The Role of Context in the Encoding of Information

Joseph W. Alba, Susan G. Alexander,
Lynn Hasher, and Karen Caniglia
Temple University

The importance of a context-inducing title for the acquisition of information from prose was investigated by manipulating the degree to which subjects were able to use their existing knowledge. Subjects read passages taken from Bransford and Johnson's materials either with or without the context-inducing title provided. The presence of the title increased comprehension and recall (Experiment 1) but had no effect on recognition (Experiments 2 and 3). Activation of relevant information already stored in memory may not be essential to the encoding process.

Two aspects of Bartlett's (1932) theory have been extremely influential in the past 10 years. The first is the assumption that memory contains schematic rather than detailed representations of experience. Two related propositions have received considerable support: (a) General meanings and relationships are stored at the expense of the specific details used to express them (Barclay, 1973; Bransford, Barclay, & Franks, 1972; Bransford & Franks, 1971; Potts, 1973; Sachs, 1967, 1974); (b) those meanings that are stored are integrated into an individual's knowledge structure (Dooling & Christiaansen, 1977; Frederiksen, 1975a, 1775b; Spiro, 1977; Sulin & Dooling, 1974).

Bartlett's second influential assumption deals with the process by which new information is assimilated: Information intake is strongly, and perhaps even totally, under the influence of whatever schema is invoked. Thus what is comprehended and remembered is a function of a person's existing knowledge (Ausubel, 1960; Bransford & Johnson, 1972; Dooling & Lachman, 1971; Dooling & Mullet, 1973; Gardner & Schumacher, 1977; Royer & Cable, 1975). Information compatible with one's current orientation will be understood in those terms (Bransford & Johnson,

1973; Kozminsky, 1977; Schallert, 1976) and will also be better recalled than incompatible information (Pichert & Anderson, 1977).

Although the support for these two assumptions is strong, there are now several lines of evidence that do not easily fit with the theory. First is the surprising accuracy of memory for detailed surface-structure information, even under unintentional instructional conditions (Baker, 1978; Bates, Masling, & Kintsch, 1978; Hayes-Roth & Hayes-Roth, 1977; Keenan, MacWhinney, & Mayhew, 1977; Kintsch & Bates, 1977). Second is the challenge to the notion that related ideas are inextricably integrated into a larger semantic whole (Flagg, 1976; James & Hillinger, 1977; Katz & Gruenewald, 1974; Reitman & Bower, 1973). Third is the finding that facts not compatible with a learner's schema are nevertheless encoded into memory (Anderson & Pichert, 1978). And fourth is the finding that a "shock" treatment administered after acquisition can dramatically alter the accuracy of recall of a passage (Hasher & Griffin, 1978) or of a set of facts (Hasher, Attig, & Alba, 1981).

Taken together these lines of research led us to a preliminary investigation of the role of prior knowledge in the encoding of text information. We used a task that is frequently cited as strong evidence for the critical role of prior or contextual knowledge in the encoding process (e.g., Bransford & Johnson, 1973; Dooling & Mullet, 1973; Reder, 1980; Royer & Cable, 1975). Bransford and Johnson (1972) had subjects read passages that were written so as to be nearly incomprehensible in the absence of their titles. A typical passage described a common activity (e.g., washing clothes) but never explicitly mentioned any of the concrete objects involved in the activity

(e.g., clothing, detergent, etc.). They found that subjects who had access to the title before reading the passage understood it better and recalled substantially more of it than subjects who did not.

Though the effects of the title provision manipulation in the Bransford and Johnson task are substantial, as measured by both comprehension and recall, there is no evidence in the literature of the effects when recognition is tested. This is a nontrivial gap in the literature if one assumes that recognition can be a more sensitive index of what is stored in memory than is recall. The latter of course is highly influenced by retrieval problems. If schemata are critical in determining what is actually stored in memory, subjects knowing a context should show better recognition than subjects not knowing one. On the other hand, if storage is independent of the prevailing context, recognition should be equivalent.

Experiment 1

Subjects read one of two passages, taken from Bransford and Johnson's (1972) materials, either with or without the title and were then given either a recall or a recognition test. The first experiment is described in some detail because the basic procedure was repeated in two further experiments (2 and 3). These additional experiments were required because recognition levels were surprisingly high in the first experiment.

