each condition
IV Summary of the results of all pairwise comparisons on the PT-1 category and PT-2 category and cued recall measures (Y age-span)
V Means and standard deviations on each measure at PT-1 and PT-2 of the M age-span group in each condition
VI Summary of the results of all pairwise comparisons on the PT-1 category measure and the PT-2 category and cued recall measures (M age span)
VII Means and standard deviations of each measure at PT-1 and PT-2 by the O age-span group in each condition
VIII Summary table of results of the Tukey HSD post-hoc analysis on the category measure (at PT-1) with all age-spans across all conditions
IX Summary table of the results of the Tukey HSD post-hoc analysis on the category measure (at PT-2) with all age-spans across all conditions
X Summary table of the results of the Tukey HSD post-hoc analysis on the cued recall measure (at PT-2) with all age-spans across all conditions
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td>2A</td>
<td>57</td>
</tr>
<tr>
<td>2B</td>
<td>128</td>
</tr>
<tr>
<td>3A</td>
<td>60</td>
</tr>
<tr>
<td>3B</td>
<td>60</td>
</tr>
<tr>
<td>4A</td>
<td>63</td>
</tr>
<tr>
<td>4B</td>
<td>64</td>
</tr>
<tr>
<td>5A</td>
<td>67</td>
</tr>
<tr>
<td>5B</td>
<td>68</td>
</tr>
<tr>
<td>6</td>
<td>72</td>
</tr>
<tr>
<td>7</td>
<td>73</td>
</tr>
<tr>
<td>8</td>
<td>74</td>
</tr>
</tbody>
</table>

1. Procedural flow chart with time elapsed for each activity in preliminary preparations.

2A. Mean recall performance (PT-1 and PT-2) on the category measure by each treatment condition group (EC IC SC and SIRC) for each age span group.

2B. Mean recall performance (PT-2) on the cued recall measure by each treatment condition group (EC IC SC and SIRC) for each age span group.

3A. Condition group performance means for Y age span (category and unit measures at PT-1).

3B. Condition group performance means for Y age span (category, unit and cued recall measures at PT-2).

4A. Condition group performance means for M age span (category and unit measures at PT-1).

4B. Condition group performance means for M age span (category, unit, and cued recall measures at PT-2).

5A. Condition group performance means for O age span (category and unit measures at PT-1).

5B. Condition group performance means for O age span (category, unit, and cued recall measures at PT-2).

6. Performance means for each age-span group in each condition on the category measure at PT-1.

7. Performance means for each age-span group in each condition on the category measure at PT-2.

8. Performance means for each age-span group in each condition on the cued recall measure at PT-2.
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CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

INTRODUCTION

"Everybody who is skilled at anything necessarily has a good memory for whatever information that activity demands." (Neisser, 1982, p. 17)

Failure to recall information from connected discourse may be highly implicated in a student's poor performance in school. Various researchers have explored the relationships of recall performance to age, coding systems, recall strategies, clustering or chunking, mnemonic or mediation techniques, and organization of material into superordinate or subordinate categories (for example, Jablonski, 1974; Kreutzer, Leonard, & Flavell, 1975; Moely, 1977; Kobasigawa, 1977). In recent years researchers have directed attention to young children's (ages 4-7 years) recall of narrative material in the form of sentences or brief stories (Brown, 1975; Glenn, 1978; Horton & Mills, 1984; Paris & Lindauer 1976; Stein & Glenn, 1975).

This attention to memory for prose is actually a revitalization of a tradition which was given substance by the work of Bartlett (1932). Bartlett departed from what became the mainstream style of memory study in that he preferred to study
memory for meaningful content rather than memory for nonsense syllables or other discrete units which do not together comprise meaningful content. Researchers in this latter tradition which Ebbinghaus (1964) established have sought regularities in memory by controlling between subject's differences in such factors as prior learning (DiSibio, 1982). By substituting unconnected units such as nonsense syllables or numerals for the content of connected discourse, greater experimental control was exercised and greater precision was gained in gauging such matters as memory capacity for discrete items; effects of organizational mnemonics; different interference phenomena; and rehearsal effects (to list but a few of the matters studied). In contrast, Bartlett was prepared to accept a lesser degree of precision in order to gain an understanding of memory for meaningful content.

The Bartlett tradition has been revitalized recently as people like Neisser (1982) have concluded that regularities revealed by rigorous studies of the Ebbinghaus tradition tell us little about the concerns that draw us to the study of memory in the first place. Neisser, like Bartlett, contends that digit span and word list memory tell us little about memory for the content of connected discourse upon which teachers rely for instruction.

The study of memory for narrative content is addressed here. This is important for both theoretical and educational purposes because little is known about how such memory develops
or how such memory of people, in varying degrees of maturity, is affected by different encoding conditions. The reported research on memory for narrative content evoked suggestions for the present work which compared how memory for narrative content varied with age and encoding conditions. Accordingly, a consideration of published research pertinent to the present study is in order.

LITERATURE REVIEW

The present study of macro-memory is an expression of a growing interest, within the research community, in a variety of aspects of macro-memory. Some researchers study memory for text. Drum (1985) is one of these. She of course follows in the tradition of Bartlett (mentioned above) and those like Cofer (1941) who kept this line of thought alive. Cofer (1941) was interested in differences in verbatim learning as compared to logical or essential idea learning by college students. He found that verbatim recall of different lengths of prose passages was more difficult than was recall of gist or essential ideas. Of course Jerome Bruner and his colleagues have maintained an interest in memory for meaningful content too. Bruner and Olson (1977-78) for example, explored "symbols and texts as tools of intellect", because of an abiding interest in memory (and for other considerations connected with "transfer" and competence of higher order processes).
Others have focused on so-called schemata theory as it pertains to recall of meaningful content. Schemata of stories, or classificatory systems of structures and elements (often ordered in hierarchies) (Thorndyke, 1977), have been used to study what is remembered in a story. Among those who report such work are Mandler and Johnson (1977); Rumelhart (1975); Thorndyke, (1977); and Thorndyke and Hayes-Roth (1979), to list but a few. These researchers generally report that "high level" (or central) story elements are recalled more than are "low level" (or peripheral) details. Unfortunately, this line of work has come under a cloud in recent times (Horton & Mills, 1984).

Memory for scripts has also become a topic of interest to a number of researchers such as Mandler and Murphy (1983); Bower, Black, and Turner (1979). While "script" theory is attributed to specific elaboration of the frame theory of Minsky (Bower, Black, & Turner, 1979), a "script" is described as a generic memory structure of stereotyped situations (such as going to a restaurant; going to a zoo; riding a plane, and the like) (Bower, Black, & Turner, 1979). Although there may be some question about the use of "scripts" for study in recall of prose (Mandler and Murphy, 1983), it is an area that some researchers find promising as a means of enhancing our understanding of what is recalled. For example, Mistry and Lange (1985) recently reported that stories which contain "strong" script (material which treats experience and events in stereotype) were recalled
better than stories with "weak" scripts. That is, since children usually visit fast food outlets more frequently than they visit circuses or zoos they are more likely to remember a story about a visit to McDonald's than about a visit to the zoo.

Attention to what is remembered from complex, meaningful material has also attracted interest. Of course gist continues to be of great interest. Bartlett (1932) reported that the stories he used were not recalled verbatim but were recalled in what he and aformentioned researchers would now say was script, schemata, or gist. Gist, of course, is not verbatim content, but is what Cofer (1941) called logical and essential ideas of the prose recalled.

Many researchers have studied sentence, story, and text recall, and have proposed various concepts of what is recalled and why. Hertel (1985) is one of those who brings interest in interference to the study of complex prose material. This is merely one of a variety of theoretical perspectives one notices. Thus one sees a range from a Gestalt view of sentence memory to an associiative view (or from well formed wholes to independently linked concepts) (Horton & Mills, 1984, p. 385) of script, schemata, and gist adapted to endeavors which look for reasons why specific information in sentences and stories is recalled. All of this has made the Ebbinghaus tradition look quaint and archaic.

The present thread of research, which combines interest in
memory for story content with concerns about the significance or impact of encoding conditions and the impact of development, is part of this renewed and growing interest in macro-memory. Some of the roots which anchor, and the main features of the stem which supports the present work warrant mention.

Paris & Lindauer (1977) describe studies of recall of narratives in which young children (around 5 years of age), in comparison with older children (around 10 years of age), exhibit poor recall of narrative material. This is consistent with other memory research (eg. on paired associates, digit span, etc.) wherein recall is generally reported to increase with age (Brown, 1975a; 1975b; Elkind, 1971; Flavell, 1971; Jablonski, 1974; Kobasigawa, 1977). However, some research suggests that encoding conditions also affect recall (Paris & Lindauer, 1976; 1977; Travis & White, 1979). This suggests that the magnitude of recall differences between older and younger children may be composed of variability due to the interaction of developmentally differing structural characteristics (Jablonski, 1974; Paris & Upton, 1976; see below) and encoding conditions.

Both the Genevan theorizing (Inhelder & Piaget, 1964; Furth, 1969) and the aforementioned evidence (Paris & Lindauer, 1976; 1977; Travis & White, 1979) suggest that when children of about 5 to 7 years of age organize information through overt actions they increase their capacity to recall it. Apparently, the younger child's cognitive functioning is more dependent upon enactive schemes than is that of older children who generally
seem to be comparatively more adroit in assimilating information to figurative aspects of both imaginal and symbolic representation schemas (Furth, 1969).

Both Piaget (Piaget, 1962; 1967; 1969; 1976a; 1976b; Piaget & Inhelder, 1971; 1973) and Bruner (1964; 1966; 1973) have claimed that representational systems develop in a sequence: First, the child organizes and represents information through his actions; the second, or what Bruner (1964; 1973) calls the iconic system, develops from the functioning of the enactive or first system, and it entails the assimilation of information to images with which the child represents information to himself. Third, and still later in ontogeny, children develop the capacity to assimilate information to more abstract representations the elements of which are signs or true symbols (Inhelder & Piaget, 1964).

Each of these representational systems putatively enables the child to construct knowledge of the world; but the knowledge which is so constructed is given character by the particular system or systems which are used to construct it. While young children's knowledge of the world is constructed first, from their overt actions in and on it (and it on them), older children can construct a world of images and still older children can construct knowledge with symbolic representations as well as actions and images (Bruner, 1973; Piaget, 1976).

A constructivist theory (DiSibio, 1982) such as that of
Piaget (Paris & Lindauer, 1977), would suggest then, that not only do children who can construct knowledge with images and symbols gain advantage through increased capacities to know more of the world, they can assimilate it and accommodate to it with more versatility (Piaget, 1976). The capacity to construct knowledge in imagery and symbols apparently enables children to gain increasing independence from their concrete actions for their construction of knowledge (see also DiSibio, 1982).

From a constructivist vantage point, then, one can argue that what a child knows is affected by both how he or she can know and how he or she has come to know. Moreover, the child's recall and knowledge are not independent of one another. Accordingly, if the young (prior to age 7 or 8) child's knowledge is predominantly enactive knowing, one might expect that such children who construct their knowledge of given material through their own motoric actions on it, will recall more of the material than will their cohorts who are deprived of the opportunity to encode the same material in the same manner. Older children who are deprived of the opportunity to encode the same material in enactive schemes, should not be handicapped. With the capacities to construct knowledge of the material in iconic and/or symbolic schemas more fully developed, children at or beyond the age of mid-latency should be able to construct and recall knowledge of the material as well as or better than the younger children who constructed enactive knowledge of the material. This line of reasoning seems to inform the Brunerian
conjecture (1964) about the ontogenetic order in the development of the representational systems.

In passing, we should notice that all systems are usually in place in rudimentary forms by the end of the second year. However, they do not seem to differ in their subsequent careers from other systems, such as skeletal and neurological systems, which are incomplete in the infancy years. That is, they will become more elaborate and complete through the passage of time. Apparently, our experience contributes something to such differentiation, organization and elaboration of language just as it contributes to the development of coordinated actions and neurological development (Bower, 1979). However, some systems have an inherent potential to develop a much greater complexity and capacity to handle a much greater diversity of experience than do other systems. The range of physical actions which can emerge, be organized and become coordinated seems to be more limited than is the range of images (because more than actions can be imagined), and still more limited than is the range for abstractions. For these reasons we can expect the action-scheme systems to approach their full possibilities sooner than the image and symbol systems. That is their premier status and limited range forecast this. The imaginal systems might be expected to approach their full maturity after the action systems but before the symbol systems. The symbolic capacities have the greatest potential for elaboration, differentiation, and organization; are the most flexible; and, in addition to the
factors mentioned, because their rudiments appear last, they can be expected to take the greatest amount of time and experience to reach full bloom.

If Bruner is correct, one might expect that children in late latency might be expected to recall information reconstructed from enactive or iconic representation systems with proficiency. However, their capacity to reconstruct a narrative in a recall task would be expected to be greater, if at this age, they construct their knowledge of the narrative in a symbolic representation system such as language. For as they approach puberty, children's proficiency with language has usually developed sufficiently to enable them to contemplate possibilities, ideals, and counter-factual information. This enables them to be more flexible, independent, and fluent. Recall of language-construed content (as opposed to content ordered with actions or images) might be expected to be optimal since "material that is organized in terms of a person's own interests and cognitive structure is material that has the best chance of being accessible in memory" (Bruner, 1973, p. 412).

Well before this stage of development the child's capacity to order reality with what Pavlov, as well as Vygotsky (1978), called the second signal system has been repeatedly shown to be well established. However, with each passing year our verbal fluency and flexibility increases very noticeably. Accordingly, by age 10 or so our vocabularies and our knowledge surpass those of pre-school and primary school children so that we can handle
feats of symbolic manipulation that mystify children of 5 or 6 years. What Bruner (1966, pp. 44-50) called the "power" and "economy" of the symbolic "mode" of representation enable one to hold and process more information in that mode than is the case with the other two (enactive and iconic) representational systems.

Some research indicates that the development of competence in motoric representation precedes the development of competence with iconic and symbolic representations; that iconic knowing develops prior to the development of our powers of symbolic knowing, and that our memory performances are influenced by our competencies for knowing (Bruner, 1964; 1966; 1973; Flavell, 1963; Furth, 1969; Inhelder & Piaget, 1964; Richardson, 1969; Vygotsky, 1978). Likewise, there also are indications of notable gains in cognitive functioning as manifested on a variety of indicators during the period between ages 7 and 8 (Cavanaugh & Borkowski, 1980; Dunham & Levin, 1979; Flavell, 1971; Hartup & Coates, 1972; Inhelder & Piaget, 1964; 1969; Jablonski, 1974; Lange & Jackson, 1974). At this time children's strategic thinking (with mnemonics, organization, cueing, rehearsal, etc.) and their overall ability to recall information improves noticeably (Flavell, 1977; Jablonski, 1974), as do their logical competencies which require the maturation of capacities to use true symbols to understand and represent more complex order (Owen, Froman, & Moscow, 1981; Piaget, 1976).
Thus if young children's iconic and symbolic representational structures are relatively undeveloped, conditions which require that they encode information in iconic or symbolic schemas may produce assimilation difficulties which are reflected in their comparatively poor recall of material. In most investigations, the subjects' latitude for encoding the material on which their recall is to be tested appears to be restricted by the conditions in which they typically encounter the information. Since the information usually is apprehended as it is made available, in visual or verbal form, the apparent recall advantage that accompanies increasing age may simply reflect concomitant increases in encoding capacities which accompany the development of iconic and symbolic representational systems. If the conditions in which the material is encountered restrict encoding to either iconic or symbolic registers (i.e. to those systems which are more fully developed with age), the results may be misleading with regard to the conclusion regarding the memory capacity of children at younger ages. At younger ages, children's optimal recall efficiency may depend upon enactive encoding which usually appears to be excluded by the conditions under which they encounter the material to-be-recalled in conventional test conditions. Reported results may not represent the young children's recall capacities well.

