Cognitive Structures in Comprehension and Memory of Narrative Discourse

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The effects of structure and content variables on memory and comprehension of prose passages were studied in two experiments. The experimental passages exemplify a class of simple narrative stories that is described by a generative grammar of plot structures. A comprehension model is proposed that assumes a hierarchical organizational framework of stories in memory, determined by the grammar, representing the abstract structural components of the plot. The quality and characteristics of subjects' memory for stories were tested on a variety of experimental tasks in which story organization was manipulated. Comprehensibility and recall were found to be a function of the amount of inherent plot structure in the story, independent of passage content. Recall probability of individual facts from passages depended on the structural centrality of the facts: Subjects tended to recall facts corresponding to high-level organizational story elements rather than lower-level details. In addition, story summarizations from memory tended to emphasize general structural characteristics rather than specific content. For successively presented stories, both structure and content manipulations influenced recall. Furthermore, repeating story structure across two passages produced facilitation in recall of the second passage, while repeating story content produced proactive interference. The implications for a model of memory for narrative discourse are discussed.

Much recent research in language comprehension has examined the structures and processes associated with learning word lists or sets of unrelated sentences. In contrast, relatively little attention has been given to memory for prose paragraphs or stories. This is true despite the fact that people frequently use memory to comprehend anecdotes, stories, or sequences of events with situational context, rather than isolated and unrelated sets of words or sentences.

The present paper has several aims. First, a model is proposed that attempts to distinguish the structure of a prose passage from its con-
tent. The term "structure" is used here to mean the syntax of plot organization in a narrative; that is, the grammar for describing the legal combinations of abstract narrative elements. A model for comprehension of a certain class of prose passages is described that assumes the use of the abstract structure in guiding comprehension and encoding of particular passages. Experiment I tests the effects of systematically varying the amount of structure present in to-be-learned passages. Experiment II assesses the independent contributions of structure and content variables in comprehending and learning prose.

The notion that discourse is remembered with the aid of an abstract structural "schema" was first proposed by Bartlett (1932). Other researchers have adopted the same notion of an underlying structure for prose under a variety of names, including "theme" (Dooling & Lachman, 1971; Dooling & Mullet, 1973; Sulin & Dooling, 1974), "surrogate structure" (Pompi & Lachman, 1967), and "macro-structure" (van Dijk, 1973; Bower, 1974). However, none of these investigators has specified the details of this underlying organization.

Several researchers have proposed theories for the representation of the underlying meaning in a connected discourse (Crothers, 1972; Kintsch, 1974; Meyer, 1975; Frederiksen, 1975a). In each of these theories the structure of a text (typically a descriptive essay) is represented as a set of concepts and propositions relating the concepts. Such analyses address primarily the semantic content of stative relations (e.g., quantification, classification, attribution), case relations of individual actions, and causal dependencies among actions. However, other narrative discourses conform to additional organizational conventions of plot and episode structure. Thus, like sentences, narratives have their own internal structure. For example, a simple plot sequence might involve a problem facing a main character, a sequence of attempts by the main character to solve the problem, and some eventual resolution of the problem. Such narrative dependencies among events permit the reader to generate expectations of certain structural elements based on a knowledge of implicit causal relations, underlying goals, and character motivations. Recently, a few researchers have proposed grammars that encode this type of knowledge in discourse (Labov & Waletzky, 1967; Grimes, 1975; Rumelhart, 1975; Kintsch & van Dijk, 1975).

The analysis of discourse proposed here focuses on this more abstract level of structure. The emphasis here is on identifying the underlying structural elements common to a class of narrative discourses. These elements and their rules of combination constitute a framework or schema that describes the organization of numerous texts. This grammar for narratives is analogous to Fillmore's (1968) case analysis for sentences. The research presented here attempts to demonstrate that such general structures are used during the comprehension and
TABLE 1
GRAMMAR RULES FOR SIMPLE STORIES

<table>
<thead>
<tr>
<th>Rule number</th>
<th>Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>STORY → SETTING + THEME + PLOT + RESOLUTION</td>
</tr>
<tr>
<td>(2)</td>
<td>SETTING → CHARACTERS + LOCATION + TIME</td>
</tr>
<tr>
<td>(3)</td>
<td>THEME → (EVENT)* + GOAL</td>
</tr>
<tr>
<td>(4)</td>
<td>PLOT → EPISODE*</td>
</tr>
<tr>
<td>(5)</td>
<td>EPISODE → SUBGOAL + ATTEMPT* + OUTCOME</td>
</tr>
<tr>
<td>(6)</td>
<td>ATTEMPT → (EVENT*</td>
</tr>
<tr>
<td></td>
<td>EPISODE</td>
</tr>
<tr>
<td>(7)</td>
<td>OUTCOME → (EVENT*</td>
</tr>
<tr>
<td></td>
<td>STATE</td>
</tr>
<tr>
<td>(8)</td>
<td>RESOLUTION → (EVENT</td>
</tr>
<tr>
<td></td>
<td>STATE</td>
</tr>
<tr>
<td>(9)</td>
<td>SUBGOAL</td>
</tr>
<tr>
<td>(10)</td>
<td>CHARACTERS</td>
</tr>
</tbody>
</table>

recall of narratives as a technique for improving memory for the text. The underlying assumption is that isofar as people are able to identify a particular story as an example of a general, previously learned organizational framework, they use that framework to comprehend and encode the information in a particular text. The analysis of structure used here intentionally bypasses a detailed microlevel analysis of the content of individual propositions. Rather, the focus is on how common features of narrative text organization influence recall of entire propositions and sets of propositions.

THE ANALYSIS OF STRUCTURE: A STORY GRAMMAR

A grammar for a simple, prototypical narrative structure is given in Table 1. The grammar provides the basis of a representational framework for the passages used in the present experiments. It is similar to one suggested by Rumelhart (1975), having been simplified by the deletion of a few structural components. The resulting grammar is sufficient to represent the stories used in the present paper.

The grammar assumes that stories have several unique parts that
are conceptually separable, although in most stories the parts are rarely explicitly partitioned and are usually identified inferentially by the reader. It consists of a set of productions providing the rules of the narrative syntax and is independent of the linguistic content of the story. The successive application of these productions in generating a representation of a story results in a hierarchical structure that has as intermediate nodes abstract structural elements of the plot and as terminal nodes actual propositions from the story.

Rule 1 provides the top-level structure for stories. The symbol " + " indicates the combination of elements in sequential order. The requisite components of all stories are Setting, Theme, Plot, and Resolution. The Setting information in simple stories consists of one or a few stative propositions establishing the time, location, and main characters. The Theme of the story is the general focus to which the subsequent plot adheres. It is often a stated or implied goal for the main character to achieve. The introduction of the goal is often preceded by a sequence of events leading up to and justifying it. This condition is given in Rule 3 of Table 1. The parentheses around EVENT indicate that the element is optional; the asterisk (*) indicates that the element may be repeated. Hence, several events may precede the statement of the goal.

The Plot of the story is an indefinite number of episodes, each of which is a cluster of actions comprising attempts to achieve the goal or a subgoal and the outcomes of these attempts. The subgoal is a particular method of achieving the desired goal. The multiple attempts to achieve the subgoal are actions that are either direct attempts at satisfying the subgoal conditions or involve the creation of additional subgoals (see Rule 6). In the latter case, an attempt may consist of an entire episode. Thus episodes may be recursively embedded in the plot structure, producing a hierarchy of events in the representation.

The Resolution is the statement of the final result of the story with respect to the theme. It consists of either a successful attainment of the goal or a response of the main character to the final state of affairs that is consistent with his satisfaction with the outcome.