Method

Subjects and design. Eighty undergraduates read one of two passages, were or were not given the title of the passage prior to reading, and were tested via recall or recognition.

Materials. Two of Bransford and Johnson's (1972, p. 722) short passages, "Making and Flying a Kite" and "Washing Clothes," were used as the stimulus materials. These materials are reproduced in Appendix A. The passages were typed on blank paper, one passage to a page, and were the first page of a booklet containing the remaining experimental materials. Half of each of the passages had their titles typed immediately above them. The second page of the booklet contained a 7-point comprehensibility scale, ranging from "easy to understand" to "difficult to understand." The final page of the booklet differed depending on test condition. In the recall condition the final page was blank except for instructions telling the subject to recall. Attached to this page was a slip of paper that contained another 7-point scale. The scale represented the subject's confidence in recall performance and ranged from least to most confident.

In the recognition condition the last page of the booklet contained a randomly ordered list of all sentences from the stimulus paragraph interspersed with several distractor items (four for the "Making and Flying a Kite" passage and five for the "Washing Clothes" passage). Distractors were sentences that could be true of the topic of the passage and/or that were similar to the original sentences in that they contained no explicit concrete referents. Appendix B contains all distractors used in these experiments. Two different random orders of all test sentences were created for each passage, and these were used equally often. Accompanying the test sheet was a sheet of paper containing a long narrow slot that allowed subjects to view one sentence at a time. Also on the slotted sheet was a 7-point scale representing the subject's confidence that a particular sentence actually appeared in the original text. The scale ranged from "positive it did not appear in passage" to "positive it did appear in passage."

Procedure. Subjects were run in groups of 2–17. Due to the nature of the booklets, all subjects in a group were given the same test type, but within a group title and no-title conditions were randomly assigned.

Subjects were given booklets and were told that they would read a short paragraph that they would be tested on. No details of the test were given. Subjects had 5 min to read the passage and 15 sec to make a comprehensibility decision.

Subjects in the recall condition were given 5 min to write down all they could remember from the passage as accurately as they could. They were then asked to rate their confidence that each recalled sentence had actually appeared in the text. Subjects did so by placing a number from the confidence scale next to each sentence. Three min were allowed to complete this task.

Subjects in the recognition condition were instructed in the use of the slotted sheet that accompanied the test page as well as in the use of the confidence scale. They then went down the list of sentences and next to each placed a number representing their degree of certainty that the particular sentence had appeared in the passage. Three min were allowed for this. All subjects easily completed all tasks before the time expired.

Results

Comprehension and recall. A three-factor (Story × Title Condition × Test Condition) analysis of variance (ANOVA) was performed on the comprehension ratings (see Table 1). Subjects who received a title found the passages much easier to understand than subjects who did not, $F(1, 72) = 60.94$, $MS_e = 1.97$, $p < .01$.

Recall was scored by separating the original passages into the same number of the idea units used by Bransford and Johnson. Thus "Washing Clothes" contained 18 units, and "Making and Flying a Kite" contained 14. An idea unit was considered present in a recall protocol if a statement represented the gist of the corresponding passage element. This allowed for paraphrasing, as Bransford and Johnson had done. Scoring was done by two different raters. Interrater reliability was .95. The few disagreements were resolved by discussion before any analyses were conducted.

Results of a 2 (story) $\times$ 2 (title) ANOVA on proportion of story idea units recalled (Table 1) revealed that recall was higher for those subjects provided a title than for those who were not, $F(1, 36) = 11.71, MS_e = .035, p < .01$. No other effects approached significance.

Recall confidence was also analyzed. A mean confidence rating for each subject was obtained by summing the individual sentence confidence ratings and dividing by the number of sentences recalled (Table 1). The results of the 2 (story) $\times$ 2 (title condition) ANOVA showed that subjects who had access to a title not only recalled more than the no-title subjects but also were more confident of their performance, $F(1, 36) = 6.55, MS_e = 1.66, p < .05$.

Provision of the title greatly increased comprehension, recall, and confidence in recall. These findings are all consistent with those of Bransford and Johnson (1972) and make an encoding interpretation of the role of context attractive. The next set of findings does not.