Measures of free recall of narrative material require that the young child reconstruct the narrative material in a symbolic
system (i.e. language). From a constructivist perspective the young child's capacity to reconstruct the narrative in the recall task might be expected to be greater if the child constructs knowledge of it in his or her enactive representation system, rather than if the child constructs his or her knowledge of the narrative in the symbolic system (see Brown, 1975). This expectation is based on the premise about the relationship between what one knows and what one can evoke from memory. Given the relatively immature condition of the young child's capacity to construct knowledge in symbolic systems (compared with his capacity to construct knowledge enactively) the material to-be- recalled will be known less well - it will be assimilated less fully - if such knowledge must be constructed in a symbolic register than if it were assimilated to enactive schemes. In the first case, the child might be induced to say more than he knows; and in the second case, he will know more than he can say - even though he may be expected to recall more than he would in the first case. Presumably, one can, at any age, make better translations or transpositions from one register to another if one knows well the to-be- translated or transposed (i.e. transformed and reconstructed) material well than if one knows the material less well.

If optimal recall of information by younger children depends upon enactive encoding of it, optimal recall of such information may be obtained by providing young children with conditions which enable them to construct knowledge of
to-be-recalled material through motoric organization of it. Moreover, since older children become more adept with an iconic representational system as Bruner (1964) conjectured, their optimal recall may be associated with conditions which enable them to assimilate to-be-recalled material to imaginal structures. For still older children, conditions which enable them to benefit from the advantages of symbolic coding may facilitate optimal recall. In other words, optimal recall may depend at first on enactive encoding; next it may depend upon iconic coding; and still later, it may depend upon symbolic coding. What has not been examined extensively is the degree to which children's memory of narrative material is affected by the conditions under which they encode it and how their relative efficiency with and dispositions to employ different representational systems change as they develop.

Moreover, neither the age-span within which optimal recall is associated with enactive organization or when optimal recall becomes associated with iconic or symbolic encoding has been established. In spite of the wealth of research on children's recall abilities, there is a poverty of information about how or if age and encoding conditions interact to influence free recall.
CHAPTER II

DERIVATION OF RESEARCH QUESTIONS AND HYPOTHESES

The foregoing discussion suggests that optimal recall may be associated with different encoding conditions as age increases. Developmental theorists such as Piaget and Bruner propose a developmental sequence in the emergence of increasingly mature powers of representation. These theorists claim that while optimal cognitive functioning depends at first on enactive schemes it subsequently depends upon information structures and functions associated with images and then symbols.

Although the rudiments of all three representational systems for most children may well be functional by the middle of the second year; and although all three systems may be functional thenceforth, development of differentiation in abstract systems is putatively less a matter of prospect as age increases (Bower, 1979; Bruner, 1964). That is, in the preschool years, the development of the ontogenetically premier (enactive) system is more advanced than is that of the second (iconic) system and the second is more fully developed than the third (symbolic). Accordingly, the necessity of relying on enactive knowing decreases with increasing age because alternatives become both increasingly available and reliable as
the second and third systems develop more fully (with increasing age).

This line of theoretical speculation (eg. Bruner, 1966; 1973) and accumulated evidence (Travis & White, 1979) led to the formulation of the following questions:

(1) Does the recall advantage that age advance seems to confer remain constant within as well as across various encoding conditions? (2) Does the comparative recall advantage which enactive encoding conditions seem to confer on young children also emerge for older children when the performances of such older children, in various encoding conditions, are compared?

The superior memory performances of young children induced to encode and organize information through overt actions which represent the to-be-remembered subject matter (Travis & White, 1979) further suggest that recall is affected by encoding conditions and their interaction with structural variables (or cognitive functions) which apparently change with increased age. According to Piaget (Flavell, 1963) and Bruner (1964), enactive representations appear to entail organization of information into systems built on action schemes, and young children's symbolic representations are presumed to develop from their prior construction and use of enactive representations (Bruner, 1964; Inhelder & Piaget, 1964). Unfortunately, there is presently no basis for assuming that the pattern of relative impact of the encoding conditions (which were compared in the Travis & White study) is similar or uniform across ages.
However, one can conjecture that the improved memory performances of children in the latter years of primary school may be a consequence of enhanced maturity of capacities for representing information in iconic or symbolic codes (Jablonski, 1974; Kail, 1979; Kuhlman & Wolking, 1972; Vygotsky, 1978). Notable observers have described how children appear to develop increased capacities to assimilate information to iconic and symbolic systems and increase their strategy efficiency in learning with increased age (Flavell, 1970; 1977; Paris & Lindauer, 1976; 1977). In other words, children in the latter years of primary school may have matured or developed representational systems which are more economical and powerful than that which is established through the motoric organization of their experiences (see Inhelder, Bovet, & Sinclair, 1974; Inhelder & Piaget, 1964; Levin, Ghatala, DeRose, Wilder, & Norton, 1975; Piaget, 1969; Richardson, 1969; Vygotsky, 1978). Thus, older pupils may not need to rely so heavily on enactive schemes for the construction of knowledge as do their younger counterparts.

The foregoing analysis led to the formulation of research hypotheses. The testing of these entailed the organization of equal interval age-spans which together (in sum) encompassed (1) a period when the utilization of enactive schemes seems to be associated with maximum recall; (2) a period when the utilization of symbolic systems could be expected to be
associated with maximum recall; and (3) a period which follows the former and precedes the latter, and in which notable transitions in cognitive functioning have been documented. The experimental procedures also required that, in addition to design features which systematically vary the (age-related) structural factors (represented by age as their proxy), factors which influence encoding also had to be varied and standardized. Accordingly, four experimental conditions were devised to induce encoding variability within each age-span sub-set of a sample of children. These features, together with random assignment within age-spans; standard (common) information (narrative) content; standard recall metrics; and uniform time controls, comprised the major features of the design devised to test the hypotheses by experiment and gain data which bear on the research questions.

Therefore, given three age-spans (Y= 60-83 months; M= 84-107 months; O= 108-131 months); given four encoding treatment conditions designed to allow for estimation of the impact of such conditions both within and between age-spans; and given a common narrative as well as common measurement instrumentation, one can test predictions with respect to treatment (condition) effects within and between age-spans (and age effects within treatments). Thus, the following hypotheses (H) were formulated with regard to the measured recall performances of the twelve sub-sets of the sample:

An interaction of age and encoding conditions is suggested
by two propositions: First, as age increases children's recall of narration content is more complete when such content is organized and represented with symbols (such as language) than is the case when such content is organized and represented with enactive and iconic representations. Second, at younger ages, children are better able to recall material that is organized and represented by enactive schemes (compared to recall of material organized and represented by iconic or symbolic structures). Thus the first hypothesis was formulated as follows:

H1: There will be a significant interaction between age-spans and encoding conditions on recall.

Since there is little reason or evidence which suggests that enactive capabilities which have been associated with optimal recall by young children should decline with age; and since recall differences were expected to be observed (as past research indicates improvements of recall with age increase), the following hypotheses were made with regard to age effects:

H2: The oldest (O) age-span will be significantly superior to the youngest and middle (Y and M) age-spans on recall.

H3: The middle (M) age-span will be significantly superior to the youngest (Y) age-span on recall.

Since, as indicated above, the enactive capabilities (for recall performance) of the children are not expected to decline with age, but the symbolic capabilities (for recall performance) are expected to increase with age, the following hypotheses were
made for condition effects:

H4: The recall performances of children from enactive encoding conditions will be superior to the recall of children from iconic encoding conditions.

H5: The recall performances of children from enactive encoding conditions will be superior to the recall of the children from symbolic encoding conditions.

The next set of hypotheses was concerned with what educators must deal with when considering the possibility of variable effects of learning conditions on the performances of children between the different encoding conditions at specific age levels. For example, teachers of children 9 to 11 years of age, while perhaps interested, presumably would not be as concerned with the performances of children 5 to 7 years of age as they would be with performances in the 9 to 11 year age-span. However, little research has been conducted on children's performance with regard to encoding conditions. Therefore, following the theoretical speculation and accumulated evidence presented above, hypotheses were formulated which are concerned with the differential attenuation of condition effects by developmental (age) advance. The first of these follows from the premise that observed relationships reported by Travis & White (1979) could be replicated. Accordingly, the following hypothesis focused on encoding treatment effects within the youngest age-span:

H6: In the Y age-span, children from the enactive encoding
condition will recall significantly more narrative content than their age cohorts in the iconic or symbolic encoding conditions.

Since there was no empirical basis for predicting that the conditions would differentially affect recall in the M age-span; and there were theoretical reasons for supposing that the differentiation and maturation of cognitive or symbolic abilities would enable children of this age to construct representations and recall same with greater proficiency than was the case when they were younger, an exploratory analysis was conducted to test for any systematic difference between the conditions for this age-span.

While youngsters are usually remarkably able to handle true symbols in speech at an early age, by age 9 their symbolic powers are much richer. They order abstractions with fluency, flexibility and complexity that are beyond the powers of young children. The economy and power of such symbol systems should confer cognitive and recall advantages on those members of this age-span, who, due to experimental conditions, rely on same (as opposed to cohorts who do not do so). In a similar vein, by this age the superior efficiency of iconic processing (compared with enactive) should be observable. Moreover, the often observed advantage of rehearsal (Kail, 1979) can also be expected to be seen. Therefore, the following hypothesis was made with respect to encoding treatment effects within the oldest group (0 age-span):
H7: In the 0 age-span, children from the symbolic and rehearsal encoding condition will demonstrate superior recall performance when compared to the performances of their age cohorts from the other (enactive, iconic, and symbolic-no rehearsal) encoding conditions.

Since reliable knowledge of the degree of influence which different encoding conditions and different levels of maturity have on free recall was sought, two sets of observations were made at thirty seconds (PT-1) and one week (PT-2) after the to-be-recalled narrative had been encountered. The second comparison (PT-2) enables one to assess retention of the sort which is of interest in instruction. It also provides a basis for assessing reliability of measurement. Therefore, one week after PT-1 had been concluded the second post test (PT-2) was administered to test for stability of observed free recall performance differences. Enduring effects are most readily seen to have pedagogical implications since teachers are concerned with long term retention of information; and the effects of age in interaction with conditions, such as might be discerned, can be seen to bear on questions about instructional practices. Therefore, the above hypotheses apply to scores on both the immediate tests of recall (thirty second delay), and the more delayed test of recall (one week delay); that is, the hypothesized relationships were expected to be robust across a period of one week.
CHAPTER III

DESIGN AND METHODOLOGY

DESIGN

As suggested earlier, significant improvements of recall abilities (as well as other cognitive abilities) are frequently notable around 8 years of age (Richardson, 1969). However, little notice has been taken of the extent to which the magnitude of measured gains is affected by encoding conditions for these children and those, both younger and older, with whom they are compared.

With the above considerations in mind, this study was designed to investigate how four different encoding conditions affect free recall performances of 170 children who varied in age from 5 to 11 years of age. Further, it was designed to discover the extent to which the free recall performances for each of the twelve age-encoding variations would be stable over a period of one week. Accordingly, the recall performances of children in the age-span 84-107 months were compared with those from the adjacent (older and younger) age-spans of equivalent width, so that all age-spans were compared to one another.
Age

The three age-spans included:
(1) the youngest (Y) group (age 60-83 months) the members of which have not reached the age within which notable cognitive gains are commonly seen (and to which reference has just been made);
(2) the middle (M) group (age 84-107 months) which included those one might expect to manifest the memory gains which accompany other gains in cognitive powers;
(3) the oldest (O) children (age 108-131 months) who might be expected to be the most mature thinkers and proficient recollectors.

Encoding

Children within each of three adjacent age-spans were randomly assigned to the four encoding conditions, three conditions of which were devised to restrict encoding to one or another of the representational systems (enactive, iconic, and symbolic); and one of which (symbolic and imagery rehearsal) was included to make possible the estimation of the magnitude of imagery rehearsal effects. These encoding conditions are denoted by the following four names and abbreviations: (1) enactive (EC); (2) iconic (IC); (3) symbolic (SC); (4) symbolic and imagery rehearsal (SIRC).

The encoding conditions were designed to restrict encoding options, such that (a) a sub-set of each age group encountered
conditions which were designed to maximize the probability that the to-be-recalled information would be transformed into a system of action schemes (an enactive system of representation); (b) another sub-group was induced to transform the information into systems of mental imagery (iconic schemata or an iconic system of representation); (c) another sub-set of each age-group was induced to employ the system of mentation we call symbolic (or a symbolic system of representation); (d) and the last of the sub-groups for each age-span was induced to employ the system of symbolic representation and then imagery rehearsal. This fourth condition was included because children in the enactive condition would necessarily rehearse the substance of the story as they dramatized it, and children in the alternative (iconic and symbolic) treatments did not have to rehearse the material. Accordingly, an estimate of the extent to which rehearsal influences the recall of those in the enactive condition was sought. The fourth condition then, consisted of the conditions of the symbolic treatment plus a feature that allowed for an estimation of rehearsal effects. A comparison of the recall performances of children in this (symbolic and rehearsal) condition with those in the symbolic condition should indicate the magnitude of the impact of rehearsal on recall. This difference, subtracted from the enactive condition performance scores, should allow one to estimate the magnitude of rehearsal contributions to the scores from the enactive condition. A more detailed description of the encoding conditions can be see on pages 36-40 (below).
The performances of each sub-set of the sample as measured with two indices of free recall, were compared with those of all other sub-sets. That is, performance comparisons were made within the age-spans across the conditions and then within the conditions across the age-spans. At the end of the second free recall procedure (during PT-2), questions were employed to obtain another type of memory measure. This allowed for further assessment of the impact of the different encoding conditions on children's memory for narrative discourse as they vary in age.

This design afforded the assessment of (1) the extent to which free recall varied with encoding conditions within age-spans; (2) the extent to which the pattern of recall performances associated with the conditions within age-spans remained stable across age-spans; and (3) the extent to which free recall varied with age within and across conditions.

**Descriptive Data**

Although treatment groups within each of the three age-span sub-sets of the sample were formed on the basis of random assignment, random assignment between age-spans (as contrasted to within age-spans) was not possible given the age manipulation requirement of the design. Accordingly, between age-span groups could differ from one another with regard to not only age but other characteristics such as gender composition, abilities, and socio-economic class. Since the recall performances (as
assessed by three measures—see below) may have covaried with gender, abilities (I.Q.), and social class (SES), descriptive statistics on these variables for each age group provided a basis for assessing the extent to which the groups came from the same gender-mix, socio-economic, and abilities populations. Therefore, as a precaution, data on IQ, sex, and social class were analyzed to control, by statistical means, any possible systematic influence they might have on the dependent measure scores. A description of the intellectual ability measure and social class information follows.