Figure 1A illustrates the application of the grammar to the analysis of one of the stories used in Experiments I and II. The story, entitled "Circle Island," is a condensed and slightly modified version of a passage used in earlier memory experiments by Dawes (1966) and Frederiksen (1972, 1975b). The text of the story is as follows.

(1) Circle Island is located in the middle of the Atlantic Ocean, (2) north of Ronald Island. (3) The main occupations on the island are farming and ranching. (4) Circle Island has good soil, (5) but few rivers and (6) hence a shortage of water. (7) The island is run democratically. (8) All issues are decided by a majority vote of the islanders. (9) The governing body is a senate, (10) whose job is to carry out the will of the majority. (11) Recently, an island
Fig. 1. Plot structure for stories used in Experiment I: (A) the Circle Island story; (B) the Old Farmer story.
scientist discovered a cheap method (12) of converting salt water into fresh water. (13) As a result, the island farmers wanted (14) to build a canal across the island, (15) so that they could use water from the canal (16) to cultivate the island's central region. (17) Therefore, the farmers formed a procanal association (18) and persuaded a few senators (19) to join. (20) The procanal association brought the construction idea to a vote. (21) All the islanders voted. (22) The majority voted in favor of construction. (23) The senate, however, decided that (24) the farmers' proposed canal was ecologically unsound. (25) The senators agreed (26) to build a smaller canal (27) that was 2 feet wide and 1 foot deep. (28) After starting construction on the smaller canal, (29) the islanders discovered that (30) no water would flow into it. (31) Thus the project was abandoned. (32) The farmers were angry (33) because of the failure of the canal project. (34) Civil war appeared inevitable.

The numbers in Fig. 1A at the terminal nodes of the tree refer to the corresponding propositions numbered in the text of the story. A proposition is defined here to be a clause or sentence containing an action or stative verb. Relationships between modifiers and their modified terms are not considered as separate propositions unless they appear as relative clauses. A more detailed propositional analysis of semantic relations, such as those utilized by Crothers (1972), Kintsch (1974), and Frederiksen (1975b) was not used here because a more macrolevel of analysis was sufficient to specify the structural details of the stories uniquely.

It may be noted that some of the propositions in Fig. 1 are connected by a horizontal line. This notation designates a single idea or event expressed in two mutually dependent propositions. For example, the goal in Fig. 1A represented as propositions 13 and 14 linked together, appear in the passage as The island farmers wanted to build a canal across the island. Other numbered propositions are linked vertically in the network. In these cases the proposition subsumed under a higher proposition expresses an idea or event that is different from its parent but which is a topical elaboration, a further specification, or a causal implication of the information in it. For example, proposition 9 of Fig. 1A, The governing body is a senate, subsumes proposition 10, whose job is to carry out the will of the majority, because the latter proposition specifies properties of the concept introduced in the former proposition.

The analysis of the second passage used in Experiment I is given in Fig. 1B. This story is an adaptation of an old English fairy tale taken from Rumelhart (Note 1), entitled "The Old Farmer and His Stubborn Animals." The text of this story is given in Appendix I. The hierarchies generated here by the application of the grammar to stories specify levels of abstraction in the underlying narrative structure. The intermediate nodes in the hierarchy encode the important functional relationships among structural elements in the story and the mapping of the relationships onto the plot sequence. Propositional dependencies
based on semantic content are reflected only at the low levels of the hierarchy at the terminal nodes.

This formulation of a story grammar presumes, at a certain level of abstraction, a stereotypy in the structure of and relationships between the elements of a narrative discourse. The stereotypical narrative framework can be modified to fit the characteristics for a particular story by specifying how the details of the story map onto the abstract rules and relationships. This is similar to Bartlett’s (1932) notion that a story is reconstructed from memory using a general schema and a few specific details. More recently, this general approach to knowledge representation has been embodied in Minsky’s (1975) theory of “frames.” The domain of stories described by the grammar of Table 1 may be conceptualized as comprising a “frame” that encodes the invariant structure common to all exemplars of the domain. The components of the frame, the abstract story elements, are “slots” that become instantiated according to the grammar with the specific details or content of the particular story in question. During comprehension of a story, the frame for general “stories” produces a description of the current story by substituting real properties of the story for prototypical ones provided by the frame. This instantiation of a frame is similar to creation of a token node from a type node in a semantic network. When a particular story is encoded, for example, a frame for that particular story is created in which the default or prototypical structure given by the general “story” frame is modified to fit the particular content of that story. In this way, general frames encoding the story grammar are used to produce the representation of a particular story conforming to that grammar.

EXPERIMENT I

If structural information is used to construct plot frameworks into which particular events of a story are mapped, then the extent to which this information can be used should directly influence subjects’ ability to comprehend and remember the story. Although there has been substantial general discussion of the use of structural frames in story comprehension and memory, the effects of systematically varying the amount of structure in a story have not been studied.

The purpose of Experiment I was to assess the effect of varying the degree of plot structure in a story on a person’s memory for that story. The term plot structure is used here to refer to those elements of a story which render the sequence of actions coherent and purposeful: the theme or goal, the stated or implied intent and motivation of actions performed by the characters, and some final resolution of the initial problem of the story. Subjects were presented and later asked to recall passages that exemplified one of four possible conditions of plot
structure ranging from a highly stereotypical narrative form to a structure with very little narrative organization provided by temporal or causal event sequencing. It was postulated that subjects' memory for the events of the story would depend on their ability to map those events into a familiar pattern or story form incorporating structural information about narratives.

Two different stories, the "Circle Island" and the "Old Farmer" stories, were used in Experiment I. For each story, four passages differing in narrative structure were constructed. These conditions were labeled STORY, NARRATIVE-AFTER THEME, NARRATIVE-NO THEME, and DESCRIPTION. The four versions of each story were nearly identical in content (the number and linguistic composition of the individual propositions), but differed in the amount of plot structure present in the passage as determined by the structural relationships among the events. In the STORY condition the original story was intact: The theme was presented at the outset, and the plot consisted of episodes depicting the creation and nesting of goals by the main characters in an attempt to satisfy the overall goal. The text of these stories is presented above and in Appendix I. The term "story" will be applied hereafter to only those passages containing these elements of goal-direction and actor intent as part of the plot. Such passages are assumed to conform to the grammar of Table 1 and thus be representable in a structure similar to Fig. 1.

In the NARRATIVE-AFTER THEME condition, the theme of the passage was removed from its normal position near the beginning of the passage and inserted as the last proposition of the passage. Temporal sequencing within episodes, local causal constraints, clarity of intersentential nominal and prenominal reference of the original story remained intact, but the theme-directed plot structure was removed. For illustrative purposes, the text of the NARRATIVE-AFTER THEME condition for the Circle Island passage is given in Appendix II.

It was supposed that a subject reading this passage would perceive it as a sequence of unrelated events initiated by the main character. At the end of the passage, when the original intent of the main character is stated, the subject could reorganize in memory the events of the narrative into the goal-hierarchy suggested by the stated theme. The inability to use this organization at the time of the presentation of the original events, however, should lead to a decrement in the memory for those events relative to the STORY condition, in which the organizing structure was available from the outset. This prediction is based on the assumption that the hierarchical goal-directed structure is a more effective memory organization than one in which events are related in a linear, temporal order with no underlying motivational structure. Thus, although presentation of the theme at the end of the NARRATIVE-AFTER
THEME passage might allow cognitive reorganization, some of the prior events would have been forgotten due to the inability of the subject to attribute to them a suitable organizational frame.

The third version of the passage, the NARRATIVE-NO THEME condition, was identical to the NARRATIVE-AFTER THEME passage, except that the statement of the top-level goal was entirely deleted from the passage. The text of the passages differed from the AFTER THEME passages only in the substitution of non-goal-related information for the goal statement. The NARRATIVE-NO THEME passage of the Circle Island story is given in Appendix III.