Recognition. Recognition scores were obtained for each subject by calculating the mean confidence ratings separately for old and distractor items (Table 2). These scores were then subjected to a three-factor (Story $\times$ Title Condition $\times$ Item Type) ANOVA with repeated measures on the last factor. Subjects showed marked discrimination between old and new items, $F(1, 36) = 1,053.50, MS_e = .40, p < .001$. No other effects were significant. Although it is evident that subjects in both title conditions were able to dis-

criminate between old and new items, the critical aspect of these data is the remarkable similarity in performance between the title and no-title subjects. For recognition performance the title variable accounted for less than 1% of the variance (ω^2). For recall the title variable accounted for almost 23% of the variance.

This pattern of results raises questions about the appropriate interpretation of the effect of context on encoding. The data, however, are not so clear-cut as might be desirable. The major problem is with apparent ceiling effects for both old and new items. An assessment of the degree of this problem was made by drawing confidence intervals around each mean to determine whether the interval included the boundary. For old items 99% confidence intervals did not include the boundary. For new items, on the other hand, 95% and 90% intervals had to be drawn to omit the boundary.

Thus although provocative, the recognition findings are not as sensitive as might be the case. A second, more difficult recognition test was constructed in an attempt to avoid the near-ceiling problems seen here.

Experiment 2

It is ordinarily assumed that differences in comprehension are associated with differences in the aspects of a story that are encoded. In particular, subjects who know the topic of a story, and so understand it well, should know more about meaning and implication than subjects who do not know the topic. These subjects are likely, on the other hand, to know more about lexical and syntactical aspects of the story than are subjects who understand the story well.

In this experiment we attempted to assess for such differences in encoding by constructing recognition foils that should be more or less difficult depending on the knowledge that subjects have about a story. Three types of distractors were used. One set consisted of sentences that were perfectly valid statements about the topic of the

Table 1

Mean Proportion of Gist Recall and Mean Comprehension and Confidence Ratings (Experiment 1)

	Title presented			No title presented		
Story	M recall	Confidence rating	Comprehension rating	M recall	Confidence rating	Comprehension rating
Making and Flying a Kite	.51	5.92	6.50	.28	4.75	2.90
Washing Clothes	.47	6.51	5.90	.29	5.60	3.90
M	.49	6.22	6.20	.28	5.18	3.40

Table 2
Mean Recognition Ratings for Old and New Items and Mean Comprehension Scores (Experiment 1)

	Title presented			No title presented		
Story	Old items	New items	Comprehension rating	Old items	New items	Comprehension rating
Making and Flying a Kite	6.12	1.30	5.10	6.17	1.35	3.20
Washing Clothes	5.95	1.62	6.00	5.95	1.56	3.70
M	6.03	1.46	5.55	6.06	1.46	3.45

passage but had little or no lexical overlap with sentences in the original passage. A second set consisted of sentences that were valid about the theme and also had substantial lexical overlap with sentences in the original passage. The third set consisted of sentences that had meanings inappropriate to the topic (i.e., invalid) but that nonetheless shared substantial lexical overlap with the passage.

Subjects who know what the story is about (because they are provided with its title) might be expected to confuse some of the new valid statements (either with or without lexical overlap) with statements taken from the story. They should, however, be able to recognize as new those statements that are not true of the theme, even though they have substantial lexical overlap with other statements actually in the story.

The performance of the no-title subjects could be quite different. With minimal knowledge of the overall meaning of the story and perhaps with more lexical information than the title subjects, no-title subjects should misrecognize as being old those statments that have lexical overlap, whether or not they are valid of the theme. Given their presumed lack of knowledge about the true theme, it should be easy for no-title subjects to reject the valid statements that do not have lexical overlap.

Method

Subjects and design. Forty university students were given one of two different passages with or without a context-inducing title. All subjects were tested for recognition. There were 10 subjects per group.