Intellectual Ability

The ability measure (I.Q.) was derived by administering Form 2 of the Quick Test (QT) (Ammons & Ammons, 1962). The QT is a reasonable estimator of the general level of intellectual ability as indicated by perceptual-verbal performance (Ammons & Ammons, 1962; 1979; Davis & Dizzonne, 1970; Joesting & Joesting, 1972; Libb & Coleman, 1971; Mednick, 1969; Violato, White, & Travis, 1984), which performance was of interest in this study. Since this study entailed the participation of children 5 to 11 years of age, a test that did not entail written responses (difficult for many 5 year old children) was required. Moreover, since the design of this study made the use of the same test for all participants desirable, and circumstances required that children did not lose more class time than was necessary, the attractiveness of the QT for the present purposes was enhanced (Dizzonne & Davis, 1973; Gendreau, Roach, &
Social Status

Parents were asked to indicate their usual occupations on a parental permission form. The occupation of the father, or in his absence, that of the mother, was used to indicate social status. After the parents' occupations were established, all children were classified as belonging to one of four SES classifications: 1) Entrepreneurs (e.g., independent, self employed, businessmen); 2) Professional/Managerial (e.g., lawyers, physicians, teachers, executives, etc.); 3) Skilled Labour (e.g., licensed workers such as plumbers, electricians, etc.); and 4) Non-skilled (unlicensed) Labour (e.g., clerks, labourers, mill workers, etc.). Three raters classified each parent's occupation independently; and their ratings were compared. There was 100% agreement between the independent ratings. The number and percentage of children in each SES level are presented below in the sample description section.

METHOD

Sample

The sample of 170 children ranged in age from 65 to 131 months. They attended two schools in the same urban school district in north-central British Columbia; and came from a developed neighborhood which followed city planning bylaws of proportional (economic) mixed housing development (the mix of
domiciles one would expect from the occupational mix described above). Parental consent for each child who was a prospective participant was obtained. The entire age range was divided into three equal intervals (described earlier) so that three nonoverlapping age groups (Y, M, and O) were formed. Each age group so formed had a minimum of 54 children. Children from each age group were randomly assigned to one or another of four treatment conditions. This allowed for a minimum of 13 subjects for each treatment condition at each age interval. The age means (expressed in months) and standard deviations for each sample age-span can be seen in Table I.

Table I

Means and Standard Deviations of Ages (in months) for each Age-Span Group

<table>
<thead>
<tr>
<th>Age-Span Group</th>
<th>Mean Age (in months)</th>
<th>Range</th>
<th>Sd</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>72.66</td>
<td>65-83</td>
<td>4.80</td>
<td>59</td>
</tr>
<tr>
<td>M</td>
<td>98.37</td>
<td>85-107</td>
<td>5.55</td>
<td>54</td>
</tr>
<tr>
<td>O</td>
<td>120.77</td>
<td>109-131</td>
<td>6.66</td>
<td>57</td>
</tr>
</tbody>
</table>

Total=170

The Quick Test (Ammons & Ammons, 1962) was administered to gain an estimate of each child's intellectual ability (see Table II). Demographic data were collected to establish a socio-economic rating for each child (the percentage and number of children in each SES level were: 5.9% entrepreneur (n=10);
22.9% professional/managerial (n=39); 37.6% skilled labour (n=64); 33.5% nonskilled labour (n=57)). These data and the gender of each child were recorded, which provided a basis for identifying or describing the populations which this sample represents. These descriptive data results are reported in Chapter IV.

Table II

Means and Standard Deviations of Ability (IQ) Scores by Age-Span Group and Gender

<table>
<thead>
<tr>
<th>Age-Span Group</th>
<th>Gender</th>
<th>Mean Score Ability (IQ)</th>
<th>Sd</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Y M</td>
<td>105.38</td>
<td>10.91</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>101.32</td>
<td>14.41</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Mean Total</td>
<td>103.46</td>
<td>12.75</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>102.55</td>
<td>10.80</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>100.63</td>
<td>10.55</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Mean Total</td>
<td>101.41</td>
<td>10.59</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>O M</td>
<td>101.82</td>
<td>17.39</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>93.79</td>
<td>12.72</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Mean Total</td>
<td>97.74</td>
<td>15.59</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Mean Grand Total</td>
<td>100.89</td>
<td>13.32</td>
<td>170</td>
</tr>
</tbody>
</table>

Apparatus

A Panasonic portable cassette tape recorder (Model #RQ 2108) with a built in microphone was used to deliver a narrative and to record the children's recall of same. A cassette tape
recording of a male voice vocalizing a narrative for one minute and 17 seconds in duration, was used with the recorder. (See below for a transcription of the narrative and Appendix A for the rationale for the use of this material). Two homemade cotton sock puppets were used. One, a brown cotton sock on which were affixed felt eyes, ears, nose, and tail resembled a gopher. It was used during a training session in which each child participated (see procedural section below). The other was made to resemble a black cougar. It was also made from a (black) cotton sock on which were sewn felt eyes, ears, nose, and tail. This puppet was used in the EC and IC experimental conditions. A two part folding scene of a forest with a winding trail, a cluster of houses for a town, and a backdrop of a blue sky, clouds, and sun was used for a background prop in the EC and IC conditions. The cougar puppet and scenery prop were utilized to dramatize the experiences of the central character in the narration. A Remex electronic stop watch (Sports Stopwatch model) was used to measure time sequences during training, treatment, and testing. A record form for the Quick Test results and demographic data, as well as a parental consent form, was also used for each child.

The Narrative

The story used in this study was as follows:

One early morning, a black cougar named Rufus left his hole that was home and walked along a forest trail. He was looking for something to eat. As he looked he turned his head from one
side to the other. The longer he looked the faster he walked. He even ran a little, with his head still turning as he searched. Suddenly the forest disappeared and to his left he saw a town. He thought, "There must be food there." He leaped toward the town. Soon he could see nothing but houses when he turned round and round. As he did so he nearly fell over. He felt dizzy - and hungry. The sight of a bowl with a juicy bone in it made him forget he was dizzy and hungry. "That will make a good meal," he said. Rufus dived at the bowl. The clatter awoke a dog whose bark made the cougar's ears stand up. The dog's bark was coming closer and closer. Rufus pressed his body close to the ground and began to creep away. But suddenly something made a loud noise next to him. Rufus jumped high into the air and ran home as fast as his legs could carry him. He had nothing to eat for breakfast but food for thought: A bone in a bowl puts a cat in the hole.

Procedure

Preliminary preparations.

Preliminary preparations consisted of three phases:

(1) A one minute "warm up" designed to put each child at ease;

(2) a three minute "training session" which was devised to ensure that all children would (or could) use a puppet to dramatize narrative content;

(3) a one minute "habituation period" wherein the children were made familiar with the presence and operation of a tape recorder.

A flow chart for times involved on each phase of the preliminary preparations with each experimental condition can be seen in Figure 1 below.
Figure 1

Procedural flow chart with time elapsed for each activity in preliminary preparations

<table>
<thead>
<tr>
<th>Activity</th>
<th>EC</th>
<th>IC</th>
<th>SC</th>
<th>SIRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Warm up&quot;</td>
<td>1 min.</td>
<td>1 min.</td>
<td>1 min.</td>
<td>1 min.</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>&quot;Training&quot;</td>
<td>3 min.</td>
<td>3 min.</td>
<td>3 min.</td>
<td>3 min.</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>&quot;Habituation&quot; and Treatment Set-up*</td>
<td>50 sec.</td>
<td>50 sec.</td>
<td>1 min.</td>
<td>1 min.</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 sec.</td>
<td>10 sec.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Time 5 min. 5 min. 5 min. 5 min.

*: Treatment set-up for the EC and IC conditions consisted of placing a scenery prop in front of the child, as well as placing a puppet on the child's hand (EC) or experimenter's hand (IC) - see below for a description of this activity.

Each of the preliminary preparation phases is discussed in turn.

"Warm-up"

Each child was introduced to the experimenter in the classroom and was then taken to a testing room. As soon as the child entered the room he/she was asked to sit down at a table.
A brief "warm-up" designed to put the child at ease ensued (i.e. the experimenter talked with the child in a warm and friendly manner about conventional topics which arise in initial encounters wherein people "get acquainted" with one another). After one minute lapsed the experimenter said, "I have something I would like to show you." A "training" session then followed.

"Training Session"

The training session lasted three minutes for all children. It entailed a demonstration of how a puppet could be made to dramatize or make manifest whatever some sentences indicated. When the demonstration was completed the experimenter asked the child if he/she would like to try. With a positive response the experimenter gave the child the puppet and helped put it on the child's hand if needed. The experimenter then asked the child to demonstrate some moves that the puppet might make. After the child made some manipulations with the puppet, the experimenter asked the child to dramatize an uttered sentence with the puppet. Two such sentences were used to provide help and observe the child's response. The first sentence used, was: "The gopher was walking through the grass when he heard his mother calling him to come to dinner as fast as he could." The second sentence used, was: "A gopher was walking through a yard when he saw some friends. He stopped to say hello, and then went on again." Since the training session was intended to ensure that the child was competent to manipulate a puppet while listening, once the child responded appropriately, a discussion
about puppets ensued until the three minutes lapsed (from the time the training session began). If there was difficulty in manipulating or dramatizing the sentences, the experimenter helped the child by either moving the child's hand or making suggestions, and repeating the sentences until three minutes lapsed from the beginning of the training session. Any child who showed a disinclination to undertake or had difficulty dramatizing the sentence content at the end of this time frame was omitted from the study. There were four such cases. At the end of the "training session", the puppet was removed from the child's hand and placed out of the child's sight. A short (approximately one minute) discussion about tape recorders ("habituation period") followed.

"Habituation Period"

The discussion about tape recorders commenced when the experimenter pointed to a tape recorder which had been on the table since the child entered the room, and said, "(Child's name), this is a tape recorder. Have you ever used one before?" The operation of the tape recorder was then discussed. After about one minute (dependent upon the treatment condition the child had been assigned to - see above flow chart) the child was told, "I have a story on the tape recorder that I would like you to listen to. Would you like to listen to it?" If the child responded negatively to listening to the story, he/she was returned to the classroom and subsequently dropped from the study (one Y age group child did not wish to listen to the story
and was dropped from this study at this point). With a positive response the session continued.

In sum, the introduction to the experimenter (one minute in duration), the training session (three minutes in duration), discussion about tape recorders and the invitation to listen to a story (about one minute in duration), took a total of five minutes. This same amount of time was spent with each child before the story was heard. No child spent more or less than this five minutes with the experimenter on these procedures. Each child was then given a story in his/her assigned treatment condition.

Experimental Conditions and Purposes

The encoding conditions (as discussed above and below) were structured to restrict encoding options. That is, each condition was designed to enhance the probability that the narrative content would be encoded in one system and not in the alternatives. These encoding conditions are denoted by the following four names and abbreviations: (1) enactive (EC); (2) iconic (IC); (3) symbolic (SC); (4) symbolic and imagery rehearsal (SIRC). The purpose and major feature of each of these follow. A more complete description of each condition is provided thereafter.

The purpose and major feature of each condition follows:

(1) Children in the enactive (EC) condition encountered conditions which were designed to maximize the probability that
the to-be-recalled information, a narrative, was transformed or transposed into a system of sensory motor schemes (or an enactive system of representation). In this condition children manipulated a puppet to dramatize the content of the narration while they listened to the tape recording of it.

(2) Children in the iconic (IC) condition encountered conditions which were designed to maximize the probability that the to-be-recalled information (a narration) was transformed or transposed into systems of mental imagery (or iconic schemata). In this condition children listened to a narration while watching a puppet (manipulated by an experimenter so that it enacted the narrative content).

(3) Children in the symbolic (SC) condition encountered conditions which were designed to maximize the probability that the to-be-recalled information (a narration) was assimilated to a system of symbolic representations. In this condition children merely listened to the narration. No puppets or scenery props were used.

(4) Children in the symbolic encoding and imagery rehearsal (SIRC) condition merely listened to the recorded narrative (as did children in SC); but in addition, and immediately after they listened to the story, the SIRC children were told to close their eyes and tell themselves the story they have just heard and try to see what happens in the story as they told it to themselves (imagery rehearsal). No puppets or scenery props were used.
Experimental Conditions and Procedures

As stated earlier, all children, within each age-span, were randomly assigned to the four conditions; and they were treated and tested individually. Involvement with treatment conditions commenced when the tape recorder was turned on. Further descriptions of detail in each condition follow:

(1) EC: After the child responded positively to the invitation to listen to the story, the experimenter placed a scenery prop on the table in front of the child, brought out another puppet and said, "Here is another puppet. Would you like to put this one on?" When the child agreed, the experimenter then helped the child put the puppet on his/her preferred hand when needed. (This procedure took ten seconds, and is part of the preliminary preparations described above). The experimenter then said, "I am going to play a story that is on this tape recorder. I want you to make the puppet act out the story while you are listening to the story. Do you think you can do that?" As soon as the child gave a positive response, the experimenter, while turning the tape recorder on, said, "Listen very carefully to the story, and make the puppet do what the story says." The story was then played. As the story was being played the experimenter watched but did not make any gestures or comments during this time. As soon as the story was finished, the scenery was removed from sight, and the puppet was taken off of the child's hand and placed out of sight. The story tape was removed from the tape recorder; and a blank tape was put in its place. During this
time the experimenter remained quiet. The removal of the props and story tape, and the placing of a blank tape into the tape recorder usually took slightly less than 30 seconds. If this procedure took less time, the experimenter remained quiet and waited (i.e. looked at a procedure paper in front of him, acted busy, and so forth) until 30 seconds passed. Post-test 1 (PT-1) then commenced (see below).

(2) IC: After the child responded positively to the invitation to listen to a story, the experimenter placed a scenery prop on the table in front of the child, and brought out another puppet used with the story to be heard. The experimenter then placed the puppet on his, the experimenter's, hand. (This procedure took ten seconds; and is part of the preliminary preparations described above). The experimenter then said, "I am going to play a story that is on this tape recorder. I will make the puppet act out the story while you watch the puppet and listen to the story. Do you think you can do that?" As soon as the child gave a positive response, the experimenter, while turning on the tape recorder, stated, "Listen very carefully to the story and watch the puppet do what the story says." While the recorded story was played on the tape recorder, the experimenter enacted the story with the puppet. As soon as the story was over, the same procedures carried out when the story finished in the EC condition were followed. PT-1 then began (see below).

(3) SC: After the child responded positively to the invitation to listen to a story, the experimenter said, "I am going to play a story that is on this tape recorder. I want you to listen to
the story while it is being played. Do you think you can do that?" As soon as the child responded positively, the experimenter said, while turning the tape recorder on, "Listen very carefully to the story." While the story was being played, the experimenter listened with the child. The experimenter followed the same procedures as in the EC and IC conditions as soon as the story finished, except that there was no puppet or scenery prop to remove. PT-1 commenced when the standard time had elapsed.

(4) SIRC: After the child responded positively to the invitation to listen to a story, the experimenter said, "I am going to play a story that is on this tape recorder. I want you to listen to the story while it is being played. Do you think you can do that?" As soon as the child responded positively, the experimenter said, while turning the tape recorder on, "Listen very carefully to the story." While the story was being played, the experimenter listened with the child. Immediately after hearing the story the children in this group were told, "Close your eyes, tell yourself the story, and imagine or try to see what happens in the story as you tell yourself the story." The child was given 30 seconds to do this. While the child was doing this the experimenter exchanged tapes in the tape recorder and remained silent until the 30 seconds lapsed. When 30 seconds lapsed, PT-1 then began (see below).
Post-Test Procedures

Post-test 1 (PT-1): Thirty seconds after the child listened to the narration the experimenter asked the child, while turning the tape recorder on to 'record', "Would you please tell me the story you just heard? If you can not tell it to me exactly as you heard it, then tell me the story as best as you can." (The rationale for the character of directions is given in Appendix B). When the child was finished responding (or remained silent for 20 seconds), the experimenter said, "Tell me everything or anything you remember about the story." When the child was finished, indicated either by statement or by failure to respond for 20 seconds, the experimenter said, "I will give you a moment to think. When I tell you, if there is anything else you would like to tell me which you have not said yet, you may tell me then." After a 30 second pause, the child was asked, "Is there anything else you remember about the story that you would like to tell me?" When the child was finished responding, as indicated by saying so or through a 20 second period of silence, PT-1 was terminated. However, before returning to the classroom, the child was told, "Please do not tell anyone what you did today." The experimenter then continued in two different ways. For the Y group the experimenter said, "Let's make this our secret and not tell anyone else, unless you wish to tell your parents." For the O and M groups the experimenter said, "It is important for this study that you do not tell anyone what we did today. Of course
if your parents ask you, you may tell them, but it is important that you do not tell any of your classmates. When I am finished with all of the children who will participate I will tell you. Then if you wish to talk about what you did today you may. Can you do this for me?" After the child responded he or she was returned to his or her class. This concluded PT-1.