In the DESCRIPTION condition, the content of the text was presented without benefit of temporal sequencing or local causal implications. The information in the passage was presented as a set of stative propositions or single actions, with no temporal or causal continuity among propositions (Appendix IV gives the text of this condition for the Circle Island story). While the meaning of each individual sentence would be clear to subjects, there would be no reference to an organizational frame in which to encode the sequence of statements. Rather, the passage was essentially a set of individual facts related by only a topical context, similar to a simple expository essay. Since intersentential associational and organizational cues were held to a minimum, it was expected that recall would be equivalent to the learning of a set of unrelated propositions or sentences and be independent of sentence order.

To test this latter prediction, sentence order of the passages was manipulated orthogonally to plot structure. Sentence order for each condition could be either NORMAL, as in the passages described above and listed in the appendices, or RANDOM. RANDOM passages were constructed by randomly permuting the sentences within each of the conditions. Hence the semantic and syntactic structure of individual sentences was preserved, and was identical to the NORMAL passages, but any intersentential causal and temporal associations were destroyed. The effect of this manipulation was expected to vary as a function of the utility of intersentential dependencies in passage comprehension. Thus for the DESCRIPTION passage, the effect was expected to be minimal or nonexistent; while for the STORY passage sentence randomization would prevent the identification and use of prototypical goal structures in the narrative, and hence performance should be greatly reduced.

In addition to passage recall, two other experimental tasks were devised to test subjects' memory for the texts. In one task, subjects produced from memory a concise summarization of the passages they had seen previously. A recognition test was included to obtain false alarm rates for different distractor types as a function of passage type. Different classes of distractors were defined for the purpose of testing
specific hypotheses about the way memory for details of events and propositions degraded as a function of passage type presented. The details of these tasks will be treated in the discussion of Experiment I.

Method

Subjects

The subjects were 64 undergraduates at Stanford University. They participated in the 1-hr experiment either to satisfy a course requirement or for $2.00 pay.

Design

A $4 \times 2 \times 2$ between-subject design was used. There were four conditions of passage type: STORY, NARRATIVE-AFTER THEME, NARRATIVE-NO THEME, and DESCRIPTION. Presentation order was either Normal or Random. Within each condition, both passages ("Old Farmer" and "Circle Island") were used. In total, then, there were eight versions of each of the two passages. Presentation mode was either visual or auditory. Each subject was randomly assigned to one of the 16 conditions.

Procedure

Recall task. Subjects were tested in groups varying in size from one to four people. They were instructed to attend carefully to the passages because they would be required to recall them later. The passages were presented either visually or auditorially. If audio presentation was used, subjects heard a passage from a tape recorder read at slightly slower than normal reading rate. Care was taken not to carry inflections or intonations across sentential boundaries to suggest temporal or causal connections between sentences. If visual presentation was used, the passage was projected on a blank wall in front of the subject. One line was visible at a given exposure for 5 sec. Lines of the passage were equated for word length. The exposure time per line was computed such that the overall presentation time for audio and visual presentations were identical. Visual presentation was accomplished by moving a mask down the passage such that only one line was exposed for a given 5-sec interval. Immediately following the presentation of a passage, subjects performed a comprehensibility rating. They were told to rate on a 1 (low) to 10 (high) scale the comprehensibility (i.e., clarity and continuity) of the passage using the following guidelines: how well the passage fit together as a coherent whole, and how well the combination of ideas provided a sensible text. Subjects were then asked to give a written recall of the passage. They were instructed to write the passage as close to verbatim as possible, exactly as it appeared in wording and sentence order. However, they were told not to omit anything that they remembered simply because they could not remember its exact wording or serial position in the passage. Recall was written on a blank sheet of paper. Unlimited recall time was provided. After recall was completed, the entire presentation and test procedure was immediately repeated with the second passage. The order of presentation of the two passages was counterbalanced across subjects.

Summarization task. After the second passage had been presented and recalled, subjects were asked to write from memory a short summary of each of the passages, in the order in which they had been presented. They were informed that the summary should include what they considered to be the high points or important parts of the passage. No constraint as to the length of the summaries was imposed or suggested by the experimenter. Writing time was unlimited.
Recognition test. After both summarizations had been written, a recognition test was immediately given for sentences from the passages. The test included two parts: The first part contained only items about the first passage; the second part contained only items about the second passage. For each test item, subjects were required to give a two-part response. They first judged whether the information contained in the test item appeared explicitly in the passage they received. If their response was negative, they then judged whether, although not stated explicitly, the sentence was a true inference that could be drawn from the information given only in the passage. (For example, "The old farmer owned some mammals" was not stated explicitly in the farmer passages, but was a true inference about the information in the passages.)

Results

For all results presented here, the data have been collapsed across both modes of presentation (visual and auditory) of the stimulus materials. Presentation mode did produce some overall effect on recall; however, this variable did not interact with the pattern of results of interest here. A discussion of these effects of presentation mode is given in Thorndyke (1975).

For scoring the recall protocols, the passages were segmented into propositions. A proposition was defined as a clause or sentence which contained an action or stative verb. For example, "There was once an old farmer" was a single proposition; "... who owned a very stubborn donkey" was likewise a single proposition. Under this segmentation scheme, each passage contained 35 propositions.

The protocols were scored for gist recall of the propositions based on a proper reconstruction of the action or relationship given in the propositions. Synonymous paraphrases were permitted, as were deletions of adjective and adverb modifiers. For example, a recall of "A farmer once owned a donkey" would be scored as recall of two propositions. Scoring was performed independently by two scorers. The correlation between the judgments of the two scorers was $r = .93$, and many of the disagreements were errors in scoring, not disagreements in judgment.

Comprehensibility and Recall

The mean comprehensibility ratings for passages are shown in Fig. 2. For the normal presentation orders, mean ratings decreased monotonically as structure in the material decreased. Combining the means of the Old Farmer and Circle Island passages, the effect of structure on rated comprehensibility was reliable, $F(3,48) = 2.85, p < .05$. The obtained differences between Normal and Random presentation orders were highly reliable, $F(1,48) = 57.07, p < .001$. As expected, the interaction between structure and presentation order was significant, $F(3,48) = 3.98, p < .02$. Newman–Keuls tests were used to test the reliability of pair-
wise differences between means. For the Normal presentation order, the differences for all three pairwise comparisons were significant, \( p < .05 \). For the random presentation order, the means for the STORY, NARRATIVE-AFTER THEME, and NARRATIVE-NO THEME passages did not differ reliably. The mean for the DESCRIPTION passage did not differ reliably from the DESCRIPTION-Normal passage or the STORY-Random passage, but did differ from the two NARRATIVE passages (\( p < .05 \) for both).

When the comprehensibility ratings are divided for the individual stories, as shown in Fig. 2, the ratings for the Old Farmer passages are consistently higher than for the Circle Island passages in the structured conditions, \( F(1,48) = 4.23, p < .05 \). Materials also interacted with presentation order, \( F(1,48) = 8.57, p < .01 \).

The pattern of recall data shown in Fig. 3 for passage types and presentation orders is identical to that of comprehensibility ratings. The correlation between these measures, computed by comparing across all subjects the rating of a passage and its recall proportion, was significant, \( r = .64, t(126) = 9.35, p < .001 \).

The recall results were first analyzed by combining the means for the Old Farmer and Circle Island passages. For the Normal presentation orders, mean recall decreased with decreasing amounts of structure in the material; for Random presentation orders, recall was unaffected by the structure variable. The overall effect of structure on recall was reliable, \( F(3,48) = 3.12, p < .001 \), as was the interaction between structure and presentation order, \( F(3,48) = 4.63, p < .01 \). Neuman–Keuls tests declared that the DESCRIPTION Normal and Random means did not differ reliably. For Normal presentation
orders, the STORY and NARRATIVE-AFTER THEME means were significantly different, as were the NARRATIVE-NO THEME and DESCRIPTION mean ($p < .05$ for both). As expected, the mean recall for the NARRATIVE-AFTER THEME passage (65%) was greater than for the NARRATIVE-NO THEME passages (59%), but this difference was not significant.