Materials and procedure. All aspects of this experiment were identical to the recognition portion of Experiment 1 with the exception of the test items. Here 12 distractors (rather than the 4 or 5 as in the first experiment) were randomly interspersed with the sentences from the story (see Appendix B). Four distractor sentences were written for each of the three experimental categories:

thematically valid but without substantial lexical overlap with original sentences (V); thematically valid with substantial lexical overlap with original sentences (V + L); thematically invalid with lexical overlap (I + L). The last category consisted of sentences that were irrelevant, neutral, or contradictory to the theme.

Results

Comprehension. Mean comprehension scores are presented in Table 3. As before, there is a large difference in comprehensibility as a function of context. A two-factor (Story × Title Condition) ANOVA revealed a highly significant effect of the context variable, $F(1, 36) = 18.77$, $MS_e = 2.35$, $p < .001$. No other effects approached significance ($Fs < 1$).

Recognition. This experiment contained more distractors and more different types of distractors than was the case in Experiment 1. The presumed increase in difficulty level of the present recognition test compared to the test in Experiment 1 did result in a slight reduction in overall performance. Mean confidence ratings were slightly further away from the endpoints of the 7-point scale than were those in Experiment 1. Direct comparison of responses given to the old terms in both experiments showed a reduction in mean response from 6.05 to 5.86, $t(78) = 1.38$, $.10 > p > .05$. The increase in ratings for new items did not reach significance.

As can be seen from Table 3, subjects showed good discrimination between old and new items. A three-factor ANOVA (Story × Title × Item) confirmed the expected effect of item type, $F(3, 108) = 389.66$, $MS_e = .48$, $p < .001$, and the lack of an effect of the title condition ($F < 1$). There was an unexpected story difference, however, with higher ratings being given to the "Washing Clothes" passage statements, $F(1, 36) = 4.94$, $MS_e = .96$, $p < .05$. Separate analyses were then done on each story. For both there were large item differences ($ps < .001$). Newman-Keuls tests

Table 3

Mean Recognition Ratings for Old and New Items and Mean Comprehension Scores (Experiments 2 and 3)

| | Title presented | | | | | No title presented | | | | |
| | Old items | New items | | | Comprehen-sion ratings | Old items | New items | | | Comprehen-sion ratings |
Story		V	V + L	I + L			V	V + L	I + L	
					Experiment 2					
Making and Flying a Kite	5.94	1.23	1.50	1.25	5.60	5.87	1.33	1.48	1.15	3.10
Washing Clothes	5.77	1.90	1.65	1.35	5.10	5.85	1.98	2.45	1.55	3.40
M	5.86	1.57	1.58	1.30	5.35	5.86	1.66	1.97	1.35	3.25
					Experiment 3					
Making and Flying a Kite	5.22	2.34	2.73	2.31	4.69	5.30	2.16	2.84	2.27	2.94

Note. There are three types of recognition foils: V = valid of theme without lexical overlap; V + L = valid with lexical overlap; I + L = invalid with overlap.

showed that subjects easily discriminated between old and distractor items ($p < .01$) but did not respond differentially to the different types of distractors. Most important is the finding that the title manipulations did not affect recognition either as a main effect or in interaction with item types ($Fs < 1.16$).[1]

These findings certainly offer no support to the hypothesis that subjects who differ in their access to thematic knowledge also differ in the aspects of information that are encoded. Subjects provided with the theme are no more likely to accept as old distractor sentences that are true of the theme than are subjects lacking the theme. Subjects lacking the theme are no more likely to accept as old distractor sentences that have substantial lexical overlap with original sentences than are subjects who have the theme.

These findings are not easily interpreted by recognition models that assume that when familiarity and/or frequency are not available as discriminative cues for recognition, additional cues are invoked (e.g., Atkinson & Juola, 1973; Mandler, 1972; Raye, 1976). In the case of the distractor sentences used here, familiarity is not likely to be a useful discriminative cue, since all foil sentences share either thematic validity or lexical units or both with original sentences. One might then expect (as Birnbaum, Johnson, Hartley, & Taylor, 1980, argue) that the provision of a thematic title should provide additional cues for recognition. Apparently it did not—as such themes did not for comparable subjects in two of three experiments reported by Birnbaum et al. (1980).[2]

Experiment 3

Even though recognition scores in Experiment 2 were slightly lower than in the first experiment,

one might like to see them lower still. To create an extremely sensitive test of the effect of context on what is stored in memory, another two groups of subjects were tested for recognition 48 hours after reading the story.