Post-Test 2 (PT-2): one week after each child heard the narration, he/she was again tested on his/her recall of the story. This was done in two parts. Part One: after the child entered the testing room, a brief (one minute) warm-up or visit intended to help put each child at ease occurred. After the visit the experimenter stated, "Last week you heard a story on this tape recorder." While saying this the experimenter pointed to the tape recorder and turned it on. The experimenter continued: "Would you please tell me the story you heard on this tape recorder? If you cannot tell it to me exactly as you heard it, then tell me the story as best as you can." The exact directions as given in PT-1 were then followed to where PT-1 terminated. At this point the first part of PT-2 terminated. Part Two: The second part of PT-2 began immediately after the first part of PT-2 concluded. The experimenter said, "I am going to ask you some questions about the story." The experimenter then read a set of questions for the child to answer (see Appendix C). After all recall tasks were complete the Quick Test (QT) was administered. When the QT was completed, the experimenter concluded PT-2 by thanking the child
for coming in again, and asked the child not to tell his/her (class) friends about the test as was done at the end of PT-1. Moreover, prearrangements were made in that each child's teacher was asked to remind each child, privately, not to discuss what had been done.

**Scoring Measures**

The purpose of this study was to examine the extent to which four different encoding treatment conditions affected memory performances of children who varied in age. Memory performance here had as its object of recall, narrative content which was identical for all age-span groups and treatment conditions. Duration of the period allowed for encoding this content was also identical for all subjects. With these and the other controls described in place, age and condition effects on narrative recall were assumed to be assessable.

As indicated earlier, there are a number of researchers who are concerned with prose material and its recall. However, these people appear to have been more concerned with how content features influence recall or the impact of the type of content used on recall; and they have not studied how variations in age interact with encoding conditions to influence recall. Variability in story characteristics, such as length, content, theme development, and so forth are of interest in such studies. As such, these story characteristics are varied while age and encoding conditions are held constant. Thus, not all studies of
children's memory of narrative prose examine age effects. At the same time little interest and attention have been devoted to the study of the impact of encoding conditions on recall of narrative content. For reasons of the same sort, the present study keeps the story characteristics (e.g. narrative content) constant while varying the age and encoding conditions, the impact of which variations is of interest here. Therefore, in order to examine the influence of the encoding conditions on the amount of recall, one passage was used for all age-span groups and all encoding treatment conditions to maintain the same pattern of specific relations across the experimental conditions and age-span groups with regard to content.

There are, of course, many ways of measuring and/or scoring free recall protocols from prose passages (see Bartlett, 1932; Brown, 1975; Cofer, 1941; Mandler & Johnson, 1977; Meyer, 1975; Rubin, 1978a, 1978b; Rumelhart, 1975; Stein & Glenn, 1975b). However, what is measured is of concern. As Cofer (1941) has suggested, there are two major ways of examining recall mastery of prose. One entails a focus on verbatim (or word for word) content, and the other focus is on essential ideas (idea content or gist) of a passage. When descriptive, argumentative, or expositional discourse (three of the four types of connected discourse) are recalled, exact or verbatim recall might be of concern since variations in recall of details from these types of discourse could be critical to the meaning or substance of them. In such cases, the first major way of examining mastery
of prose (focus on verbatim content), might be more desirable as a measure for these types of discourse. However, with the fourth type of connected discourse, narration (which was used in this study), variations in reconstructions of content do not necessarily change meaning or substance. Furthermore, the age and encoding conditions entailed in this study may influence the degree to which reconstructions of the narrative depart from verbatim recall or are transformations or reconstructions of gist. In any event, minor variations are commonly reported where subjects are asked to recall prose material (Bartlett, 1932; Brown, 1975; Meyer, 1975; Northway, 1940; Stein & Glenn, 1975a).

As Bartlett (1932) has reported, recall of prose may be changed to fit one's "schema" when recalling a story. And, even if "exact" recall is required or asked for, transformations are normal rather than anomalous (Nelson, 1981) in reconstructed stories. Since minor variations must be expected, scoring procedures should reflect this. Furthermore, where children frequently resign or say less than they know when faced with what they regard as an impossible task (such as making an "exact" reproduction), avoidance of this is desirable if one wants to avoid false negatives. Accordingly, one does not ask for exact reproduction, and hence this justifies adoption of a scoring system which reflects the fact that exact reproduction was not requested. Thus, this study used the latter focus or second major way of examining recall of prose. To repeat, the
present focus was on essential ideas (or gist) of the story, not verbatim recall. Therefore, two ways of measuring free recall were used. Both of these were designed to measure the essential ideas or substance of the story, and take into account substitutions and/or transformations of the story content (see below).

Another way of measuring memory of discourse is through interrogation. One asks questions about the subject matter. Such interrogation may produce higher recall performances than free recall because the respondent is cued by the questions. However, the age and/or treatment conditions again may affect these performances. Accordingly, an exploration of recall through interrogation may reveal possible differential effects which may or may not be evident in the analysis of free recall output. This also may add weight to the conclusions that can be drawn from analysis of the data.

The foregoing considerations led to the adoption of three measures of the children's recall of the story content. The first two of these were designed to measure the children's free recall, and the third was designed to measure (test) the children's remembrance of the story content as elicited through questioning. It is possible to use only one measure to explore the predictions and the hypotheses in this study. However, the use of three measures (as discussed below) allows for a more thorough examination of observed differences, and provides a broader basis for drawing conclusions about the relationships
between the variables of interest than is provided by a single measure.

**Rubin's units of measurement.**

The first instrument (or scoring scheme) employed was designed to measure free recall of specific word units of a story as defined and described by Rubin (1978b). This measure scored specific "word units" (units) of the text recalled. This procedure allowed minor variations of the following sort: tense, case, number, and semantics. Noun to pronoun changes, and synonym substitutions are also acceptable. Therefore, this measurement scheme allowed for substitutions of the words which comply with the rules for the defined units in the text in order to measure amount of content remembered but recalled in a transformed state. At the same time it maintains the same scoring procedure for all children in all conditions. The story used in this study contained 76 possible "units" (see Appendix D) that could be recalled.

**Rumelhart's story categories.**

The second instrument (or scoring scheme) employed was designed to measure free recall of the substance or essential ideas of the text. This measure was based on the "category" structure of a story developed by Rumelhart (1975) and modified by Stein and Glenn (1975b). This design separates a story into content categories. These categories or "schemas" denote settings, events, internal responses (thoughts and feelings),
activities (excluding thoughts), and consequences. The story was categorized into Rumelhart's (Stein & Glenn, 1975b) schemas, or meaning units. This method, then, measures amount of recall by story category rather than by word units for analysis of the substance of the content. It allows for gist to be counted in the scoring as well as the verbatim content. Since the category substance or essential idea is the concern for this scoring procedure, the subjects are not penalized for transformed accounts which maintain the gist with fidelity. There were 41 "categories" (see Appendix E) derived from the story.

Both of the aforementioned measures examine the essential ideas or substance of a text. The word unit measure examines specific word units which are based on "content" words described by Rubin (1978b). The category measure examines specific phrases (categories) which include these "content" words as well as "function" words omitted by Rubin (1978b). The word unit measure is a smaller unit of measure than the category measure; and the category measure includes the contents of word units but treats same in terms of the category referents. However, it is possible to recall a word unit and not the category of a text, as well as it is possible to recall the essential idea or substance of a category without the defined word unit. Therefore, for a more complete analysis of the free recall the use of both these measures is desirable in order to reveal any possible differential effects which may or may not be evident with one measurement of the free recall output.
Memory under interrogation (or cued recall measurement).

A third means of measuring story recall was made by asking questions about the story. The questions (referred to as cued recall) were a sample of possible questions about the story content. These questions were used to allow for further analysis and comparison of the treatment conditions. They were constructed in accordance with Spencer's (1973, c.f. Meyer, 1975) prose analysis system based upon who, what, why, when, where, and how questions. The interrogation of children for recall of story content took place after the second free recall post-test. They were not asked after the first post-test so that the exchange entailed at PT-1 would not confound the free recall results at PT-2 (see Flavell, 1977; Kail, 1979; Kobasigawa, 1977; Meyer, 1979). A total of 24 questions were asked. The last five of these questions were not used as part of the total cued recall score since they were "opinion" questions. As such, there were 19 questions to be answered for scoring purposes. These are listed in Appendix C.

Scoring procedures

The measurement procedures yielded three sets of scores of recall data. These scores were derived from the three dependent measures: word units, story categories, and answers to questions (cued recall). These measures were scored as follows:

1) Word unit scores were tallied using a predetermined list made from the words derived from the story (see Appendix D).
Substitutions of any word unit were counted as correct if acceptable under the given rules.

2) Category scores were tallied from a predetermined list of categories (see Appendix E). All transformations of each category were individually judged or rated by two trained judges (raters) to determine whether or not the transformed category should be counted as correct. Where disagreements arose, the raters were brought together to come to a mutual agreement. This procedure resulted in 100% agreement between the raters.

3) The answers given to the questions (from interrogation about the story at the end of the PT-2 free recall session) were tallied for correctness from a list of predetermined answers (see Appendix C).

Since either one does or does not recall a given instance of information, the data (word unit scores, category scores, and cued recall scores) were treated as nominal data and recall of same was scored as one point while failure or incorrect recall was indicated by zero. Each child accumulated two scores for each of the word unit and category measures. Thus one pair was acquired at PT-1 and one pair was gained at PT-2. In addition, each child acquired one score from the number of correct answers on the cued recall measure (given as the second part of PT-2). This comprised the scoring of the three measures (word unit recall, category recall, and cued recall) of memory for the narrative content in the story.
Analysis

Since this study was a two factor (one classification, i.e., age factor plus one treatment i.e., encoding factor) experiment (Ferguson, 1981), a factorial design with 3 levels of age and 4 of encoding conditions was devised to organize observations of the effects of these factors on the dependent (memory) measures. The principal factors were age (Y, M, and O) and treatment condition (EC, IC, SC, and SIRC). A multivariate analysis of variance (MANOVA) was used to test for age and treatment effects, as well as for age by treatment interaction effects. The criterion for judgement of statistical significance was $p < .05$. For individual age-span differences, contrasts between the conditions (within age-spans) were made to test for between group differences. Tukey's HSD procedure was also used in this study for post-hoc analysis which usually included all pairwise comparisons that could be made. Moreover, when making all possible comparisons between means, such comparisons could not be regarded as independent. Therefore, this post-hoc test was taken to be appropriate (Hays, 1973; Kirk, 1967).
CHAPTER IV

Results

The present study was designed to discover if recall of narrative information is affected by age and encoding conditions (in which children encountered narrative material). Specifically, this study attempted to test hypotheses about the effects of conditions (as stated in Chapter 2) within age-span groups and of age within conditions.

In order to test the hypotheses, a multivariate analysis of variance tested the first set of hypotheses raised in Chapter 2. This analysis tested for age by treatment interaction, age effects, and treatment effects. These results are reported in part A of this chapter.

For the second set of hypotheses raised in Chapter 2, contrasts between the different condition groups for the Y and O age groups tested for between condition effects within each age-span; and a one way analysis of variance test for differences between the condition groups within the M age-span was also undertaken as an exploratory analysis. When differences were indicated by this latter analysis, pairwise contrasts between the groups were made in order to find where the differences were. These results are reported in part B of this chapter.
A third section (part C) is included in this chapter which gives results of a post-hoc analysis. The purpose of this analysis was to explore empirical connections between the encoding treatment conditions and memory for narrative content performance. Since this analysis was of a decidedly exploratory nature, the opportunity to compare results between the three age-spans provides some insight as to possible performance differences not seen in the analysis in part A or B (and questions which they raised).

Statistical control of variability on the recall measures attributable to other than the independent variables, age and encoding conditions, was sought through comparisons of all cells with respect to gender, IQ (ability), and SES. These comparisons are reported at the end of this chapter (below, pages 78-79). Analysis of results pertinent to the study now follows.

Part A

Age and Treatment effects

The preliminary multivariate analysis of variance indicated that there was no age by encoding condition interaction. Therefore, hypothesis 1, which predicted age and encoding interaction effects, was rejected. However, this analysis did reveal a significant main effect of age, $F(10,308)=13.17$, $p<.001$. As well, there was a significant main effect of treatment, $F(15,426)=4.16$, $p<.0001$. Since the hypotheses were
concerned with both PT-1 and PT-2, the results from an analysis at PT-1 and PT-2 follow. Further, since the category measure was found to be highly correlated to the unit measure (a correlation coefficient of .93 between the category and unit measure at PT-1; and a correlation coefficient of .94 between the category and unit measure at PT-2) the unit measure performances were dropped from further consideration since they contribute little that is not merely redundant for present purposes. Hereafter, the measures under discussion should be understood to be the category measures unless otherwise stated. Moreover, since it is the univariate results that are of interest (seen especially at PT-2) Bonferroni's procedure (Kirk, 1968, pp. 79-80) of dividing the significance level for hypothesis testing was used. Therefore, the critical region of acceptance for the hypotheses testing was reset to $p < .01$.

An univariate analysis of variance at PT-1 revealed a significant main effect of age, $F(2, 158) = 61.41, p < .0001$; and a significant main effect of treatment, $F(2, 158) = 6.08, p < .0007$. At PT-2 there was again a significant main effect of age ($F(2, 158) = 41.62, p < .0001$; for the cued recall measure, $F(2, 158) = 36.79, p < .0001$). As well, at PT-2, there was a significant main effect of treatment ($F(3, 158) = 9.03, p < .0001$; and for the cued recall measure, $F(3, 158) = 19.26, p < .0001$). Nonorthogonal contrasts between the age-spans across the treatment conditions indicated that at PT-1 the Y age-span was significantly inferior to the M age-span ($F(1, 158) = 13.34,$
and to the O age-span \( (F(1,158)=109.48, p<.0001) \). The M and O age-spans were not significantly different at PT-1. Therefore, hypothesis 2, which predicted superior recall by the oldest age-span (as compared to the Y and M age-spans), was rejected; while hypothesis 3, which predicted superior recall by the M age-span (as compared to the youngest age-span), was supported at PT-1.

At PT-2 the mean performances for the Y and M age-spans were not significantly different from each other. However, the Y age-span was significantly inferior to the O age-span \( (F(1,158)=71.97, p<.0001) \); and on the cued recall measure, \( F(1,158)=51.37, p<.0001) \). As well, the M age span was also found to be significantly inferior to the O age-span \( (F(1,158)=11.50, p<.0001) \); and on the cued recall measure, \( F(1,158)=22.20, p<.0001) \). Accordingly, at PT-2 hypothesis 2 was supported while hypothesis 3 was rejected.