It may be noted in Fig. 3 that recall for the Old Farmer passages was consistently higher than for the Circle Island passages, especially for normal presentation orders. This effect of materials was significant, $F(1,48) = 5.10$, $p < .05$, and interacted with presentation order, $F(1,48) = 4.87$, $p < .05$.

The hierarchical relationships among propositions resulting from the structural analysis of plot were a strong determinant of recall for the most structured passages. Figure 4 shows the recall of propositions from both Circle Island and Old Farmer passages as a function of their location in the organizational hierarchy. Each point in Fig. 4 represents the mean percentage of all propositions at that level in the hierarchy recalled by subjects in that structuring condition. The line corresponding to recall of the Random passages represents the mean of all four randomly ordered passages. The location of propositions in the hierarchy was determined for the STORY passage according to the analysis given in Figs. 1A and 1B (note numbers on left side of the figures). For the other passage conditions, the level of a proposition was defined to be the same level as that proposition identical in semantic content from the STORY passage. Thus, for a given level in the hierarchy, the recall of propositions from that level across structuring conditions corresponded to a comparison of propositions of identical or nearly identical content.
embedded in different structural frameworks. Observed differences in recall, then, could be attributed to structural differences in the passages and not confounded with semantic content of the to-be-recalled propositions. However, this control was possible only for the comparison of recall of a given hierarchical level across structuring conditions. Within a given passage, comparisons of propositional recall from different levels necessarily involved propositions with different semantic content.

It may be noted in Figs. 4A and 4B that recall of propositions from both STORY passages decreased with descending hierarchical level. For both NARRATIVE-AFTER THEME passages, this monotonic
TABLE 2
MEAN PROPOSITIONAL LENGTH OF SUMMARIES AND PERCENTAGE OF RECALLED PROPOSITIONS APPEARING IN SUMMARIES

<table>
<thead>
<tr>
<th>Passage type</th>
<th>Mean length</th>
<th>Percentage recalled propositions</th>
</tr>
</thead>
<tbody>
<tr>
<td>STORY-Normal</td>
<td>8.00</td>
<td>30</td>
</tr>
<tr>
<td>NARRATIVE-AFTER THEME-Normal</td>
<td>8.00</td>
<td>36</td>
</tr>
<tr>
<td>NARRATIVE-NO THEME-Normal</td>
<td>8.25</td>
<td>40</td>
</tr>
<tr>
<td>DESCRIPTION-Normal</td>
<td>9.00</td>
<td>58</td>
</tr>
<tr>
<td>Random Passages</td>
<td>10.25</td>
<td>89</td>
</tr>
</tbody>
</table>

trend was present but the differences among levels were greatly reduced. The difference in level 1 recall between the STORY and the NARRATIVE-AFTER THEME Circle Island passages was reliable, \( t(7) = 2.96, p < .05 \), as was the difference in level 1 recall between the AFTER THEME and NO THEME passages, \( t(7) = 2.44, p < .05 \). Similarly, the level 1 and level 2 means of the Old Farmer NARRATIVE-AFTER THEME passage differed reliably from the corresponding means in the STORY passage \( (p < .05 \) for both). No recall differences due to hierarchical level were obtained for the NARRATIVE-NO THEME, DESCRIPTION, or Random passages for either Circle Island or the Old Farmer tests.

Summarizations

Passage summarizations were scored to determine their length and propositional content. Scoring criteria were identical to those used for the recall protocols. The results from both Old Farmer and Circle Island passages were combined and are shown in Table 2. The four random presentation conditions have been averaged together, since these conditions produced no differences in summary length. The mean propositional length of summaries did not differ significantly across conditions. The second column of Table 2 gives the percentages of propositions from the recall protocols that were included in the summaries. Each percentage is a mean of all subjects in that condition. This percentage increased reliably with decreasing structure in the stimulus materials, \( F(4,35) = 3.56, p < .025 \).

Figures 5A and 5B show the distribution of propositions among hierarchical levels in summaries of the Circle Island and Old Farmer STORY-Normal passages. The probability given for each hierarchical level is the mean conditional probability of including propositions in the summary given that the propositions appeared in the recall protocol.
This conditional probability measure was used because different hierarchical positions produced varying recall levels. It was desirable to observe subjects’ sampling characteristics in summarizations from the population of recalled facts rather than from the population of all facts, which would be biased in favor of higher-level propositions due to their relative advantage in memory availability. It may be noted in Fig. 5 that for both stories hierarchical level influenced probability of summary inclusion. Subjects receiving STORY-Normal passages produced summaries that included propositions corresponding to the central structural
elements, while deleting the detailed actions represented at low levels in the hierarchy.

**Recognition Test**

The results of the recognition test are given for each test item type in Table 3. There were five item types, each with several exemplars on the recognition test from both the Circle Island and Old Farmer passages. **True** items consisted of statements occurring in the passage or paraphrases of these statements containing explicitly stated information. The remaining four item types were distractors, referred to hereafter as **True Inference,** **Incorrect Inference,** **Incorrect Filler,** and **False Statement.** True Inferences were statements representing a correct summarization of or inference from information appearing in the story, but omitting other information included in the original text. For example, one item of this type was

(1) As soon as the cat scratched the dog, the dog scared the donkey into the shed.

While this is a true summarization of the events of the story, it omits the intermediate events of the dog barking and the barking frightening the donkey.
Incorrect Inferences consisted of two true events from a passage linked in the distractor statement by a false inference relating the events. For example, one such item from the Old Farmer passages was

(2) The cat did not have any milk, so it scratched the dog.

While both individual propositions were true, the causal connection between the two was not true in the story.

Incorrect Fillers were statements in which a true event frame from a story was falsified by substitution of an incorrect detail. For example, one proposition from the Circle Island passages was

(3) The island farmers wanted to build a canal across the island.

The Incorrect Filler distractor created from this sentence is

(4) The island ranchers wanted to build a canal across the island.

False Statements were items for which no information suggesting their validity appeared in the original texts. These statements were neither true, inferable from true statements, nor derived from true statements. Such an item is

(5) The farmer trained his dog to bark loudly.

For each test item, subjects made a two-part response. They first judged whether information in the statement was true (i.e., stated explicitly in the passage). If not, they then judged whether the statement was inferable from the information in the passage but not stated explicitly, or false (neither true about nor inferable from the passage). In Table 3, mean hit rates for true items and error rates for distractors are shown for subjects in the eight structure and ordering conditions. A false alarm was defined as a "True" response. For all distractor items except True Inferences, an error was also scored for a "not-stated-but-inferable" response. For True Statements a "hit" was scored only if a subject responded "True" to an item.

The hit rate for true statements decreased monotonically with decreasing structure for Normal presentation orders. The hit rates for the four randomly ordered conditions and for the DESCRIPTION-Normal condition were nearly equal. The interaction of structure and presentation order for True Statements was reliable, $F(3,56) = 2.83$, $p < .05$.

False alarm rates for both Incorrect Fillers and True Inferences decreased with decreasing structure for the Normal presentation orders, while no differences in false alarm rates were obtained for the Random presentation orders. For both of these distractor types, the interaction between structure and presentation order was significant ($p < .05$). Essentially no false alarms were obtained for Incorrect Inferences for
the Normal presentation orders; however, the probability of incorrectly judging these items to be true inferences increased with decreasing structure. For False Statements, a main effect of presentation order was obtained for incorrect judgments that the items were true inferences, $F(1,56) = 6.37, p < .02$.