Two-phase models of recognition (e.g., Mandler, 1979, 1980) often propose that familiarity tags are more vulnerable to sources of forgetting than are codes tied to the organizational/elaborative aspects of memory traces. Accordingly the role of variables that influence organization and/or elaboration should be especially visible when recognition is tested after a delay.

Method

Two groups of 16 subjects each read the "Making and Flying a Kite" story. One group received the title before reading, the other did not. Subjects were informed before the retention interval that they would be tested for their memory of the story. In all other respects the procedure and materials were indentical to those used in Experiment 2.

Results

Again there were substantial and significant differences in comprehension between the two

[1] In a replication of the procedures of this study, subjects *heard* rather than *read* their experimental story. A story was heard only once. This eliminated any possibility of differential study time for title and no-title subjects. Although recognition was poorer for these subjects (15 per group) than for subjects in Experiment 2, the pattern of results was essentially the same: The title manipulation did not influence performance.

[2] The comparable subjects were sober as opposed to intoxicated.

groups, with those subjects having the title assigning higher comprehension values than those who did not, $t(30) = 2.645$, $p < .01$.

The recognition ratings of the two groups can be seen in Table 3. Recognition was substantially poorer here than in Experiment 2. Direct comparisons can be made between these subjects and others who were tested on the same story, but 48 hours earlier (Experiment 2). For 14 old items there was a significant difference, $t(30) = 3.52$, $p < .001$, as there was for new items, $t(30) = 4.62$, $p < .001$. In this experiment there was no reason to worry about ceiling problems; we should have had optimal conditions for showing the beneficial effects, if any, of a title on recognition.

An overall analysis compared the two title conditions across the four item types. Once again the provision of a title had no significant effect on performance, either as a main effect or in interaction with item type ($Fs < 1$). There were significant differences among item types, $F(3, 90) = 89.31$, $MS_e = .732$, $p < .001$. A Newman-Keuls test at the .01 level showed that subjects discriminated between old items and the three types of foils. At the .05 level, however, subjects had a greater difficulty recognizing as new the foils that were valid and had lexical overlap than they did with the other two foil types. The latter two, valid and invalid with lexical overlap, did not differ from each other.

The lack of differential misrecognition patterns between theme and no-theme subjects cannot be easily handled by any models (including two-phase recognition models) that assume that there are fundamental differences in what the two groups of subjects were able to store in memory.

Discussion

Comprehension performance (in Experiments 1–3) and recall performance (in Experiment 1) replicated a pattern of results (Bransford & Johnson, 1972) widely cited as support for one of the basic tenets of a constructivist model of memory: The quantity and quality of what is stored during acquisition depends on the nature—and presence—of a schema, which when appropriately activated enables new information to be quickly and efficiently assimilated to relevant prior knowledge. One would then expect that across testing situations, subjects possessing an appropriate schema during acquisition would outperform subjects lacking one. Our recognition results contradict this: Performance was unaffected by the schema manipulation (Experiments 2 and 3). People appear to be capable of encoding the individual ideas contained in what they consider to be a generally incomprehensible passage and do so at a

level equal to that of people who find the passage easy to understand. Furthermore, there is no evidence in two experiments (2 and 3) that differences in comprehension are associated with differences in the level or type of knowledge people abstract from a passage. No-title subjects were no more likely than title subjects to misrecognize statements having lexical overlap with original sentences; title subjects were no more likely than no-title subjects to misrecognize statements that were true of the theme. Thus both groups appear to encode equivalent information.