For the treatment conditions (across the ages), at PT-1 the IC condition group was found to be superior to the SC group \( (F(1,158)=15.01, p<.0002) \). Similarly the IC condition group was found to be superior to the SIRC group \( (F(1,158)=9.46, p<.0025) \). No other differences were found at PT-1. Accordingly, hypothesis 4, which predicted recall differences between the EC and IC conditions was rejected at PT-1. Further, hypothesis 5, which predicted recall differences between the EC and both symbolic conditions (SC and SIRC), was also rejected at PT-1.
At PT-2, the EC condition group was found to be superior to the SC group \( F(1,158)=17.42, p<.0001 \). On the cued recall measure, \( F(1,158)=35.86, p<.0001 \). The EC condition group was also found to be superior to the SIRC group \( F(1,158)=15.11, p<.0002 \); on the cued recall measure, \( F(1,158)=29.34, p<.0001 \). Further, the IC condition group was found to be superior to the SC group \( F(1,158)=13.99, p<.0003 \); on the cued recall measure, \( F(1,158)=32.96, p<.0001 \). Also, the IC condition group was found to be superior to the SIRC group \( F(1,158)=9.57, p<.0024 \). The same result was found on the cued recall measure, \( F(1,158)=21.90, p<.0001 \). Therefore, hypothesis 4 was rejected while hypothesis 5 was supported at PT-2.

Part B

Within Age-Span Comparisons Between the Conditions

Again, for clarity and simplicity, only the PT-1 category measure and PT-2 category and cued recall measures performance results are reported (given the high correlation coefficients obtained between the category and unit measures at PT-1 and at PT-2 as reported above). Figure 2A (below, page 57) is a graphic representation of the mean recall performances on the category measure for each age-span group in each condition at PT-1 and PT-2. A graphic representation of performances on the cued recall measure (PT-2) can be seen in Appendix F, Figure 2B. The analysis of results pertinent to each age-span group follows:
Figure 2A

Mean recall performance (PT-1\(^1\) and PT-2\(^2\)) on the category measure by each treatment condition group (EC, IC, SC, and SIRC conditions) for each age-span group

1- The upper most extremity (.) in each condition represents the mean performance on the category measure at PT-1.

2- The bottom most extremity (.) in each condition represents the mean performance on the category measure at PT-2.

- The vertical bar (|) between the two extremities represents the decrement from PT-1 to PT-2 on the category measure for the conditions.
Y age-span comparisons (between conditions).

For the performance on all measures (PT-1 and PT-2) by the Y age-span group, the means and standard deviations for each condition are presented in Table III (below, page 59). A graphic representation of the means on each measure for each condition group at PT-1 and PT-2 is presented in Figure 3A and 3B (below, page 60).

An initial univariate analysis of variance contrast (Helmert contrast) indicated that there was no significant difference between the EC condition and the other conditions when contrasted at PT-1 and PT-2. Moreover, this was case on the cued recall measure too. Therefore, hypothesis 6, which stipulated that the EC group would be superior on performance to all the other conditions (IC, SC, and SIRC) was rejected. However, a post-hoc analysis revealed that children in the EC condition were significantly superior to the children in the SC condition at PT-1 and on the category and cued recall measures at PT-2 (Tukey HSD, p<.05). As well, the EC group was significantly superior on performance when compared to the SIRC group on the cued recall measure at PT-2 (Tukey HSD, p<.05). However, the IC group was significantly superior to the SC group at PT-1 and on the PT-2 cued recall measure. Also, the IC group was found to be significantly superior to the SIRC group on the cued recall measure at PT-2 (Tukey HSD, p<.05). It appears that the IC group was accounting for the nonsignificant differences found when testing this hypothesis. This is evident since at
Table III

Means and standard deviations of each measure at PT-1 and PT-2 by the Y age-span group in each condition

<table>
<thead>
<tr>
<th>Measure</th>
<th>Condition</th>
<th>PT-1 Mean</th>
<th>PT-1 SD.</th>
<th>PT-2 Mean</th>
<th>PT-2 SD.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category:</td>
<td>EC</td>
<td>6.53</td>
<td>3.81</td>
<td>5.40</td>
<td>3.66</td>
</tr>
<tr>
<td></td>
<td>IC</td>
<td>7.67</td>
<td>4.42</td>
<td>4.60</td>
<td>3.02</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>2.80</td>
<td>2.31</td>
<td>2.33</td>
<td>1.84</td>
</tr>
<tr>
<td></td>
<td>SIRC</td>
<td>4.21</td>
<td>3.40</td>
<td>3.00</td>
<td>2.75</td>
</tr>
<tr>
<td>Mean Total</td>
<td></td>
<td>5.32</td>
<td>3.98</td>
<td>3.84</td>
<td>3.08</td>
</tr>
<tr>
<td>Unit:</td>
<td>EC</td>
<td>13.47</td>
<td>7.02</td>
<td>10.53</td>
<td>6.19</td>
</tr>
<tr>
<td></td>
<td>IC</td>
<td>15.00</td>
<td>7.72</td>
<td>9.06</td>
<td>4.64</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>6.13</td>
<td>4.45</td>
<td>4.47</td>
<td>3.40</td>
</tr>
<tr>
<td></td>
<td>SIRC</td>
<td>9.50</td>
<td>6.25</td>
<td>5.71</td>
<td>4.01</td>
</tr>
<tr>
<td>Mean Total</td>
<td></td>
<td>11.50</td>
<td>7.22</td>
<td>7.47</td>
<td>5.19</td>
</tr>
<tr>
<td>Cued Recall:</td>
<td>EC</td>
<td>-----</td>
<td>-----</td>
<td>8.60</td>
<td>2.59</td>
</tr>
<tr>
<td></td>
<td>IC</td>
<td>-----</td>
<td>-----</td>
<td>7.07</td>
<td>2.28</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>-----</td>
<td>-----</td>
<td>4.33</td>
<td>2.32</td>
</tr>
<tr>
<td></td>
<td>SIRC</td>
<td>-----</td>
<td>-----</td>
<td>4.21</td>
<td>2.39</td>
</tr>
<tr>
<td>Mean Total</td>
<td></td>
<td>6.08</td>
<td>3.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

n: EC=15; IC=15; SC=15; SIRC=14; Total= 59.

both PT-1 and PT-2 the mean recall scores for the IC group closely resembled those of the EC group. A summary of these results is presented in Table IV (below, page 61).
Figure 3A
Condition group performance means for Y age-span
(category and unit measures at PT-1)

Legend:  
category=    
unit=  

Figure 3B
Condition group performance means for Y age-span
(category, unit, and cued recall measures at PT-2)

Legend:  
category=    
unit=  
cued=  

Condition Groups (Y Age-Span)
Table IV

Summary of the results of all pairwise comparisons on the PT-1 category and PT-2 category and cued recall measures (Y age-span)

<table>
<thead>
<tr>
<th>Group Contrast</th>
<th>PT-1 Category Measures</th>
<th>PT-2 Category</th>
<th>Cued Recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC vs IC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC vs SC</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>EC vs SIRC</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>IC vs SC</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>IC vs SIRC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SC vs SIRC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = significant at p<.05 (Tukey HSD Test, Post-Hoc). Absence of asterisks = no significant difference between groups.

M age-span group comparisons (between conditions).

For the performance by the M age-span group at PT-1 and PT-2 on all measures, the means and standard deviations for each condition are presented in Table V (below, page 62). Further, a graphic representation of the means on each measure for each condition group can be seen in Figures 4A and 4B (below, pages 63-64).
### Table V

Means and standard deviations of each measure at PT-1 and PT-2 by the M age-span group in each condition

<table>
<thead>
<tr>
<th>Measure</th>
<th>Condition</th>
<th>PT-1</th>
<th>PT-2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD.</td>
</tr>
<tr>
<td>Category:</td>
<td>EC</td>
<td>14.23</td>
<td>3.79</td>
</tr>
<tr>
<td></td>
<td>IC</td>
<td>14.00</td>
<td>5.16</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>11.00</td>
<td>4.58</td>
</tr>
<tr>
<td></td>
<td>SIRC</td>
<td>9.86</td>
<td>4.67</td>
</tr>
<tr>
<td></td>
<td>Mean Total</td>
<td>12.26</td>
<td>4.81</td>
</tr>
<tr>
<td>Unit:</td>
<td>EC</td>
<td>23.92</td>
<td>4.91</td>
</tr>
<tr>
<td></td>
<td>IC</td>
<td>24.50</td>
<td>7.78</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>20.46</td>
<td>6.75</td>
</tr>
<tr>
<td></td>
<td>SIRC</td>
<td>18.21</td>
<td>6.23</td>
</tr>
<tr>
<td></td>
<td>Mean Total</td>
<td>21.76</td>
<td>6.85</td>
</tr>
<tr>
<td>Cued recall:</td>
<td>EC</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td>IC</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td>SIRC</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td>Mean Total</td>
<td>7.89</td>
<td>3.10</td>
</tr>
</tbody>
</table>

n: EC=13; IC=14; SC=13; SIRC=14; Total= 54.

A one way univariate analysis of variance on the category measure at PT-1 did not indicate that there were any significant differences between the conditions. However, at PT-2 significant differences were revealed \(F(3,50)=5.71, p<.002\); and for the cued recall measure, \(F(3,50)=8.35, p<.001\). Pairwise comparisons between the treatment groups on the measures using Tukey's HSD procedure indicated that at PT-2 the EC group was
Condition group performance means for M age-span (category and unit measures at PT-1)

significantly superior to the SC and SIRC groups on both (category and cued recall) measures (Tukey HSD, p<.05). Further, the IC group was superior to the SC and SIRC groups on the cued recall measure. A summary table of the results can be seen in Table VI (below, page 65).
Figure 4B

Condition group performance means for M age-span (category, unit, and cued recall measures at PT-2)

Legend:  
category= 
unit= 
cued= 

Condition Groups (M Age-Span)
Table VI

Summary of the results of all pairwise comparisons on the PT-1 category measure and the PT-2 category and cued recall measures (M age-span)

<table>
<thead>
<tr>
<th>Condition Group Contrast</th>
<th>PT-1 Measures</th>
<th>PT-2 Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Category</td>
<td>Category</td>
</tr>
<tr>
<td>EC vs IC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC vs SC</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>EC vs SIRC</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>IC vs SC</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>IC vs SIRC</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>SIRC vs SC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

absence of asterisk = no significant difference between groups.
* = significant at p<.05 (Tukey HSD Test, Post-Hoc)

O age-span comparisons (between conditions).

The means and standard deviations of the measures performances for the O group condition subgroups at PT-1 and PT-2 are presented in Table VII (below, page 66). Furthermore, the means of each measure in each condition are graphically presented in Figures 5A and 5B (below, pages 67-68). Moreover, since it is obvious from close inspection of the mean recall performances that the SIRC group was not superior to at least one other condition group at PT-1 or PT-2, as hypothesis 7 predicted, hypothesis 7 was rejected. Finally, a post-hoc
analysis (using Tukey's HSD test) did not reveal any significant difference between any of the groups on this analysis at PT-1 or PT-1.

Table VII

Means and standard deviations of each measure at PT-1 and PT-2 by the 0 age-span group in each condition

<table>
<thead>
<tr>
<th>Measure</th>
<th>Condition</th>
<th>PT-1 Mean</th>
<th>PT-1 SD.</th>
<th>PT-2 Mean</th>
<th>PT-2 SD.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category:</td>
<td>EC</td>
<td>13.93</td>
<td>3.91</td>
<td>10.79</td>
<td>3.12</td>
</tr>
<tr>
<td></td>
<td>IC</td>
<td>15.29</td>
<td>5.31</td>
<td>11.64</td>
<td>3.43</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>12.80</td>
<td>5.33</td>
<td>8.67</td>
<td>5.45</td>
</tr>
<tr>
<td></td>
<td>SIRC</td>
<td>14.00</td>
<td>5.83</td>
<td>8.43</td>
<td>4.83</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>13.98</td>
<td>5.09</td>
<td>9.86</td>
<td>4.44</td>
</tr>
<tr>
<td>Unit:</td>
<td>EC</td>
<td>24.14</td>
<td>5.48</td>
<td>18.86</td>
<td>3.16</td>
</tr>
<tr>
<td></td>
<td>IC</td>
<td>26.86</td>
<td>8.39</td>
<td>20.93</td>
<td>5.77</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>22.73</td>
<td>8.59</td>
<td>15.00</td>
<td>8.30</td>
</tr>
<tr>
<td></td>
<td>SIRC</td>
<td>24.64</td>
<td>10.15</td>
<td>15.21</td>
<td>8.98</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>24.56</td>
<td>8.24</td>
<td>17.46</td>
<td>7.24</td>
</tr>
<tr>
<td>Cued Recall:</td>
<td>EC</td>
<td>-----</td>
<td>-----</td>
<td>10.86</td>
<td>1.99</td>
</tr>
<tr>
<td></td>
<td>IC</td>
<td>-----</td>
<td>-----</td>
<td>11.57</td>
<td>2.59</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>-----</td>
<td>-----</td>
<td>9.13</td>
<td>2.50</td>
</tr>
<tr>
<td></td>
<td>SIRC</td>
<td>-----</td>
<td>-----</td>
<td>9.36</td>
<td>3.73</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>10.21</td>
<td>2.89</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

n: EC=14; IC=14; SC=15; SIRC=14; Total= 57.
Figure 5A

Condition group performance means for 0 age-span
(category and unit measures at PT-1)

Legend: category=  
unit=  

Condition Groups (O Age-Span)
Figure 5B

Condition group performance means for O age-span (category, unit, and cued recall measures at PT-2)

Legend: category= unit= cued= 
Part C

Other Observed Differences: Exploratory Post-Hoc Analysis

Observed differences which arise from comparisons made for reasons other than those required for testing the hypotheses set forth above are worthy of examination.

Figure 6 (below, page 72) is a graphic representation of the mean recall performances at PT-1 on the category measure across the age-span groups within each condition. A similar graphic representation of the mean recall performances on the PT-2 category measure can be seen in Figure 7 (below, page 73). Likewise, a graphic representation of the mean cued recall performances within each condition (at PT-2) can be seen in Figure 8 (below, page 74).

As can be seen from figures 6-8, the EC condition performance graph appears to flatten (or be at a plateau) for the older age-spans, while the graphs of the other conditions appear to steadily rise as age increases. While these graphs indicate an interaction (a crossing or intersection of slopes formed from means), there was no age by treatment interaction found in the initial analysis (part A). However, just as one should exercise caution when dealing with interaction effects (Glass & Stanley, 1970), noninteraction should also be treated with thoughtful care since "such failure to see our intuitive notions reflected perfectly in our mathematical models is a hazard (or reality) of an attempt to present the real world
mathematically" (Glass & Stanley, 1970, p. 410).

A nonsignificant interaction effect would indicate that the performances (within condition across age-spans) in the conditions were similar, or that when within condition age-span means are plotted and compared to the plots of the other conditions, they should be parallel. An inspection of figures 6-8, however, does not indicate this. These figures evoke curiosity about the adequacy of the mathematical analysis. Further analysis of between groups differences and trends in the data seems warranted for both theoretical and practical reasons, since the performances of the children within each age-span differed (note between conditions comparisons in Part B above).