Discussion

The results of Experiment I demonstrate the importance of an identifiable organizational structure for comprehension and memory of narrative discourse. Rated comprehensibility correlated well with recall, and both measures were highly predictable from the amount of plot structure present in the passages. This result was obtained despite the fact that the semantic content of individual propositions was nearly identical in the various structuring conditions. When no narrative structure was present in the passages, recall of Normal presentation orders was not significantly higher than for Random passages.

Memory and comprehension were best when an incoming text matched up readily with a standard, well-learned structural hierarchy of goal-directed episode sequences. Direct evidence for the use of such standard organizing frames by subjects is available from a comparison of recall in the NARRATIVE-AFTER THEME and NARRATIVE-NO THEME conditions. These conditions differed only in two propositions at the end of the passage. In the AFTER THEME condition these propositions provided a statement of the top-level goal of the passage. This information appears to have produced restructuring in memory of the encoded passage from a sequence of temporally linked but unmotivated events into a hierarchical goal structure like the STORY passage. Comprehension of the AFTER THEME passages was significantly higher than for the NO THEME passages. Recall of the AFTER THEME passages differed from the NO THEME passages in the same direction, though not at a significant level. However, an earlier replication study differing from the present experiment only in minor procedural variations and using the Old Farmer story produced significant differences in recall of the AFTER THEME and NO THEME passages (Thordyke, 1975). This result contradicts the findings of Dooling and Mullet (1973) and Bransford and Johnson (1972), who found that the presentation of "theme" or "context" of the story at the conclusion of the passage did not improve recall of information from the passage over a group that received no theme at all. However, the present study differs from these in that the passage in the AFTER THEME condition maintained clear temporal sequencing and referential clarity. The passages of Dooling and Mullet and Bransford and Johnson were referentially obscure and ambiguous in the absence of a theme. It is possible
that the absence of a theme during presentation of their passages precluded any structural integration by subjects, and hence, most of the propositional information was lost by the time the theme was finally presented.

Additional evidence for the attempted restructuring of memory by subjects in the AFTER THEME condition was obtained in Thorndyke (1975) from the fact that 75% of the subjects in the AFTER THEME condition intruded the top-level goal propositions into the beginning of their recall protocols, following the SETTING propositions, rather than recalling them as the final propositions of the passage. In contrast, none of the NO THEME subjects intruded a theme or goal into any location of their recall protocols. These intrusions occurred despite explicit instructions to recall the passage in precise serial order, indicating that the passage was reorganized into a standard story frame.

Restructuring by AFTER THEME subjects is further suggested by the hierarchical analysis of recall results. No levels effect was obtained for the NO THEME conditions. For the AFTER THEME passages, however, some differences in recall due to hierarchical location were obtained. In particular, the advantage in recall of the AFTER THEME over the NO THEME conditions occurred primarily in the additional recall of structurally central propositions located high in the hierarchy. Insofar as the restructuring of information occurred in subjects' memory, the pattern of hierarchical recall began to resemble that for the STORY passages.

This effect of propositional location in the hierarchy on recall of that proposition is similar to results reported by Meyer (1975), Kintsch and Keenan (1973), and Kintsch, Kozminsly, Streby, McKoon, & Keenan (1975). The hierarchies postulated in the Kintsch et al. studies are based on Kintsch's (1974) representation of semantic content underlying text. One difficulty with these previous experiments is the confounding of structure and content in contrasting recall of propositions in different conditions. The comparison of recall probabilities of propositions at different hierarchical levels invariably involved propositions with entirely different semantic content. In the present experiment, recall probabilities of an identical set of propositions in different structural contexts were compared. For example, in Fig. 4 the data points for any single hierarchical level represent recall of the same set of propositions across all structuring conditions. Thus, the effects of varying amounts of structure in the passages on recall were assessed independently of the actual semantic content of the passage.

Subjects' memory organization of the passages was further reflected in the character of summaries. Summaries of STORY passages represented only a small proportion of the total facts recalled. Propositions
in these summaries corresponded to central elements occurring near the top of the representational hierarchy, while details and specific actions from lower levels were systematically excluded. For the unstructured passages, summaries represented a much larger proportion of recalled propositions and consisted primarily of details of the setting or individual events with no relationship to structural centrality.

The recognition data provide some indication of the nature of the information remembered by subjects. When the passages contained identifiable plot structure, much of the detailed surface information was forgotten. However, when the passages are less structured, more surface information from the passages is retained. For both True Inferences and Incorrect Filler item types, the underlying idea from the original text was preserved but detail in the surface structure was changed. These distractors produced the highest false alarm rates in conditions in which the passages were well structured, and errors decreased with decreasing structure. For the Incorrect Inferences, however, single events from the passages were causally linked incorrectly in the test items. While the surface forms of the events were intact, then, the structural relationship of the events was altered to falsify the statements. For these item types false alarms occurred only for Random passages, and the probability of responding "true inference" increased with decreasing structure for Normal passages. That is, in well-structured passages the causal relationships among events could be easily identified. Thus Incorrect Inferences could easily be rejected as false. When the passages were unstructured, subjects noted surface forms but were unable to infer structural relationships. Thus, they frequently false-alarmed to Incorrect Inferences in which the component events were individually true but the structural relationship was not.

For equivalent conditions in Experiment I, the ratings and recall of the Old Farmer passages were consistently higher than for the Circle Island passages. At a general level, the STORY-Normal versions of both the Old Farmer and Circle Island texts were well-formed narratives—they utilized approximately the same number of characters, and they contained identifiable goals, temporal and causal event sequences, and conclusions relating to the goals. Yet the sizable difference in the rated comprehensibility and recall of the stories suggests the influence of other properties of the texts on memory. These properties may be characterized along two dimensions: structure and content. The term structure refers here to the functional relationships among the components of the plot, independent of any particular set of characters or the specific actions they perform. Content refers to the semantics of the individual propositions of the story: the set of characters, specific setting information, and the actions involving the characters. These two dimensions may be thought of as conceptually distinct in stories.
Structurally, the Old Farmer story contained a recursive nesting of goals and subgoals and the repetition of the same information in successive sentences, as in (6):

(6) . . . The farmer asked his dog to bark loudly at the donkey and thereby frighten him into the shed. . . . So then, the farmer asked his cat to scratch the dog so the dog would bark loudly and thereby frighten the donkey into the shed.

These repetitions made explicit the structural relationships among events and thus contributed to the story's simplicity and comprehensibility.

In contrast, the Circle Island plot contained no repetition of propositions and less explicit reference to the narrative goal structure. Thus, subjects should find the construction of the appropriate organizational frames more difficult than for the Old Farmer story. If this were in fact the case, then the observed results of lower-rated comprehensibility and mean recall would be expected.

Similarly, the content of the Old Farmer story was more concrete than that of the Circle Island story. In the former, the characters consisted of a farmer and familiar farm animals whose actions in the story were stereotypical of their normal behaviors. In the Circle Island story the characters (senators, farmers, ranchers, and procanal association) were less familiar and less obviously suggested by the context and setting than in the Old Farmer story. The actions performed by these characters were not highly associated with them. Therefore, learning the relationships of the characters in the Circle Island story would be expected to be more difficult than for the Old Farmer story, since less extra-experimental knowledge could be brought to bear in making those assignments. Thus, subjects' reduced comprehensibility and recall of the Circle Island passages over the Old Farmer passages would also be predicted on the basis of content differences.

EXPERIMENT II

Because of the confounding of structure and content differences between the two stories in Experiment I, it was impossible to assess to what extent each of these dimensions influenced performance. In Experiment II, the plot structure and concreteness of passage content were varied orthogonally to determine their separate effects on recall.