These results join with other recent work showing that information acquisition may not be different among people who possess definite, yet different, guiding schemata (Anderson & Pichert, 1978; Hasher & Griffin, 1978). The locus of the effect of schemata, titles, or contexts may then be at retrieval, where they can serve as cues to guide memory search. As such they may be expected to have substantial impact on recall performance. There is one finding in the literature, however, that appears to contradict a retrieval interpretation of the role of schemas: Bransford and Johnson (1972) found that a context-inducing title introduced after a story is read does not raise recall performance above that of subjects never given a title. Though this finding is cited as evidence for the role of schemas at encoding, there are at least two alternative explanations, both of which we prefer. Our findings suggest that people encode the individual ideas or sentences of an incomprehensible passage. What they may not be able to do, however, is to relate one sentence to the next. Bransford and Johnson's passages purposely avoid the use of concrete referents, preventing readers from discovering that all ideas refer to a common activity. Thus subjects lacking a title are prevented from using a given-new strategy (Haviland & Clark, 1974) and perceive the passage to consist of a series of disjointed sentences. This results in a "loose" representation in memory (see also Kintsch and van Dijk, 1978); when individual ideas are not tied to one another, recollection of one will be unlikely to cue another (Hirst, 1980). To integrate such a loose structure into the more tightly tied one that title subjects presumably have, no-title subjects would have to be able to recall all of the component ideas, an extremely difficult task given the connections that exist among ideas. Thus a title given after the story has already been encoded is unlikely to help recall.

A second explanation for the failure of context provided after a story has been read is based on the principle of encoding specificity (e.g., Tulving & Thompson, 1973). Retrieval cues are most effective when they bias the same interpretation at

retrieval as they do at encoding. Subjects who did not use the title to encode the passage are then unlikely to benefit from it at the time of retrieval (see also Schustack & Anderson, 1979).

It is thus our belief that the present findings can safely be interpreted as demonstrating that differences in comprehension are not necessarily associated with differences in the type and extent of information stored in memory. Comparable data—substantial differences in recall but not in recognition—have been reported elsewhere (Birnbaum et al., 1980, Experiments 1 and 2; Bower, Karlin, & Dueck, 1975; Chiesi, Spilich, & Voss, 1979, Experiment 2). The stimuli in the Bower et al. study were "droodles," uninterpretable drawings with amusing meanings. Subjects either were provided with labels that clarified the meaning of the drawings or were given no labels. When recall was tested the subjects with labels were at a substantial advantage compared to subjects without labels. When recognition was tested—after a week's retention interval—performance was very good, and most important, the difference between the two groups was eliminated.

A recent set of findings might appear to contradict our conclusions. Schustack and Anderson (1979) reported better recognition when new information could be related by analogy to previous knowledge than when such a connection was impossible or useless. Substantial procedural and materials differences prevent any direct comparison between their study and ours. However, the interpretation of their findings is ambiguous. As Schustack and Anderson note (1979, p. 575), the advantage of analogical knowledge in learning new information may be due to better elaboration at encoding (the explanation they prefer) or to greater accessibility of stored information (the explanation we prefer).

The present results suggest that recall may be an inappropriate task for assessing encoding, at least when dealing with prose materials. The cohesiveness of the representation of a text will be a major determinant of the level of recall for that text. Cohesiveness is determined by at least two factors, the higher level macrostructure and the lower level intersentential associations (Kintsch & van Dijk, 1978). Passages that are devoid of concrete referents (as the Bransford and Johnson passages are) and passages that contain randomly arrayed sentences (e.g., Thorndyke, 1977) not only lack a higher order schematic structure but also have a lower degree of intersentential associative strength than is commonly the case. Thus the reduced levels of recall typical of such passages (compared to the same passage integrated by a title or presented in a logical order) may be more appropriately attributed to the lack of in-

tersentential cues (or to the inaccessibility of the isolated propositions, Kozminsky, 1977) than to the failure of a schema-directed encoding process.

In relation to Bartlett's original theory, our results suggest that (a) memory for a prose passage contains more than just salient details, (b) memory can contain poorly integrated information, and (c) a schema is not a necessary component of the encoding process. Along with other recent findings, these experiments provide reason to question a strong constructivist point of view.

References

Anderson, R. C., & Pichert, R. D. Recall of previously unrecallable information following a shift in perspective. *Journal of Verbal Learning and Verbal Behavior*, 1978, *17*, 1–12.

Atkinson, R. C., & Juola, J. F. Factors influencing speed and accuracy of word recognition. In S. Kornblum (Ed.), *Attention and performance IV*. New York: Academic Press, 1973.

Ausubel, D. P. The use of advance organizers in the learning and retention of meaningful verbal material. *Journal of Educational Psychology*, 1960, *51*, 267–272.

