

95%, and the conditional probability of a proposition being predicted, given that it was recalled, was about 88%. These results seem similar to Meyer's: information high in his tree structure was recalled as was information high in her content structure; information that was lower in structural importance, and therefore not predicted to be recalled by Rumelhart, was output 12% of the time. Meyer also found some recall of low-level material.

Although Rumelhart has accounted for much of the variance in subject's recall using his grammar, one must still be cautious in making conclusions on the basis of its predictive power. All the stories he used in his experiment he designed (or selected) to fit the grammar. (It is easy to find stories that will not fit the grammar.) That is, before giving the stories to subjects to summarize and recall, he made sure that his own summary of the story fit the grammar.

Thorndyke's grammar (1977) is adapted from Rumelhart's and bears a great deal of resemblance to it, except that he emphasizes the importance of goals more than Rumelhart. The main character is seen as trying to solve a problem or obtain a goal. Thorndyke demonstrated the importance of goal structure by rewriting stories that initially fit the grammar to violate various aspects of it. Recall was best in the untouched version of a story for which the goal structure was clearest. It was somewhat worse if the theme or goal was transposed to the end with all the subgoals removed; it was worse yet with no theme. The version that changed the story to consist only of stative and single action sentences led to the poorest performance.

Thorndyke showed that recall of a second story was facilitated by first reading and recalling a story with the same structural representation. Repetition of characters in two stories with different representations (of plot) was detrimental. This result is similar to the one reported by Bower (1974), mentioned earlier. The facilitation could have arisen from savings in time needed to process structure, as Thorndyke suggests. This would allow more time to process the content of the story and presumably improve memory for it. On the other hand, the improvement in recall may have been due to better learned retrieval cues. That is, the second recall would be aided by a better learned story structure to help guide retrieval of the content. It is also possible that both factors were operating. Thorndyke also concluded that content affected recall independent of structural organization. Imagery ratings were correlated with recall of a passage even when factors of structural complexity were partialled out.

Mandler and Johnson (1977) have adapted Rumelhart's grammar and have constructed a story grammar (or "schema" as they call it) which seems to have a lot of promise. Their grammar allows more recursion of episodes and is somewhat more complex. They have deleted Rumelhart's semantic structure rules and added a moral at the topic level of the tree structure, similar to van Dijk's (1975) analysis.

Mandler and Johnson's approach seems more promising than previous ones in part because of the greater flexibility and recursive capacity of their grammar. The rules for their grammar are given in Table IV. Flexibility is needed in grammars even for "simple" stories, since the class of simple stories has a great deal of variability in structure.

Mandler and Johnson view the story schema as a collection of expectations that are modified as new semantic and syntactic information is processed. The schema is thought to facilitate encoding and retrieval. Because their model attempts to utilize

TABLE IV  
Summary of Rewrite Rules for Mandler & Johnson's Story Grammar<sup>a</sup>

- (1) Fable → Story AND Moral
- (2) Story → Setting AND Event Structure
- (3) Setting → State\* (AND Event\*)  
Event\*
- (4) State\* → State [(AND State)<sup>n</sup>]
- (5) Event\* → Event  $\left[ \begin{array}{c} \text{AND} \\ \text{THEN Event} \\ \text{CAUSE} \end{array} \right]^n [(AND State)^n]$
- (6) Event Structure → Episode [(THEN Episode)<sup>n</sup>]
- (7) Episode → Beginning CAUSE Development CAUSE Ending
- (8) Beginning → Event\*  
Episode
- (9) Development → Simple Reaction CAUSE Action  
Complex Reaction CAUSE Goal Path
- (10) Simple Reaction → Internal Event [(CAUSE Internal Event)<sup>n</sup>]
- (11) Action → Event
- (12) Complex Reaction → Simple Reaction CAUSE Goal
- (13) Goal → Internal State
- (14) Goal Path → Attempt CAUSE Outcome  
Goal Path (CAUSE Goal Path)<sup>n</sup>
- (15) Attempt → Event\*
- (16) Outcome → Event\*  
Episode
- (17) Event\* (AND Emphasis)  
Ending → Emphasis  
Episode
- (18) Emphasis → State

<sup>a</sup> Asterisks indicate that this node may have several lower-level nodes attached to it. Parentheses marked with the superscripted index *n* indicate that the item within the parenthesis occurs one or more times.

general knowledge as well as knowledge of story grammars, it may be more successful in identifying the constituents of a story. Thorndyke seems to focus on plot structure almost to the exclusion of story content, while Mandler and Johnson analyze which aspects of an episode are most important to the reader. Their predictions concerning recall take content into account.

The experimental predictions of Mandler and Johnson go beyond the traditional ones that are concerned with level in the hierarchical representation. For example, they postulate that causally connected episodes will be better recalled than temporally connected episodes. Recall of sentences in the correct order of presentation depends upon the degree of structure present in the passage, such that stories which have a higher degree of structure will be recalled in more accurate temporal order than less structured stories. Elaborations will be poorly recalled. Causality will be better recalled than simple time ordering. Omissions and violations of the ideal structure will result in additions and distortions in a subject's recall. Their model includes several deletion transformations. The structure of the famous passage "The War of the Ghosts" used by Bartlett (1932) is an example of a structure that is far from ideal.