Two passages were presented to subjects in sequence, and the relationship between the two passages was systematically varied. In one condition, the two passages were identical in plot structure but differed in the particular set of characters and their actions. Thus, the structure of the narrative sequence was held constant, but the semantic complexity and concreteness of the sentences were varied. This variation may be noted in a comparison of Appendixes I and VII. It was of interest to
determine whether the repetition of a single plot in two successive stories would prime the structural frame for the plot and hence facilitate learning of the second story, even though it contained unrelated characters, actions, and a different setting. In a second condition, the set of characters in the two passages were identical, whereas the structure of the two stories varied. Thus, a story with a given set of characters would be followed by a new story with the same characters involved in a different plot with a new theme, episode structure, and event sequence.

Method

Materials

Four stories were used, representing two distinct plot structures and two character sets. The structures (denoted hereafter by S) were taken from the STORY-Normal passages of Experiment I. The structure of the Farmer story (SF) consisted of a statement of a desired goal condition, a series of nested subgoals and attempts by the main character to achieve the subgoals, and eventual attainment of the top-level goal. The structure of the Circle Island story (SC) involved the statement of a goal, the creation of a subgoal by the main character, the intervention of a character who prevents attainment of the top-level goal, and the planned or accomplished retaliation by the main character for denial of the goal.

From each of these structures two stories were constructed by using two different character sets (denoted by C). These character sets corresponded closely to those utilized in the Old Farmer (subscript F) and Circle Island (subscript C) passages of Experiment I. The Farmer character set (CF) consisted of the characters from the Farmer story: the farmer, his donkey, his dog, his cat, and his cow. This character set contained very concrete and meaningful concepts. The passage utilizing these characters and the Farmer structure (SF,CF) was precisely the STORY-Normal passage of Experiment I, the text of which is given in Appendix I. Another passage was constructed utilizing these same characters, but the plot structure of the Circle Island story (SC,Cc). This text is given in Appendix V. Similarly, a second character set was used with the two structures to produce two other stories. This character set (CC) was similar to the set used in the Circle Island passages of Experiment I, but was altered so as to be less concrete and meaningful. The characters were three arbitrary, abstract groups called the Populists, the Federalists, and the Senators. The story constructed from this character set and the Circle Island structure (SC,Cc) differed from the STORY-Normal passage of Experiment I only in the substitution of the terms Populists and Federalists for farmers and ranchers (see Appendix VI). The other passage (SF,Cc) utilized the plot structure of the Old Farmer story of Experiment I. The text of this passage is given in Appendix VII.

Subjects

Forty-eight Stanford undergraduates participated in the 1-hr experiment for either $2.00 pay or to satisfy a course requirement.

Design

A $2 \times 2 \times 3$ between-subject design was used. The independent variables were character set of Story 2 (Old Farmer, CF; and Circle Island, CC), plot structure of Story 2 (SF and SC), and the relationship between Story 1 and Story 2. The three types of
sequential relationship between Stories 1 and 2 were same structure, same characters, or unrelated. In the unrelated condition, a subject would receive as his second story the one passage of the remaining three that shared neither structure nor content with his first passage. For example, a subject in this condition would receive as his two stories either the pair $S_F C_C$ or the pair $S_C C_F$. In total, then, there were 12 possible sequences of story pairings.

**Procedure**

Subjects were tested in groups varying in size from one to four people. An incidental learning procedure was used. Subjects were instructed that they would be presented a set of stories, one at a time, for which they were to perform several ratings on a 1 (low) to 10 (high) scale. Ratings were performed on three dimensions: comprehensibility, imagery, and meaningfulness. The comprehensibility instructions were identical to those in Experiment I. For imagery, subjects were instructed to rate how vivid a mental picture or image they could construct of the actions and characters portrayed in the story. For meaningfulness, subjects rated the extent to which they could identify the characters and actions of the story with previous experiences they had had, other stories they had read, or familiarity they had with the characters and problems being discussed.

Passages were presented visually. An overhead projector displayed the stories on a wall in front of the subjects. Each exposure contained one entire sentence for a 5-sec interval. Since the stories varied from 16 to 18 sentences in length, total stimulus presentation time was approximately 90 sec. After presentation of the first story by this method, subjects performed the three ratings. The procedure was then repeated with the second story. When subjects had completed the ratings for the second story, they performed an unrelated interpolated reading task for approximately 30 min. Subjects were then instructed to recall verbatim the first passage they had been presented. Recall instructions were identical to those in Experiment I. Recalls were written on a blank sheet of paper, and unlimited recall time was allowed. When recall was completed for the first story, subjects recalled the second story in the same manner.

**Results and Discussion**

Subjects' mean ratings of Comprehensibility, Imagery, and Meaningfulness were computed for each story type and combined across both serial positions. The mean ratings for the various stories are given in Table 4. Comprehensibility ratings were solely a function of structure. The mean rating for the two stories utilizing the Old Farmer structure ($S_F$) was reliably greater than those stories utilizing the Circle Island structure ($S_C$), $F(1,92) = 9.10$, $p < .005$. Imagery ratings, on the other hand, depended solely on Characters. The difference in mean ratings for those stories using the Old Farmer characters ($C_F$) and those using the Circle Island characters ($C_C$) was highly reliable, $F(1,92) = 28.63$, $p < .001$. No differences due to either Structure or Characters were obtained for Meaningfulness ratings.

Subjects' recall protocols were scored for gist according to the procedures used in Experiment I. Recall scores were converted to propor-
TABLE 4
MEAN RATINGS OF STORIES USED IN EXPERIMENT II

<table>
<thead>
<tr>
<th>Story*</th>
<th>Comprehensibility</th>
<th>Imagery</th>
<th>Meaningfulness</th>
</tr>
</thead>
<tbody>
<tr>
<td>S_F C_f</td>
<td>9.17</td>
<td>8.04</td>
<td>4.92</td>
</tr>
<tr>
<td>S_F C_C</td>
<td>7.52</td>
<td>7.43</td>
<td>4.52</td>
</tr>
<tr>
<td>S_f C_C</td>
<td>8.29</td>
<td>5.25</td>
<td>4.42</td>
</tr>
<tr>
<td>S_C C_C</td>
<td>7.46</td>
<td>5.08</td>
<td>5.17</td>
</tr>
<tr>
<td>Mean S_F</td>
<td>8.73*</td>
<td>6.64</td>
<td>4.67</td>
</tr>
<tr>
<td>Mean S_C</td>
<td>7.48*</td>
<td>6.25</td>
<td>4.84</td>
</tr>
<tr>
<td>Mean C_F</td>
<td>8.34</td>
<td>7.73*</td>
<td>4.72</td>
</tr>
<tr>
<td>Mean C_C</td>
<td>7.87</td>
<td>5.16*</td>
<td>4.79</td>
</tr>
</tbody>
</table>

* Story components are structure (S) and content (C). Subscripts refer to either Old Farmer (F) or Circle Island (C) versions of each component.

* Statistically significant result.

Overall, recall of the stories improved with practice. Mean recall of all first-presented stories was 40%, while mean recall of stories presented second was 49%, $F(1,24) = 8.49, p < .01$. Both Structure and Character variables significantly influenced recall. As expected, recall was best when the plot structure was that taken from the Old Farmer story ($S_F$). Across the entire experiment, recall of stories using structure $S_F$ (54%) was significantly greater than recall of stories using the Circle Island structure (35%), $F(1,24) = 21.51, p < .01$. Similarly, mean recall of stories using the concrete character set $C_F$ (49%) was reliably greater than recall of stories using the abstract character set $C_C$ (40%), $F(1,24) = 8.18, p < .01$. Recall of all stories correlated with both Comprehensibility ratings, $r = .55, t(94) = 6.45, p < .01$, and with Imagery ratings, $r = .37, t(94) = 3.87, p < .01$.