These considerations favored an exploratory analysis which was undertaken to answer the following question: What degree of polynomial best approximates the form of the curve which connects the group means for each condition (across the age-spans)? In other words, what level of polynomial function best describes the form of the group means (data points) of the various encoding conditions? To answer this question, tests for linear trends in each condition was undertaken. Tests for deviation from a linear trend were also undertaken.

Testing for linear trends across the age groups (within condition) revealed that three conditions had significant linear trends at PT-1 (t=4.13, p<.0002 for the IC condition; t=5.95, p<.0001 for the SC condition; and t=5.98, p<.0001 for the SIRC
condition). Further, one condition, the EC condition, deviated significantly from a linear trend ($t=3.12, p<.0035$), and indicated a quadratic trend. On the PT-2 category measure the same results were found: the IC, SC and SIRC conditions had significant linear trends and the EC condition deviated from a linear trend ($t=5.59, p<.0001$ for the IC condition; $t=6.92, p<.0001$ for the SC condition; $t=7.02, p<.0001$ for the SIRC condition; and the EC condition $t=2.27, p<.029$ for deviation from a linear trend). For the PT-2 cued recall measure no deviations from linear trends were found. However, all the conditions did have a significant linear trend ($t=9.82, p<.0001$ for the EC condition; $t=4.93, p<.0001$ for the IC condition; $t=6.68, p<.0001$ for the SC condition; and $t=7.28, p<.0001$ for the SIRC condition).

As indicated in Chapter 2, one might wonder if conditions of encoding mitigate age differences in recall. Accordingly, the following questions were posed: (1) Do all condition groups of the Y age-span differ significantly from all the M and O age-span condition groups at PT-1? And (2) are all condition groups of the Y age-span significantly different from all the O age-span condition groups at PT-2? To answer these two questions, a post-hoc analysis using the Tukey test (Hays, 1973; Kirk, 1967) was employed to test for all possible differences between all ages across the conditions at PT-1 and PT-2. The results of the analysis on the category measure (PT-1 and PT-2) and on the cued recall measure (PT-2) can be seen in tables
Figure 6

Performance means for each age-span group in each condition on the category measure at PT-1.

Legend: EC, IC, SC, SIRC

Age-Span Groups
Figure 7

Performance means for each age-span group in each condition on the category measure at PT-2

Legend: 
- EC = 
- IC = 
- SC = 
- SIRC = 

Age-Span Groups
Figure 8

Performance means for each age-span group in each condition on the cued recall measure at PT-2)

Legend:
- EC =
- IC =
- SC =
- SIRC =
Table VIII

Summary table of results of the Tukey HSD post-hoc analysis on the category measure (at PT-1) with all age-spans across all conditions

<table>
<thead>
<tr>
<th>age</th>
<th>Y Y Y Y M M O O M O M O</th>
</tr>
</thead>
<tbody>
<tr>
<td>condition</td>
<td>S S E I S S S E I S E I</td>
</tr>
<tr>
<td>C I C C I C C C C I C C</td>
<td></td>
</tr>
<tr>
<td>mean</td>
<td>2.80 Y SC</td>
</tr>
<tr>
<td>4.22 Y SIRC</td>
<td></td>
</tr>
<tr>
<td>6.53 Y EC</td>
<td></td>
</tr>
<tr>
<td>7.67 Y IC</td>
<td></td>
</tr>
<tr>
<td>9.86 M SIRC</td>
<td>* *</td>
</tr>
<tr>
<td>11.00 M SC</td>
<td>* *</td>
</tr>
<tr>
<td>12.80 O SC</td>
<td>* * *</td>
</tr>
<tr>
<td>13.93 O EC</td>
<td>* * * *</td>
</tr>
<tr>
<td>14.00 M IC</td>
<td>* * * *</td>
</tr>
<tr>
<td>14.00 O SIRC</td>
<td>* * * *</td>
</tr>
<tr>
<td>14.23 M EC</td>
<td>* * * *</td>
</tr>
<tr>
<td>15.29 O IC</td>
<td>* * * *</td>
</tr>
</tbody>
</table>

* = Denotes pairs of groups significantly different at p<.05.
Table IX

Summary table of results of the Tukey HSD post-hoc analysis on the category measure (at PT-2) with all age-spans across all conditions

<table>
<thead>
<tr>
<th>age span</th>
<th>Y Y Y Y M M M O O M O O</th>
</tr>
</thead>
<tbody>
<tr>
<td>condition</td>
<td>S S I E S S I S S E E I</td>
</tr>
<tr>
<td></td>
<td>C I C C C I C I C C C C</td>
</tr>
<tr>
<td></td>
<td>R R R C C C C C C C C</td>
</tr>
</tbody>
</table>

| mean | 2.33 Y SC |
|      | 3.00 Y SIRC |
|      | 4.60 Y IC |
|      | 5.40 Y EC |
|      | 5.69 M SC |
|      | 5.93 M SIRC |
|      | 8.36 M IC * * |
|      | 8.43 O SIRC * * |
|      | 8.67 O SC * * |
|      | 10.38 M EC * * * * * |
|      | 10.79 O EC * * * * * * |
|      | 11.64 O IC * * * * * * |

* = Denotes pairs of groups significantly different at p<.05.
Table X

Summary table of results of the Tukey HSD post-hoc analysis on the cued recall measure (at PT-2) with all age-spans across all conditions

<table>
<thead>
<tr>
<th>age span</th>
<th>Y</th>
<th>Y</th>
<th>M</th>
<th>M</th>
<th>Y</th>
<th>Y</th>
<th>O</th>
<th>O</th>
<th>M</th>
<th>M</th>
<th>O</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>condition</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>I</td>
<td>E</td>
<td>S</td>
<td>S</td>
<td>I</td>
<td>E</td>
<td>E</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>C</td>
<td>C</td>
<td>I</td>
<td>C</td>
<td>C</td>
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<td>I</td>
<td>C</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>4.21</td>
<td>Y</td>
<td>SIRC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.33</td>
<td>Y</td>
<td>SC</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5.69</td>
<td>M</td>
<td>SC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.57</td>
<td>M</td>
<td>SIRC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>7.07</td>
<td>Y</td>
<td>IC</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>8.60</td>
<td>Y</td>
<td>EC</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.13</td>
<td>O</td>
<td>SC</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.36</td>
<td>O</td>
<td>SIRC</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.43</td>
<td>M</td>
<td>IC</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.85</td>
<td>M</td>
<td>EC</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.86</td>
<td>O</td>
<td>EC</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.57</td>
<td>O</td>
<td>IC</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = Denotes pairs of groups significantly different at p<.05.
Ability (IQ), SES, and Gender Variables

Ability (IQ).

A oneway analysis of variance on the scores obtained from the ability factor indicated that there were no significant differences between the three age tiers on this measure. Moreover, no significant differences were found between the condition groups in regard to the ability measure within each age-span.

Gender and SES.

The proportions of males and females in the three (age-tier) distributions did not differ when they were compared with a chi square test statistic (Siegel, 1956). Nor did the age-tiers sub-samples differ in their socio-economic class composition when the distributions of proportions for each of four SES categories were compared with a Kolmogorov-Smirnov goodness of fit test (Siegel, 1956). Moreover, no significant differences in the distributions of these variables were found between the condition groups. This is as expected, given the random assignment procedure.

Since there were no significant differences in the ability, gender, and SES factors between any subgroups of the sample, it was assumed that these variables were evenly distributed throughout the sample, and as such, did not appear to have any systematic influence on the dependent measures. No further
statistical analysis for control of these variables was warranted since sample sub-sets did not differ from one another with regard to gender or sex mix, social class, and measured ability.

Reliability of the Free Recall Measurement

Since measures of free recall were taken at 30 seconds and one week following the children's encounter with the narrative, an assessment of the reliability of measurement was incorporated in the study. Calculation of Pearson product-moment correlations for test(PT-1) - retest(PT-2) reliability revealed respectable correlations (on the category measure $r = .80; n = 170; p < .001$; and on the unit measure $r = .79; n = 170; p < .001$). Accordingly, one may conclude that measurement error was very modest and that the measures were highly reliable. While the validity of the measures was discussed earlier in Chapter 3, further support is afforded the validity of the measures by the high reliability obtained.
CHAPTER V

Discussion

As was indicated in the first two chapters, the present study was undertaken to obtain empirical evidence pertinent to conjectures about the development of memory for meaningful discourse. In particular, it was informed by suggestions (a) that such memory depends upon knowing; (b) that such knowing depends upon representation; (c) that said knowing and representation are affected by the nature of the representational capacities of the knower and the conditions under which the knowledge is constructed; (d) that the knower's representational capacities are transformed, augmented and enhanced as the knower matures (through time); and finally (e) that the character and extent of memory for or recall of meaningful discourse is affected by the conditions under which the discourse information is encoded and the degree to which the representational systems in which the information is encoded have matured.

The successive emergence in the development of representational systems which Bruner (1964; 1966; 1973) described, provided the theoretical basis for the formulation of developmental hypotheses about recall performances. In the present study, the manipulation of representational maturity was made possible through (1) the use of a cross-sectional design
wherein the recall performances of children varying in age from 5 to 11 years were compared; (2) the manipulation of representations which were ordered through the systematic variation of encoding conditions (whereby the four sub-sets from any one of the three age tiers encoded the narrative content in four different encoding conditions; and each of the four encoding conditions was identical to those encountered by corresponding sample sub-sets in the other two age tiers). The said manipulations and other design features constituted a means by which the developmental hypotheses discussed above could be tested by experimental procedures.

In effect, the study attempted to explore how the interaction of encoding conditions with age-affected capacities affects recall of narrative content. The differential effects of encoding conditions were assessed within age tiers through comparisons of recall performances of the sub-sets of the age cohort formed through random assignment. The differential effects of increasingly mature representational capacities were assessed through exploratory analysis of the mean performances from the three age tiers (with one another) within the conditions.

As was seen in chapter IV (Results) a large amount of data was gathered and reported. Therefore, this chapter provides a summary of the findings and evaluation of the hypotheses. In addition, alternative explanations of the results are considered. Furthermore, the results are considered in relation
to a number of theoretical issues and questions including those raised in the first sections of this document. Thereafter, directions for further research which arise from or are underscored by the present findings are described. Finally, the implications the results have for instructional questions are explored.

Evaluation of Hypotheses

1. Part A: Age and treatment effects.

As seen from the initial analysis, commonly reported age differences in recall were also found in this study. An interesting observation however, is the variability in performances of the M age-span. While the M age-span had performances like the O age-span on the immediate recall task, they performed more like the Y age-span children on the one week delayed recall task. These results seem to reflect the intermediate degree of maturity of their cognitive structures and functions (compared with the younger and older subsamples).

The initial analysis also indicated that the performances of the children in the iconic condition were superior to the children in the symbolic (SC and SIRC) conditions at PT-1 and PT-2. At PT-2 the children in the EC condition were also superior to the children in the symbolic conditions. Lastly, although there was an absence of a significant interaction effect, there were between age-span within condition, as well as within age-span between condition, differences. It appears that
the results obtained from this study were not powerful enough to give significant interaction effects. This, of course, raises questions about the extent of qualitative changes in cognitive functioning during the time span incorporated in this study. Further discussion on this point is presented below.

2. **Part B: condition variability within age-span groups.**

A. **Youngest (Y) age-span group.**

While it was hypothesized that the same observed relationships as those reported by Travis and White (1979) would be found with the youngest (Y) age-span group, the evidence from this study indicates that not only was the enactive condition associated with optimal recall, but the iconic condition was associated with optimal recall as well. This was found on both the immediate and one week delay recall when these recall performances were compared to the recall performances of the symbolic conditions (SC and SIRC).

B. **Middle (M) age-span group.**

For the middle age-span group there was no previous theoretical basis for predicting that the encoding conditions would differentially affect recall performances. For this reason, an exploratory analysis between the encoding conditions was made for this age-span. No recall differences were found on the immediate recall, but differences were found on the one week delay recall. Further, the M age-span results were similar to
the Y age-span results at PT-2 — as was found on the initial analysis. That is, at PT-2, the EC and IC conditions were superior to the symbolic conditions (SC and SIRC) on the one week delay recall but not on the immediate recall task.

C. Oldest (0) age-span group.

Superior efficiency of symbolic representation (as compared to enactive and iconic representation) was hypothesized for the oldest group (0 age-span group). However, no significant differences between any of the encoding conditions were obtained when both the immediate and one week delay recall performances were tested.

3. Part C: exploratory analysis.

While the trend analysis indicated that there is the possibility that the enactive condition was possibly deviating from a linear trend (and that the other conditions were not), it must be remembered that the EC condition deviation was not of sufficient magnitude to be significantly different from the linear trends of the other conditions. However, it does indicate that possibly older children (than those sampled in this study) should be tested to gain a better estimate of trends from a greater (i.e. less truncated) age range. Further discussion on this latter point is resumed below.
4. **Summary evaluation.**

The mean recall performance of children of 9 years and less in the enactive encoding condition was superior to the mean performances of children in the SC and SIRC conditions, as was the case in the Travis and White (1979) study. However, the iconic condition was no less powerful for the same age-spans (up to 9 years of age). In passing we may notice that the Travis and White (1979) sample was younger than the Y group in the present study. After age 9 the enactive and iconic conditions were not associated with advantage or disadvantage on recall of a narrative. For children between 9 and 11 years of age (those in the oldest age-tier in this investigation) there were no differences in recall between the conditions.

The evidence gathered from this study (within each age-span between condition effects) appears to indicate an emergence of symbolic processing efficiency. This efficiency was evident after 7 years of age when immediate recall was asked for. However, relative efficiency of retention over one week declined for youngsters under 9 years of age in the symbolic conditions. This was evident by the superior recall performances of the Y and M age-span groups in the EC and IC conditions; and their poorer performances in the symbolic conditions. The Y and M age-span groups were not as proficient in their recall of the narrative material as the O age-span group. They (Y and M age-span groups) may not have fully developed their capacities to assimilate information in symbolic systems, or have not
matured or developed alternative systems which are more economical and powerful than that which is established through motoric or iconic organization of their experiences. As such, it appears that in the M and Y age-spans, knowledge constructed in enactive or iconic schemes was more enduring and reconstructable than the symbolic constructions (alone or with rehearsal). Perhaps the younger children's (Y and M age-span groups) cognitive functioning is more dependent upon enactive and iconic schemas (see Anderson, Spiro, & Anderson, 1978; Bower, Black, & Turner, 1979; Richardson, 1969) than is the case for the older children (O age-span) who were generally more adroit in assimilating information to all three systems of representation (enactive, iconic, and symbolic). As age increased (from 5 to 11 years of age) the importance of the encoding conditions decreased since the latter had no differential effects on recall in the eldest group. While there were no significant between-condition differences in the O group, significant between-condition differences were observed in the younger age ranges. As will be discussed below, this is perhaps the most interesting finding in this study with respect to its implications for instruction.

As can be seen from the results, the two questions raised on page twelve can now be given tentative answers in relation to the study: 1) The recall advantage that age advance seems to confer remained constant within and across the various encoding conditions at each post-test. However, this consistency is only
seen at each post-test. Within the M age-span, there was a shift between the post-tests within and across the conditions. Performances resembled those of the O age-span at PT-1 and like those of the Y age-span at PT-2. 2) The comparative recall advantage which the enactive encoding condition conferred on young children in the Travis and White (1979) report did not appear in the present study. However, both the enactive and iconic conditions of encoding narrative material were associated with recall superiority up to 9 years of age in the present study. In fact, as the children's ages increased in the present investigation, there were fewer recall differences between the variable conditions (seen especially at PT-2).