Baker, L. Processing temporal relationships in simple stories: Effects of input sequence. *Journal of Verbal Learning and Verbal Behavior*, 1978, *17*, 559–572.

Barclay, J. R. The role of comprehension in remembering sentences. *Cognitive Psychology*, 1973, *7*, 229–254.

Bartlett, F. C. *Remembering: A study in experimental and social psychology*. London: Cambridge University Press, 1932.

Bates, E., Masling, M., & Kintsch, W. Recognition memory for aspects of dialogue. *Journal of Experimental Psychology: Human Learning and Memory*, 1978, *4*, 187–197.

Birnbaum, I. M., Johnson, M. K., Hartley, J. T., & Taylor, T. H. Alcohol and elaborative schemas for sentences. *Journal of Experimental Psychology: Human Learning and Memory*, 1980, *6*, 293–300.

Bower, G. H., Karlin, M. B., & Dueck, A. Comprehension and memory for pictures. *Memory and Cognition*, 1975, *3*, 216–220.

Bransford, J. D., Barclay, J. R., & Franks J. J. Sentence memory: A constructive versus interpretative approach. *Cognitive Psychology*, 1972, *3*, 193–209.

Bransford, J. D., & Franks, J. J. The abstraction of linguistic ideas. *Cognitive Psychology*, 1971, *2*, 331–350.

Bransford, J. D., & Johnson, M. K. Contextual prerequisites for understanding: Some investigations of comprehension and recall. *Journal of Verbal Learning and Verbal Behavior*, 1972, *11*, 717–726.

Bransford, J. D., & Johnson, M. K. Considerations of some problems of comprehension. In W. G. Chase (Ed.), *Visual information processing*. New York: Academic Press, 1973.

Chiesi, H. L., Spilich, G. J., & Voss, J. F. Acquisition of domain-related information in relation to high and low domain knowledge. *Journal of Verbal Learning and Verbal Behavior*, 1979, *18*, 257–273.

Dooling, D. J., & Christiaansen, R. E. Episodic and semantic aspects of memory for prose. *Journal of Experimental Psychology: Human Learning and Memory*, 1977, *3*, 428–436.

Dooling, D. J., & Lachman, R. Effects of comprehension on the retention of prose. *Journal of Experimental Psychology*, 1971, *88*, 216–222.

Dooling, D. J., & Mullet, R. L. Locus of thematic effects in retention of prose. *Journal of Experimental Psychology*, 1973, *97*, 404–406.

Flagg, P. W. Semantic integration in sentence memory? *Journal of Verbal Learning and Verbal Behavior*, 1976, *15*, 491–504.

Frederiksen, C. H. Acquisition of semantic information from discourse: Effects of repeated exposures. *Journal of Verbal Learning and Verbal Behavior*, 1975, *17*, 158–169. (a)

Frederiksen, C. H. Effects of context-induced processing operations on semantic information acquired from discourse. *Cognitive Psychology*, 1975, *7*, 139–166. (b)

Gardner, E. T., & Schumacher, G. M. Effects of contextual organization on prose retention. *Journal of Educational Psychology*, 1977, *69*, 146–151.

Hasher, L., Attig, M. S., & Alba, J. W. I knew it all along: Or, did I? *Journal of Verbal Learning and Verbal Behavior*, 1981, *20*, 86–96.

Hasher, L., & Griffin, M. Reconstructive and reproductive processes in memory. *Journal of Experimental Psychology: Human Learning and Memory*, 1978, *4*, 318–330.

Haviland, S. E., & Clark, E. E. What's new? Acquiring new information as a process in comprehension. *Journal of Verbal Learning and Verbal Behavior*, 1974, *13*, 512–521.

Hayes-Roth, B., & Hayes-Roth, F. The prominence of lexical information in memory representations of meaning. *Journal of Verbal Learning and Verbal Behavior*, 1977, *16*, 119–136.

Hirst, W. The locus of constructive activity in memory for mathematical proofs. *Journal of Experimental Psychology: Human Learning and Memory*, 1980, *6*, 119–126.

James, C. T., & Hillinger, M. L. The role of confusion in the semantic integration paradigm. *Journal of Verbal Learning and Verbal Behavior*, 1977, *16*, 711–721.