For the stories presented first to subjects, both the Old Farmer structure and characters produced better recall. The mean recall of the story types was 60% for $S_F C_F$ (Old Farmer structure and characters), 40% for $S_F C_C$, 34% for $S_C C_F$, and 26% for $S_C C_C$. The effect due to Structure was significant, $F(1,36) = 7.16, p < .02$, as was the effect due to Character set, $F(1,36) = 14.28, p < .01$. The results of both recall and comprehensibility ratings replicate the findings of Experiment I, in which the Old Farmer STORY-Normal condition (designated as $S_F C_F$ here) produced higher comprehensibility ratings and recall levels than the Circle Island story (designated as $S_C C_C$ here). There were no retroactive effects on first-story recall as a function of the relationship between the first- and second-presented stories. However, the first presented story had significant proactive effects on second-story recall. The results
for recall of second-presented stories are summarized in Fig. 6. The proportion of propositions recalled for the four passages is given as a function of the relatedness between the first and second stories presented. It may be noted that in five out of six instances the mean recall for stories with the Old Farmer structure was higher than for the corresponding story (i.e., the story with the same character set) using the Circle Island structure. This main effect of the Structure variable on recall was reliable, $F(1, 35) = 18.32, p < .01$. Considering the Character variable, in all six pairs, the stories using the Old Farmer characters were recalled better than the corresponding stories using the Circle Island characters, $F(1, 36) = 20.10, p < .01$.

Overall, the mean recall of all four stories when the first story was unrelated (i.e., had different Structure and Characters) was 51%. When the second story presented repeated the structure of the first story, the mean recall level overall was 62%. When the second story presented to subjects repeated the same character set, the overall recall level was 37%. This effect of relatedness was reliable, $F(2, 36) = 11.26), p < .01$. Newman–Keuls tests declared both the overall means for Repeated Structure and Repeated Characters to differ reliably from the mean for Unrelated stories ($p < .05$ for both).

It may be noted in Fig. 6 that when the story structure was repeated, recall of the second story improved relative to the unrelated condi-
tion for all four stories. This was true despite the fact that the setting, characters, and specific events in the passages were unrelated and non-overlapping in the two stories. These results suggest that a priming effect or proactive facilitation occurred when the same structure was repeated in both stories. During learning of the first story, the events were comprehended and encoded in an abstract form as in Fig. 1, incorporating the goals of the main character, the attempts to achieve those goals, the outcomes of the attempts, and the ultimate resolution of the story theme. When the second story was presented, subjects became aware at some point during comprehension that the structures of the two stories were identical. (Most subjects in this condition reported during postexperimental debriefing that they had noticed that the two stories had the same "idea," "theme," or "plot." ) Subjects recognizing the structural similarity could then use the same structure formed during first-story comprehension for second-story comprehension. The use of an already existing organization then facilitated learning relative to conditions in which a new structure had to be created. This facilitation in memory for passages with repeated structures has also been obtained retroactively (Bower, 1974).

In contrast, the repetition of characters in the two stories produced proactive interference. Story 2 recall was lower for all four passages when the character set was common to both presented stories than when the two stories were unrelated. This seemed to result from subjects' inability to encode the abstract structural characteristics of the narrative during second-story presentation. During first-story comprehension, subjects encoded a plot sequence for a particular set of characters. When these same characters were engaged in a different set of actions and relationships in the second story, a new hierarchy encoding the relationships had to be constructed in memory. The goal structures and character relationships established during first-story presentation prevented the easy reassignments by subjects of the characters to new roles in a second plot sequence. Hence second-story recalls were often more rambling and disorganized with respect to the plot structure than first-story recalls, and only rarely punctuated by intrusions of propositions from the first story. Since this interference effect was obtained only for second-presented stories and not for first-presented stories, it appears that interference occurred during storage and learning, and not at the retrieval or recall stage. If the latter were the case, it would be expected that interference would have occurred in recall of both stories.

That interference is not an output phenomenon has also been demonstrated by Crouse (1971). Both Crouse and Bower (1974) have obtained retroactive inhibition in the learning of prose passages that were similar in both structure and content, but differed only in minor variations of
detail in individual facts. Their studies differed from the present experiment in that changes in content involved the same characters and events with new "fillers," such as dates or locations, rather than the complete substitution of new setting, characters, and actions.

GENERAL DISCUSSION

The results presented here suggest that both structure and content play an important role in memory for connected discourse. In both experiments, rated story comprehensibility and recall were correlated and were found to be a function of the amount of identifiable plot structure in the passages. When the narrative structure was readily inferable due to repetition and redundancy in the text (as with the Old Farmer structure), subjects could readily produce an organizational hierarchy for the plot and use it to encode the information from the passage. Such stories were rated easy to comprehend and produced high recall. A more densely structured plot with no repetition (the Circle Island structure) produced lower comprehensibility ratings and recall proportions, indicating that subjects encountered more difficulty producing the integrating framework for the passage. As the amount of identifiable structure in the passages decreased, there was a corresponding decrease in comprehensibility and recall. This result was obtained in both intentional and incidental learning situations and for both the Old Farmer and Circle Island passages.

The influence of passage structure on memory was further highlighted by the proactive facilitation effects obtained by repeating the same structure with different characters in successive passages. At the same time, however, story recall was interfered with when it was presented prior to a story with a different structure but the same characters.

Imagery ratings were solely a function of content, as defined by the characters and particular actions of the passages, and independent of structural complexity. These imagery ratings were significantly correlated with recall. Although recall was better for passages with concrete content than for passages with more abstract content, it might be argued that the effect was due not to imagery but to the extreme familiarity of subjects with the Old Farmer animals and their highly associated actions, which rendered these passages more comprehensible. The meaningfulness ratings in Experiment II assessed this familiarity effect. Subjects rated the "meaningfulness" of each presented story according to the familiarity of the characters and actions, and to the similarity of consistency of the narrative with incidents they knew or had read about previously. The obtained ratings produced no differences in meaningfulness between character sets. To the extent that meaningfulness
ratings reflect extra-experimental familiarity, it appears that a familiarity explanation cannot account for recall differences.

Data from both recalls and summarizations indicate the prominence in memory of the general structural characteristics of narratives. Recall probability of any individual proposition from a STORY passage was a function of its structural centrality as determined by the grammar. Similarly, the probability that a proposition would appear in a story summary was a function of the hierarchical level of the proposition. The superiority in recall of the AFTER THEME passages over the NO THEME passages and the displacement of the theme to its normal position in the AFTER THEME recall protocols indicate that subjects attempted to use narrative prototypes to encode stories structurally as a mechanism for improving recall.

The grammar given here provides a simple characterization of a small class of discourses, namely, single-goal, single-protagonist narratives. Other similar approaches to the representation of narrative information have been taken by Labov and Waletzky (1967), Meyer (1975), Grimes (1975), Rumelhart (1975), and Kintsch and van Dijk (1975). The text grammars proposed by these researchers represent useful attempts to extend models of language understanding and memory to complex event sequences and naturally occurring prose materials. Future research will be required to evaluate the relative strengths and weaknesses of these models and to understand the process dynamics of text comprehension. However, it is clear from the data presented here that any adequate accounting of discourse comprehension consider the high-level structural characteristics of the text and the reader's internal representation of that information.

The general approach taken here of distinguishing between and independently controlling structure and content of a discourse shows promise as a method of studying prose memory. This approach, used in conjunction with a series of converging experimental tasks, seems to have the potential for isolating the effects on memory due solely to passage structure. In addition, it allows the independent experimental control over critical learning variables of both structure and content such as causal and temporal relationship, concreteness, linguistic complexity, and context familiarity.