This latter fact is of theoretical interest. That is, the fact of diminishing differential effects of encoding conditions which accompany age increases (as observed) has a bearing on the question of how accurate is the Brunerian conjecture about the order of emergence for representational systems. A brief reconsideration of Bruner's theoretical speculation and the inferences from and extensions of the same speculation which are pertinent to the interpretation of the present results is in order.

Recall that according to Bruner (1964; 1966; 1973) the three representational systems (enactive, iconic, and symbolic) emerge in the listed order. Moreover, while rudiments of all three systems are usually evident by the end of the second year, the maturity of the first or enactive system is more advanced
then, and for some time thereafter, than is the maturity of the iconic and symbolic systems. While little more than this is explicitly set forth by Bruner, one may conjecture, as was done in the present work, that the systems that emerge in order after the enactive system, will eventually surpass the enactive system in power, economy and efficiency with respect to the representation and organization of information.

One index of such power, economy and efficiency is memory. However, since the duration of the period(s) which must elapse before the later emerging systems equal and then surpass the premier system was (and still is) unknown, extrapolation, speculation, and inference were all one had to estimate when such developments would be evident.

One can extrapolate from Bruner's (1966; 1973) discussions and speculate that one of the two later emerging systems (the iconic system) may account for the often remarked upon changes which are reportedly modal in the seventh or eighth year. Compared with the enactive mode it has superior capacities for representing information that is action-independent such as can be illustrated by states or qualities which inhere in things acted upon. That is, notable gains in cognitive functions which have been reported regularly as emerging during the seven to eight year period may reflect the emergence of a degree of maturity in the second or iconic system which makes possible feats of thought for which the action-based system is less suited. Accordingly, these expectations about the maturational
pattern for the iconic system was reflected in the hypotheses of this study.

Similarly, Bruner's writings, and those of others such as Piaget (1968; 1976), suggest that the full flower of symbolic powers emerges still later. This suggested that hypotheses should reflect an expectation that maturity of the symbolic system would be evident in superior memory performances in the oldest age tier (i.e. toward the end of latency period).

When one turns to the evidence produced by the present investigation, several matters pertinent to Bruner's theoretical conjectures emerge. First, clear-cut and unequivocal confirmation of his conjectures (about the order of emergence) and the implications drawn about the patterns of maturation for the three systems are not provided by this study. However, the evidence tends to support, more than refute, the general outline of Bruner's ideas.

While the design does not permit an actual test of the conjecture about order of emergence, the superior power of the enactive system for the youngest subjects is inferable from comparisons of recall performances between conditions for the youngest group. This is especially compelling when the between groups comparisons for the middle and older groups reveal a diminishing advantage in recall for the enactive condition and emerging symbolic efficiency, as reflected in convergence of condition effects. However, notice must be taken of the recall
performances of the Y subjects in the iconic condition whose performances are not inferior to their cohorts in the enactive condition. This suggests that the maturity of the iconic system is more advanced by the ages represented in the youngest age tier than was expected. Moreover, the full power of a mature symbolic system was not evident (in superior recall) as expected in those oldest (O) subjects in the symbolic condition. This in turn suggests that full maturity of the symbolic system may emerge later than expected. This conclusion or interpretation is bolstered in a strongly suggestive, if not compelling way by the slopes of the curves formed by joining all data points of group means from the respective or corresponding tests across ages. Said curves, when used as a basis for extrapolation about when full symbolic system power may be evident, suggests future investigation of these matters with older subjects than were included in the present study.

In sum, the differences in memory performances in the present study do suggest that the three representational systems reach maximum efficiency in an order that does not contradict what one would expect given Bruner's speculations. The older (O) children were better able to recall the narrative in a symbolic encoding condition than were the younger (Y and M) children. It therefore appears that the symbolic representational system emerged last (as Bruner conjectured) with those children in the present investigation. If such representation systems emerge at different times in a particular
order (enactive then iconic then symbolic), one might expect that in childhood the ontogeny of the system which appears first will be more advanced than will be the case with the second. Likewise, the second system will be more mature than the third, until all reach full maturity (unless they mature at different rates). Unfortunately this matter is not settled here. However, if successive emergence of maturity in the three representational systems is a warranted conclusion, as suggested, then there are obvious scientific as well as educational implications which are worthy of consideration.

Discussion and Educational Implications of this Investigation

"Since the pioneer work of Bartlett (1932) on remembering, there has been a tendency to trivialize human learning in experiments designed to discover fundamental general principles."

(Entwistle, 1976, p. 1)

Success in showing mastery of subject matter in schools depends, in part, on the capacity to recall the information content of the various forms of discourse (e.g. narration, exposition, description, and argumentation). The development of this capacity is of interest to teachers and to scholars who are concerned with gaining understanding about recall or memory for the purpose of enhancing recall of important information.
Consideration of what is entailed in such recall has, apparently, led some scholars to the conclusion that, in spite of the very substantial amount of time and research effort on memory, little of practical consequence is known about memory (Neisser, 1982; Scribner, 1984). Even so, Wickelgren (1981) has taken issue with this conclusion. However, in doing so he focuses exclusively on what may be called studies of micro-memory phenomena.

Wickelgren (1981) claims that there are three temporal phases involved in memory studies: learning, storage (consolidation and forgetting), and retrieval (recall and recognition). Further, he distinguishes micro-studies from macro-studies on the following basis: Micro-studies are concerned with the learning of single (or a small set of) associations, and encoding these single (or small set of) chunks. Storage is concerned with the consolidation and forgetting of such small cells of learned information; and retrieval is concerned with a single elementary act of recalling or recognizing some unit of information (e.g. word, concept, proposition). Macro-studies consist of such studies involving multiple recall, ordered recall, free recall, creativity, problem solving, and comprehension of large units of text.

This distinction between micro- and macro-studies of memory phenomena is important when one considers Wickelgren's (1981) contention that significant knowledge and understanding has been gathered with regard to memory. For in making his case,
Wickelgren, explicitly and exclusively, limits his argument to the consideration of micro-studies. While many studies of memory may have been able to discover significant knowledge of memory within the framework of micro-considerations, the concerns that informed the assessments of the critics to whom Wickelgren (1981) reacted might well be rooted in the macro-world (which he excludes).

If micro-studies tell us little of significance with regard to how developing memory relates to macro-phenomena such as the information content of discourse, and this is what makes memory important for teachers and learners (Neisser, 1982), one has reason to address such matters. This is not to say that micro-studies have been altogether or entirely pointless; but they may tell us little about memory in natural settings (Neisser, 1982). For however cumulative the results of micro-studies might be, they may never be able to tell us what we need to know about macro-memory. Consideration of this last point arises since the procedures employed in micro-studies exclude the study of macro-considerations, such as how the form and unity and internal relations of the content affect free recall; or how different degrees of cognitive maturity, encoding conditions, and the nature and coherence of discourse material interact to influence recall. Therefore, the utility or relevance of micro-memory research to educational questions and issues may be doubted.

Answers to questions which are central to practical
problems and issues such as "...how pupils use their own past experiences in meeting the present and the future" (Neisser, p.12, 1982), are sought through the designs of macro-memory studies. The Ebbinghaus tradition of studying "pure memory" that isolates itself from previous learning (DiSibio, 1982) and possibly future learning, divorces itself from, as Neisser (1982, p.12) would say, "natural conditions". As teacher concerns are focused on educational issues and questions that entail memory for meaningful information and understanding, and memory for what makes sense (as opposed to the interest in recall of nonsense of concern in the Ebbinghaus tradition), macro-considerations such as those listed above have to be incorporated in memory studies if the study of memory is to have significance or functional value (Scribner, 1984). This is especially so where external and ecological validities are concerned (DiSibio, 1982; Hultsch & Hickey, 1978).

Accordingly, one has reason to suggest that macro-memory studies approach the concerns of teachers who must deal with more practical problems of memory better than do studies which investigate "...mental functions... ...in isolation from one another..." (Scribner, 1984, p. 2); for macro-memory studies are concerned with practical reality and utility more than is presently the case in micro-memory studies. As such, macro-studies may have more practical (or use) value because of respect for mundane realism and ecological as well as content validities than that which derives from exclusive concern for
experimental realism and theoretical purity (Travis, 1984; in press).

It is not difficult to understand why there is a considerable body of literature which emphasizes micro-memory studies. One only needs to look at the present study to comprehend why the Ebbinghaus experimental tradition has continued to be so popular; and why one tries to control as many variables as possible. Since differences on recall performance measures have been reported with variables like age, gender, SES, ability (and the like), certainly some methodological control of such variables is desirable. Further, controlling for these variables can contribute to clarification of observed relationships and advance theoretical interpretation of experimental findings. However, such variables are frequently difficult to control in classroom or other extra-laboratory research settings. Moreover, since "attempts to measure representational capacity of short term memory have been met with numerous difficulties" (Rohwer & Dempster, 1977, p. 411), difficulties may be encountered when trying to apply the results gained from micro-memory studies, or trying to generalize from micro- to macro-memory situations (see Klapp, Marshburn, & Lester, 1983).

This is not to say that we have not gleaned any information from micro-memory studies that have educational utility. Even Rohwer and Dempster (1977) confirm this when they suggest that "Teachers should be well advised... to consider the possibility
of memory failure whenever they present a great deal of new material..." (p. 414) (One wonders though, if even our grandparents could not have told us this!). However, this is reported in relation to digit span capacity limits, and not to representational capacity. It is yet unknown how much representational capacity is available (see Rohwer & Dempster, 1977) when one deals with sentences or stories with children of different ages. In any case, the evidence of the present macro-memory study is consistent with the reliable findings in micro-memory research which show that increases in age or maturity seem to be accompanied by increases in memory proficiency (within the range of age studied herein).

The impact of age-affected factors on memory has been of interest for a long time. That increase in age affects memory favorably in early life and adversely in late life is well documented (Honsick, 1983; Pozdek & Michili, 1982). Furthermore, these observations of age-affected factors on memory are being supplemented and refined by work which focuses on particular classes of variables which are known to change with age increase (Honsick, 1983; McGraugh, 1983; Pozdek & Michili, 1982). For example, children may develop or increasingly become more planful, aware, and strategic in their approach to problems, as well as their preparation for retrieval (Cavanaugh & Borkowski, 1980; Flavell, 1977; Flavell & Wellman, 1977; Kreutsner, Leonard, & Flavell, 1975; Yussen & Levy, 1975).

Some developmental differences on recall performances have
been shown by the present study. As can be seen from the results of the exploratory analysis (Tables VII-X), between-ages performance differences decreased when the recall of the older (M versus Y; 0 versus Y) children in the symbolic conditions was compared to the younger (Y) children who were in the EC and IC conditions. When between-age-tier comparisons were made, age differences were found. However, when between-age-tier comparisons were made across all conditions, age differences diminished to the point of insignificance in a few cases (see Tables VIII-X). The present results are certainly not conclusive. However, the fact of observed diminishing differences as age increases is provocative. Results are suggestive of the possibility that if a series of studies or investigators consistently find a pattern of diminution of between-condition differences in recall performances as age increases, a noteworthy developmental phenomenon will be established.

Clearly, questions still must be raised about how encoding conditions interact with age-affected cognitive characteristics to affect memory. The extent of these effects can cancel often-seen age advantage in memory when recall performances of children as young as 5 to 7 years are compared with like performances of children 9 to 11 years. The exploratory evidence indicates that children aged 5 to 7 years, when they encode narrative content in conditions which enable them to encode same in enactive and iconic systems, do not differ in
their recall performances from that of children aged 9 to 11 years (the O children) who encode the same material in conditions which require that the narrative content be encoded in symbolic systems. The Y children in these same two conditions do not differ from the M children (aged 7-9 years) in the SC and SIRC conditions either.

Accordingly, one may question generalizations about memory development which do not take account of the influence of encoding conditions and suggest that further investigation of these matters is warranted. In particular, conclusions from past research, which as a rule only entailed symbolic encoding, may warrant reconsideration in the light of present findings. While it is difficult to incorporate procedures which embody enactive and iconic encoding conditions in studies of memory for digits, cvc's, or single words (other than concrete words) in a very short time span, the present pattern of results suggest that generalizations which have been drawn from such studies warrant revision in the light of the encoding condition effects seen herein. For example, Brown (1975), in offering a corollary to Flavell's dictum on mnemonics and efficient task performance, stated that when no mnemonic strategy is required for efficient performance of a task, "the task will be relatively insensitive to developmental trends." (p. 110). The evidence of the present study is not entirely in accord with this dictum.

While it is accepted that children's performances on recall measures generally increases with age (Jablonski, 1974; Stein &
Glenn, 1976; Cavanaugh & Borkowski, 1980), some researchers have suggested that it is the task of verbal recounting that presents difficulties for young children (Brown, 1975). Moreover, young children may be unaware of the relationship between organization and recall, or, are less apt to organize their retrieval in free recall as adults (Lange & Griffith, 1977). Similarly, Bruner (1973) has claimed that, "The key to retrieval is organization." (p. 411). Well organized information appears to be learned more readily and remembered longer than information that is not well organized (Bower, Clark, Lesgold, & Wineberg, 1964). Accordingly, there is reason to conjecture that in the present study the EC and IC encoding conditions facilitated organization which was reflected in higher mean performances for the Y and M groups in these conditions compared with their cohorts in the SC and SIRC groups. Further, "material that is organized in terms of a person's own interest and cognitive structure is material that has the best chance of being accessible in memory" (Bruner, 1973, p. 412). It is therefore suggested that the enactive and iconic encoding conditions of this study may have both (1) engaged the children's (Y and M age-span) interests; and (2) maximized efficient assimilation of the narrative content by their current cognitive structures (as seen in the results).

This would support Bruner's (1973) contention that "children do best in recovering material tied together by the forms of mediation they most often use." (p. 411). Therefore,
Bruner's suggestion of successive emergence of representation systems from enactive to iconic to symbolic forms of representation is not contradicted by the present investigation since the younger children (Y and M age-spans) were more proficient when recalling information after encoding in the enactive and iconic conditions; and since the the older children (O age-span) were more proficient than were the younger children when recall was tested after they encoded under symbolic conditions.

Bruner (1964), Piaget (1976), and Vygotsky (1978) have all suggested that cognitive functioning in young children is more dependent upon enactive schemas than is the case with older children. They seem to suggest that older children are generally more adroit in assimilating information to figurative aspects of both iconic and symbolic representational schemas than are the younger children. This suggests that there is development of cognitive characteristics from enactive to iconic to symbolic representation encoding abilities. Moreover, such differences seem to be associated with memory performance differences (as suggested by the present study). Accordingly, one might consider the meaning of these differences in relation to instruction.

**Instructional Considerations**

Past research has shown that young children recall more information when encoding in enactive systems of representation
than when encoding in symbolic representation systems (Paris & Lindauer, 1975; Paris & Scott, 1975; Travis & White, 1979). As well, there are many reports which indicate superior recall performances when children are required to do something in connection with presented material (Danner & Taylor, 1973; Levin, Ghatola, DeRose, Wilder, & Norton, 1975; Levin, Lesgold, Shimron, & Guttman, 1975; Levin, McCabe, & Bender, 1975; Paris & Lindauer, 1976; Paris & Upton, 1976; Richardson, 1969; Rubin & Pollack, 1969; Silvern & Yawkey, 1977; Travis & White, 1979). These considerations underscore the desirability of finding out if memory performance is enhanced throughout childhood when information is organized and represented by enaction.

At the present time, enactive and iconic representations of discourse information seem to be superior to symbolic representations for recall by children up to age nine. Variations in encoding conditions do not seem to have differential effects on recall of narrative content after 9 years of age.

