

memory for the material processed. Elaborations provide redundancy in the memory structure. Redundancy can be viewed as a safeguard against forgetting and an aid to fast retrieval. The importance of relevant elaborations or embellishments to memory has been argued elsewhere (Reder, 1979; Note 2) and will be discussed in more depth in a later section of this article.

Investigations of Factors that Affect Amount of Recall

Focus on Instructionally Relevant Experiments

An important application of research dealing with prose processing is how to improve people's ability to read. Various techniques have been tried to improve the student's comprehension and retention of reading material. Carroll (1971) provides an extensive review. Ausubel (1960) introduced the notion of "advance organizers." He thought that adjunct aids which gave the reader a preview of the content of the passage would improve the reader's organization of the material, thus leading to better comprehension and retention. The advance organizers were thought to activate or develop appropriate cognitive structures to which subjects could anchor the incoming ideas. An example of his task is to give subjects a passage before the critical passage. The passage either contains "subsuming" concepts of the critical passage or is essentially irrelevant to it. He predicted that prior exposure to subsuming concepts or "anchors" would facilitate retention. Ausubel and his associates (e.g., Ausubel & Fitzgerald, 1962) have found data to be consistent with these notions to some extent; they admit, however, that an advance organizer's usefulness interacts with many other variables such as previous knowledge and verbal ability.

Although many researchers agree that Ausubel's work provided interesting speculations that stimulated others to pursue similar questions, he has been criticized for lack of appropriate experimental controls and lack of objective measures of his stimulus variables (see Frase, 1975). It is difficult to test the notion that previous exposure to the high level concepts of a passage will improve retention of lower level concepts when no procedure for evaluating the structure of a passage has been proposed. Gagné and Wiegand (1970) are examples of investigators who put Ausubel's conclusions into doubt. They found that improvement in retention (better recall) due to Ausubel's advance organizers may have had their facilitation in retrieval, not in encoding or acquisition. This possibility was suggested by the finding that recall was improved even when the related topic sentence was not given until just before the test. This is inconsistent with Ausubel's argument that improvement results from the ability to embed the information in preexisting structures.⁴

The investigation of the use of adjunct aids in the comprehension of prose has been continued by a number of investigators. One such aid that has been explored thoroughly is the effect of questions on *subsequent* test performance (see, e.g., Anderson & Biddle, 1975 for an extensive review; Frase, 1967, 1968, 1971, 1972,

⁴ This improvement, however, may be due to guessing since they used a cued recall procedure that required subjects to fill in the missing words of statements. Since subjects easily remember the recently presented "topic," the additional recall cue may allow them to infer the original fact. A control condition would have been useful in which subjects who never saw the original sentences tried to "recall" to the "retrieval cues."

1975; McGraw & Grotelueschen, 1972; Rickards, 1976; Rothkopf, 1966, 1972; Rothkopf & Bisbicos, 1967; Watts & Anderson, 1971). The typical dependent measure is how well a subject can answer a set of questions about a passage (call these *test questions*) as a function of having been asked questions about the passage earlier (call these *priming questions*). Examples of the independent variables are whether the priming questions are asked before the subject reads the passage, during the passage or after the passage; whether the priming questions are general or specific; or whether the subject is given feedback on the priming questions.

The majority of the studies in the field have found that subjects do better at answering a test question if they have been asked that *same* question earlier. The improvement obtains regardless of whether the priming question was given before the passage was read or afterwards and whether or not subjects were given feedback about their answer. Performance is best if the question was asked after the passage was read. In the case where priming questions ask about information different from that to be tested, the findings are mixed: subjects do better on the "to-be-tested" questions than controls who have not seen priming questions when the priming questions were asked *after* the passage was read. If the priming questions were asked prior to reading the text, performance is occasionally worse for experimental subjects than it is for controls (who have not seen the primes).

Priming questions provide a focus that tells the subject what aspects of the text are important. However, providing a focus cannot be the entire explanation of the improvement due to priming questions. The location of priming questions is also important. Frase (1968) found that asking a question after each paragraph is superior to asking all the priming questions at the end of the passage. Frase (1967) also found that asking a priming question after two paragraphs was better than after one or four. If the effect of priming questions was merely to provide a focus, then the position of questions should not matter.

It seems that priming questions do more than provide focus; they force subjects to process the text in a certain way. This is clear from results of experiments where critical aspects of the text were directly highlighted (in a box) at study. Bruning's (1968) study found that this method of highlighting was not nearly as effective as forcing subjects to answer a question that caused that material to be reviewed in order to answer it. The conclusion that providing information may not be as effective as forcing subjects to retrieve it themselves has been encountered before. Bobrow and Bower (1969) found that providing the mnemonic to relate a pair of words was not nearly as effective as asking subjects to provide one themselves.

Frase (1967) suggested that priming questions cause subjects to review the relevant aspects of the passage. This review process probably involves more than merely stating the critical information in the question or answer since highlighting the critical information was so much less effective. Indeed, McGraw and Grotelueschen (1972) found that the information does not need to be directly tested. In their study, when a question reminded subjects of information present in the text, without either stating the information in the question or demanding it as an answer, subjects later recalled that fact better than a comparable fact unrelated to the priming question. The reason that priming questions in studies mentioned earlier for the most part only helped some questions and not new test questions is probably due to the nature of the overlap between questions. In fact, Reder (1979) and Watts and Anderson (1971) both conducted experiments in which priming questions helped some new test