APPENDIX I

The Old Farmer and His Stubborn Animals

Experiment I—STORY Condition

(1) There was once an old farmer (2) who owned a very stubborn donkey. (3) One evening the farmer was trying to put his donkey
into its shed. (4) First, the farmer pulled the donkey, (5) but the donkey wouldn't move. (6) Then the farmer pushed the donkey, (7) but still the donkey wouldn't move. (8) Finally, the farmer asked his dog (9) to bark loudly at the donkey (10) and thereby frighten him into the shed. (11) But the dog refused. (12) So then, the farmer asked his cat (13) to scratch the dog (14) so the dog would bark loudly (15) and thereby frighten the donkey into the shed. (16) But the cat replied, "I would gladly scratch the dog (17) if only you would get me some milk.'" (18) So the farmer went to his cow (19) and asked for some milk (20) to give to the cat. (21) But the cow replied, (22) "I would gladly give you some milk (23) if only you would give me some hay." (24) Thus, the farmer went to the haystack (25) and got some hay. (26) As soon as he gave the hay to the cow, (27) the cow gave the farmer some milk. (28) Then the farmer went to the cat (29) and gave the milk to the cat. (30) As soon as the cat got the milk, (31) it began to scratch the dog. (32) As soon as the cat scratched the dog, (33) the dog began to bark loudly. (34) The barking so frightened the donkey (35) that it jumped immediately into its shed.

APPENDIX II

Circle Island

Experiment I—NARRATIVE-AFTER THEME Condition

Circle Island is located in the middle of the Atlantic Ocean, north of Ronald Island. The main occupations on the island are farming and ranching. Circle Island has good soil, but few rivers and hence a shortage of wildlife. The island is run democratically. All issues are decided by a majority vote of the islanders. The governing body is a senate, whose job is to carry out the will of the majority. Recently, an island scientist discovered a cheap method of converting salt water into fresh water. The island farmers formed a cooperative association and persuaded a few senators to join. The cooperative association brought their issues to a vote. All the islanders voted. The majority voted in favor of the association. The senators began to build a small canal that was 2 feet wide and 1 foot deep. After starting construction on the small canal, the islanders discovered that no water would flow into it. The project was abandoned. Civil war appeared inevitable. The farmers were angry because of the failure of the canal project. The island farmers had wanted to build a canal across the island, so that they could use water from the canal to cultivate the island's central region. However, the senate had decided that the farmers' proposed canal was ecologically unsound.
APPENDIX III
Circle Island

Experiment I—NARRATIVE—NO THEME Condition

Circle Island is located in the middle of the Atlantic Ocean, north of Ronald Island. The main occupations on the island are farming and ranching. Circle Island has good soil, but few rivers and hence a shortage of wildlife. The island is run democratically. All issues are decided by a majority vote of the islanders. The governing body is a senate, whose job is to carry out the will of the majority. Recently, an island scientist discovered a cheap method of converting salt water into fresh water. The island farmers formed a cooperative association and persuaded a few senators to join. The cooperative association brought their issues to a vote. All the islanders voted. The majority voted in favor of the association. The senators began to build a small canal that was 2 feet wide and 1 foot deep. After starting construction on the small canal, the islanders discovered that no water would flow into it. The project was abandoned. Civil war appeared inevitable. The farmers were angry because of the failure of the canal project. The island farmers decided to build a colony for themselves, so they migrated inland from their homes to inhabit the island’s central region. However, the senate decided the farmers’ proposed move was ecologically unsound.

APPENDIX IV
Circle Island

Experiment I—DESCRIPTION Condition

Circle Island is located in the middle of the Atlantic Ocean, north of Ronald Island. The main occupations on the island are farming and ranching. Circle Island has good soil, but few rivers and hence a shortage of wildlife. The island is run democratically. All issues are decided by a majority vote of the islanders. The governing body is a senate, whose job is to carry out the will of the majority. Salt water is converted to fresh water by a cheap method discovered by an island scientist. The island farmers favor building canals across the island. Water from the rivers is used to cultivate the island’s central region. A cooperative association formed by the farmers has persuaded a few senators to join. The cooperative association issues are periodically brought to a vote. All the islanders vote. The majority favor the association. The senate is responsible for the construction of a small canal that is 2 feet wide and 1 foot deep. The project was abandoned shortly after construction
started on the small canal. The islanders discovered that no water would flow into it. Civil war appears inevitable. The farmers are angry because of the failure of the canal project. The senate believes that the farmers’ proposed canal is ecologically unsound.

APPENDIX V

The Old Farmer and His Stubborn Animals

Experiment II—$S_C C_F$ Condition

Large dairy farms are located throughout Fleetwood County. Unfortunately, all the farmers in the county are very poor, so their farms are small and usually in great need of repair. One old farmer owned several animals who all lived together in a communal barn. The old farmer cared for his animals and always tried to make their lives on the farm enjoyable. The animals organized themselves into a voting democracy and resolved barnyard issues by a majority vote. One day the farmer’s cow discovered a bag of gold coins hidden beneath a clover patch. So some of the animals decided among themselves that they wanted to build a new barn, since the old one was nearly useless. So, these animals formed a planning committee and persuaded some other animals that the money should be spent to rebuild. A referendum was held on the issue, and all the animals voted. All of the animals voted in favor of the new barn. The farmer decided that the taxes on a new barn would be too high. The farmer agreed instead to make improvements to the old barn. After remodeling of the old barn was completed, a fire destroyed the entire barn. The farmer would not rebuild again, and the animals were left homeless. The animals were angry because the farmer was such a miser. In retaliation, they burned down his house.

APPENDIX VI

Circle Island

Experiment II—$S_C C_C$ Condition

Circle Island is located in the middle of the Atlantic Ocean, north of Ronald Island. The main political factions on the island are the Populists and the Federalists. Circle Island has good soil, but few rivers and hence a shortage of water. The island is run democratically. All issues are decided by a majority vote of the islanders. The governing body is a senate, whose job is to carry out the will of the majority. Recently, an island scientist discovered a cheap method of converting salt water into fresh water. As a result, the Populists wanted to build a canal across the island, so they could use water from the canal to cultivate the island’s central region. Therefore, the Populists formed a procanal association and persuaded a few senators to join. The procanal association brought the construction idea to a vote. All the islanders
voted. The majority voted in favor of construction. The senate, however, decided that the Populists' proposed canal was ecologically unsound. The senators agreed to build a smaller canal that was 2 feed wide and 1 foot deep. After starting construction on the smaller canal, the islanders discovered that no water would flow into it. Thus the project was abandoned. The Populists were angry because of the failure of the canal project. Civil war appeared inevitable.

APPENDIX VII

Circle Island

Experiment II—$S_C\text{ }C_C$ Condition

Circle Island is governed by a constitutional democracy. The two major political parties are the Populists and the Federalists. Last spring the Federalists promoted a senate bill for the installation of an island-wide communications network to be used in weather prediction. The Federalists petitioned the senate, but the senate would not pass the bill. So the Federalists asked the Populists to join forces in support of the bill and thereby pressure the senate into action. The Populists, however, declined the proposal. Then the Federalists asked the island’s independent weathermen’s union to announce support of the bill so that Populists would join the Federalists’ fight and thereby win passage of the bill in the senate. The union agreed to support the Federalists only if the usefulness of the project could be demonstrated to them. So the Federalists made a plea to a prominent scientist to testify to the technical advantages of the communications network. But the scientist declined to testify until research on the signal transmission properties of the system could be conducted. Thus the Federalists funded scientific research which resulted in proof of the efficiency of the system. As soon as the results were released, the scientists agreed to testify. The scientist testified before the union in support of the installation project. The union was thus convinced and publicly announced their backing of the Federalists. As a result of the union’s announced support for the plan, the Populists joined the Federalists to fight for passage of the Bill. The support for the bill was so overwhelming that the senate immediately passed it and signed it into law.

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REFERENCE NOTE


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