Accordingly, where teachers require the recall of (narrative) information by children (5-11 years of age), superior recall performances may be expected if the teacher arranges for children (5 - 9 years of age) to organize the material enactively or iconically. However, this is not to imply that all materials should be addressed in these ways. Symbolic organization should also be encouraged since a well developed ability to represent information in symbolic forms is
highly advantageous, and its development probably depends upon effortful practice (Horton & Mills, 1984). Full development of such abilities might be retarded or may not be aided and abetted as well as might be the case if teachers restrict the encoding conditions to those which are most advantageous for recall in the short term or immediate sense. After all, education implies gains in knowledge, abilities, and sensibilities. Such gains require accommodation or modification of existing structures and such accommodation requires that learners augment present capacities to the requirements or discipline of impersonal reality.

The recall of children between 9 - 11 years of age may still benefit or be enhanced from enactive or iconic organization. However, symbolic ordering at this age may produce superior performance results where the child is requested to recall the given information. Again, like the younger children, this should not imply strict use of only symbolic encoding organization, but possibly judicious emphasis of it. Moreover, since the present study clearly shows that increase in age is accompanied by decreases in the differential effects of encoding conditions on recall of discourse information, another implication for instruction is that perhaps teachers of pupils over 10 or 11 years of age (and who are otherwise like those in the present study) need not be gravely concerned about such encoding conditions as they affect memory of the sort studied here.
Limitations and Caveat

The present study, like all studies, is characterized by certain limitations which warrant discussion. Some of these are connected with (1) age sample considerations; (2) the free recall procedure; and (3) the rehearsal condition results. Each of these are discussed in turn below.

Age sample.

As reported, the present study incorporated random assignment of children within each age-span to form the four condition groups in each age-span tier. As one would expect, statistical analysis confirmed that age in each age-span was evenly distributed across conditions. However, the distribution of children across the three two-year age-spans was not entirely uniform. Tests of homogeneity of variance on the three spans indicated that the distribution of the Y children in the 5-7 age-span differed from the distribution of the O children in the 9-11 age-span (Bartlett-Box F=6.007; p<.014). All other comparisons on homogeneity of variance between the age tiers were not significant (indicating that the distributions of the age variances were not heterogeneous). Accordingly, one may conclude that comparisons between adjacent age tiers are comparisons of groups which are similarly distributed within their respective age-spans. Therefore, for purposes of the present study, there is little reason to consider differences in homogeneity of distributions between the tiers.
Free recall technique.

The actions and operational routines of many teachers imply that children are expected to meet requests for information at some point in the future. Children readily discern these implicit messages about what is expected and presumably are affected by them in varying degrees. As was indicated earlier in Chapter III (in the procedure of introducing the story in the study), no child was told beforehand that they would have to recall the story after they listened to it. Since no instructions suggested that recall was imminent, this absence of instruction may have influenced the older children's (M and O age-span groups) strategies in the encoding and "storage" of same (Flavell, 1977, p. 209). As such, the recall performances obtained from the M and O age-span groups may have been higher, as is implied by Flavell (1977), had the children been forewarned. However, the Y age-span performance scores may not have been so affected since children of this age apparently do not employ mnemonic strategies in anticipation of recall to the extent that older children do (Brown, 1975; Flavell, 1977). In sum, these considerations suggest that the between age group contrasts in this study might underestimate age-related differences in recall performances.

Rehearsal effects.

As stated earlier, the SIRC condition was included because children in the enactive condition necessarily would have
rehearsed the substance of the story as they dramatized it. Children in the IC and SC conditions did not have to rehearse the material. Therefore, this condition (SIRC) was included to get an estimate of the extent to which rehearsal influences the recall measures in the enactive treatment. However, at no time was the SIRC condition significantly different from the SC condition within any age-span group. As well, there were no significant differences found between the EC and IC conditions within each age-span group. Further, the between age-span comparisons in the SIRC condition yielded similar results as found in the SC condition. Therefore, since there was no apparent contribution of rehearsal to the scores of the SIRC condition, no estimation of the putative ensconced rehearsal effects was made. These expected rehearsal effects, since they are apparently negligible, did not materialize to any notable degree.

However, why rehearsal did not provide any apparent increase in the measured recall is of interest since rehearsal probably should have had some effect (Kail, 1979). Perhaps there was not enough time allotted to rehearse the information. The story was narrated at 142 words per minute, and was one minute and thirty seconds in duration. The rehearsal time given was thirty seconds. This may mean that those children in the SIRC condition would need to rehearse the story at 284 words per minute for verbatim rehearsal of the entire story. Since listening comprehension ability apparently ranges from 75 to 175
words per minute (Broski, 1974) it is possible that the children who were told to rehearse (SIRC subjects) did not have enough time to rehearse the complete story. This, of course, could help explain the non-significant differences found between the SC and SIRC conditions within each age-span group. However, until further research can clarify what is rehearsed when one rehearses a story (verbatim content, gist, or an episode of the story -see Horton & Mills, 1984), one can only speculate about why the SIRC condition did not have greater performance scores than the SC condition, as might be expected (see Kail, 1979).

Directions for Further Research

In addition to the foregoing cautions, some questions arise from the present study which need further investigation. One may ask:

1) At what age(s) do the iconic encoding abilities begin to have efficiency in constructing knowledge similar to that of the enactive encoding abilities? Studies which include children younger than those in the present study may answer this question.

2) When the recall performances of children who are older than those in the present study are studied, will the ability of those who encode narrative material in symbolic systems (and then recall same) be associated with recall advantage (compared to recall performances of their cohorts who encode in the alternative systems)? Studies which include children older than those in the present study should answer this question.
3) Since the present study was designed to incorporate one form of discourse (narration) only, the same questions that were addressed by, as well as those which arise from, the present study should also be explored in relation to the other forms of discourse - exposition, description, and argumentation.

4) Just as it may be important to study how much is remembered, so may it be just as important to study what it is that is remembered and how much and what kind of content is forgotten under variable encoding conditions at different ages. The use of the strategy seen in the present investigation could be incorporated for the study of conditions of forgetting (with the decrement line magnitude, as seen in Figure 1, as the index of forgetting for each condition).

Conclusion

The investigation under discussion was designed to reduce our ignorance in one of the realms which encompasses macro-memory. Phenomena from that realm are significant for learning and teaching because learners and teachers rely so heavily on the various forms or types of discourse in the pursuit of educational objectives. The results of the present investigation can be interpreted for such implications as they might have for instruction and theory since the question of how encoding conditions and age-affected characteristics interact to influence recall of information in one type of discourse (narration) was entailed in the present study.
It does appear that both encoding conditions and age-affected characteristics influence recall. This is clearly evident in the present investigation. While a more complete theoretical explanation for the present results requires further research as indicated by the questions raised above, educators may take note that this study has shown how age and encoding conditions can affect the recall of narrative information by children ranging in age from 5 to 11 years after encoding under several conditions. The planned work for future explorations of recall of discourse information encoded under various conditions should clarify the degree to which this generalization has warrant.
BIBLIOGRAPHY


APPENDIX A

Rationale for the Narrative Content

The narrative used in this study is an original composition. The use of same ensured that no children had seen or heard the story prior to its presentation. In this way one gains experimental control by ensuring all subjects have an identical amount of experience with the material on which their recall is tested.

Within the story there are 7 instances of non-motoric action sequences that can not be overtly acted out. Of these 7, only 2 are complete sentences. One of these sentences deals with pure thought (and no action); and the other sentence deals with thought that contains action. In Rumelhart's (1975) story categorization, both of these sequences (as well as others) would be categorized as 'internal knowledge' and are accounted for in the measuring instrument proposed. Moreover, previous studies (Travis & White, 1979; White, 1978) have contained similar categories in their story structure. Upon investigation of the results from these studies, it has been found that some children from all treatment conditions (similar treatments to those proposed for this study) recalled some of these story 'categories' during free recall (as well as the other 'categories'). Moreover, pilot studies have been carried out with children in all age-span groups and treatment conditions, and some of these instances of information (as well as the other instances of information defined by the categories) have been recalled by some children in all the age-spans and treatment conditions. Therefore, since all categories or instances of information appeared to be recalled regardless of treatment or age-span, there was no reason to suppose that any child in any age-span or treatment condition would not be able to recall these instances of information.
APPENDIX B

Rationale for Directions for Elicitation of Free Recall

The present study was designed to investigate how age and encoding conditions interact to influence the extent to which children could produce from memory complete and accurate reconstructions of the narrative content which they encountered. However, the nature of the directions or request for the reconstruction can influence performance. Since between age (within condition) and between condition (within age) comparisons were made, one had to ensure that (1) all respondents would interpret the task requirements (for recall) in the same manner; and (2) that all respondents, without prejudice to condition or age, would perform as well as they were able.

In order to develop the instructions which fulfilled the above criteria, pilot studies were carried out which tested subjects (N=36) in all age-spans for recall and interpretations of the various requests. Some children (22%) who were given the directions to recall in the 'exact' context refused to give any account of the story with the usual response being, "I can't tell it back 'exactly'", when questioned. When probed or cued to retell parts of the story, these children (80%) as well as others who stated that they 'forgot' some parts (60%) were able to recall some parts of the story. Of those subjects who were given the same directions as in this study, about 5% refused to recall and about 5% stated they 'forgot' some parts. Moreover, when questioned, almost all (95%) of the children given the instructions said that they interpreted the instructions to mean that they were to retell the story just as they heard it.

Accordingly, requests for exact reproduction can be expected to inflate false negatives because some children refuse to respond or say less than they know when given what they seem to perceive as an impossible task. On the other hand, requests which do not indicate that the most complete and accurate possible reconstruction is desired can be expected to camouflage the magnitude of differences in recall. In such circumstances, some children might not interpret the task requirements to mean that they should reconstruct the story as accurately and completely as they can while others may assume otherwise. However, on the basis of the pilot study evidence where the experimental instructions (i.e. "recall as best as you can.") indicated that an exact reconstruction was not mandatory, but that their best efforts in reconstructing the story was desired, greater uniformity in interpretation of task requirements and greater uniformity in readiness to expend their best efforts was
expected. This set of instructions then, seemed to elicit more responsiveness than requests for exact reproduction and thus false negatives were minimized while children could be expected to strive for complete and accurate reconstructions. Under these conditions the magnitude of real differences should not be camouflaged as differences might be if children were not given to understand that their best efforts were being solicited. On the other side, the adoption of standard protocols (i.e. the word unit and category measures) which defined the limits within which deviations (transformations of verbatim text) were acceptable, controlled the possibilities for false positives.
APPENDIX C

Questions Asked about the Story
(followed by acceptable answers)

1) What animal was the story about?-----A. cougar, cat.
2) What was the cougar's name?-----A. Rufus.
3) Where did he live?-----A. In a hole, cave, den, tunnel/underground.
4) When did he leave his home to look for food?-----A. In the (early) morning.
5) What did he do as he went down the trail?-----A. He turned his head from side to side (and/or) to look for food.
6) The longer he walked along the forest trail, what did he begin to do?-----A. Walk faster / run.
7) As Rufus was walking down the forest trail, what did he see when the forest disappeared?-----A. A town / houses.
8) What side of the trail was the town on?-----A. left (side).
9) What did Rufus see all around him in the town?-----A. Houses.
10) How did Rufus feel when he looked at all the houses around him in the town?-----A. Dizzy and/or hungry (one point each).
11) What did Rufus see in the town that he thought he could eat?-----A. A juicy bone / a bone / food.
12) What happened when he dived at the bowl?-----A. The bowl clattered / it clattered.
13) Who woke up with all the noise?-----A. A dog.
14) What did Rufus do when the dog barked?-----A. His ears stood up / he began to creep away.
15) What happened when Rufus was creeping away?-----A. Something made a loud noise next to him.
16) When he heard a loud noise next to him, what did he do?-----A. (Jumped) high into the air.
17) After he jumped high into the air, what did he do?-----A. Ran away / ran home.
18) How did Rufus run?-----A. As fast as his legs could carry him / as fast as he could / fast / quickly.
19) What did Rufus have for breakfast?-----A. Nothing but food for thought / nothing.
20) Did you like the story?-----A. Omit.
21) Would you like to hear more stories like this?-----A. Omit.
22) Would you like to read stories like this?-----A. Omit.
23) Do you like stories about animals?-----A. Omit.
24) Do you like stories about people?-----A. Omit.
APPENDIX D

Word Units from Story

1) early
2) morning
3) black
4) cougar (cat / animal)
5) named
6) rufus (he / it / cat)
7) left (went/leave/came out/jumped out/got out)
8) hole (cave)
9) home
10) walked (walking)
11) forest (woods / bushes / jungle)
12) trail (path / road)
13) looking (looked / finding)
14) something (some)
15) eat (food / bone)
16) turned (twisted / swing / spinned / twirled)
17) head
18) side (around / back / forth / both ways)
19) other (around)
20) longer (more)
21) faster (fast / quicker)
22) ran (run / scampered)
23) little (some / a bit)
24) still
25) searched (sudden)
26) suddenly (gone / no more)
27) disappeared (direction - left hand)
28) saw (city / village)
29) town (told himself)
30) thought (told himself)
31) food
32) leaped (went / jumped / hopped / scampered)
33) soon
34) nothing (no)
35) houses
36) round (around)
37) nearly (almost)
38) fell
39) over (down)
40) felt (got)
41) dizzy
42) hungry
43) sight (saw)
44) bowl (dish / plate)
45) juicy
46) bone
47) made
48) forget (forgot)
50) good
51) meal (dinner)
52) dived
53) clatter
54) awoke (woke)
55) dog
56) bark (barking / growl)
57) ears
58) stand (stood / perked)
59) up
60) coming (came / got)
61) closer (nearer)
62) pressed (flattened/crouched/pushed/laid/lay flat)
63) body (himself)
64) ground
65) began (started)
66) creep (sneaking / crawl)
67) loud (big)
68) noise (bang / sound)
69) next (beside)
70) jumped (leap)
71) high (up)
72) air
73) legs
74) carry (take)
75) breakfast (food)
76) food for thought
APPENDIX E

Categories

1) One early morning,
2) a black cougar named Rufus
3) left his hole that was home,
4) and walked along a forest trail.
5) He was looking
6) for something to eat.
7) as he looked
8) he turned his head from one side to the other.
9) The longer he looked
10) the faster he walked.
11) He even ran a little,
12) with his head still turning
13) as he searched.
14) Suddenly the forest disappeared
15) and to his left
16) he saw a town.
17) He thought, "There must be food there."
18) He leaped
19) toward the town.
20) Soon he could see nothing but houses
21) when he turned round and round.
22) As he did so he nearly fell over.
23) He felt dizzy - and hungry.
24) The sight of a bowl with a juicy bone in it
25) made him forget he was dizzy and hungry.
26) "That will make a good meal." He said.
27) Rufus dived
28) at the bowl.
29) The clatter awoke a dog
30) whose bark
31) made the cougar's ears stand up.
32) The dog's bark was coming closer and closer.
33) Rufus pressed his body close to the ground
34) and began to creep away.
35) But suddenly something made a loud noise next to him.
36) Rufus jumped high into the air
37) and ran home
38) as fast as his legs could carry him.
39) He had nothing to eat for breakfast
40) but food for thought:
41) A bone in a bowl puts a cat in the hole.
APPENDIX F

Figure 2B

Mean recall performance (PT-2) on the cued recall measure by each treatment condition group (EC, IC, SC, and SIRC conditions for each age-span group)