Katz, S., & Gruenewald, P. The abstraction of linguistic ideas in "meaningless" sentences. *Memory & Cognition*, 1974, *2*, 737–741.

Keenan, J., MacWhinney, B., & Mayhew, D. Pragmatics in memory: A study of natural conversation. *Journal of Verbal Learning and Verbal Behavior*, 1977, *16*, 549–560.

Kintsch, W., & Bates, E. Recognition memory for statements from a classroom lecture. *Journal of Experimental Psychology: Human Learning and Memory*, 1977, *3*, 150–168.

Kintsch, W., & van Dijk, T. A. Toward a model of text comprehension and production. *Psychological Review*, 1978, *85*, 363–394.

Kozminsky, E. Altering comprehension: The effect of biasing titles on text comprehension. *Memory & Cognition*, 1977, *5*, 482–490.

Mandler, G. Organization and recognition. In E. Tulving & W. Donaldson (Eds.), *Organization of memory*. New York: Academic Press, 1972.

Mandler, G. Organization and repetition: Organizational principles with special reference to rote learning. In L.-G. Nilsson (Ed.), *Perspectives in memory research*. Hillsdale, N.J.: Erlbaum, 1979.

Mandler, G. Recognizing: The judgment of previous occurrence. *Psychological Review*, 1980, *87*, 252–271.

Pichert, J. W., & Anderson, R. C. Taking different perspectives on a story. *Journal of Educational Psychology*, 1977, *69*, 305–315.

Potts, G. R. Memory for redundant information. *Memory & Cognition*, 1973, *1*, 467–470.

Raye, C. L. Recognition: Frequency or organization? *American Journal of Psychology*, 1976, *89*, 645–658.

Reder, L. M. The role of elaboration in the comprehension and retention of prose: A critical review. *Review of Educational Research*, 1980, *50*, 5–53.

Reitman, J. S., & Bower, G. H. Storage and later recognition of exemplars of concepts. *Cognitive Psychology*, 1973, *4*, 194–206.

Royer, J. M., & Cable, G. W. Facilitated learning in connected discourse. *Journal of Educational Psychology*, 1975, *67*, 116–123.

Sachs, J. S. Recognition memory for syntactic and semantic aspects of connected discourse. *Perception & Psychophysics*, 1967, *2*, 437–442.

Sachs, J. S. Memory in reading and listening to discourse. *Memory & Cognition*, 1974, *2*, 95–100.

Schallert, D. L. Improving memory for prose: The relationship between depth of processing and context. *Journal of Verbal Learning and Verbal Behavior*, 1976, *15*, 621–632.

Schustack, M. W., & Anderson, J. W. Effects of analogy to prior knowledge on memory for new information. *Journal of Verbal Learning and Verbal Behavior*, 1979, *18*, 565–583.

Spiro, R. J. Remembering information from text: The "state of schema" approach. In R. C. Anderson, R. J. Spiro, & W. F. Montague (Eds.), *Schooling and the acquisition of knowledge*. Hillside, N.J.: Erlbaum, 1977.

Sulin, R. A., & Dooling, D. J. Intrusion of a thematic idea in the relationship of prose. *Journal of Experimental Psychology*, 1974, *103*, 255–262.

Thorndyke, P. W. Cognitive structures in comprehension and memory of narrative discourse. *Cognitive Psychology*, 1977, *9*, 77–110.

Tulving, E., & Thompson, D. M. Encoding specificity and retrieval process in episodic memory. *Psychological Review*, 1973, *80*, 352–373.

Appendix A

Stimulus Materials[3]

Washing Clothes Passage

The procedure is actually quite simple. First you arrange things into different groups depending on their makeup. Of course, one pile may be sufficient depending on how much there is to do. If you have to go somewhere else due to lack of facilities that is the next step, otherwise you are pretty well set. It is important not to overdo any particular endeavor. That is, it is better to do too few things at once than too many. In the short run this may not seem important, but complications from doing too many can easily arise. A mistake can be expensive as well. The manipulation of the appropriate mechanisms should be self-explanatory, and we need not dwell on it here. At first the whole procedure will seem complicated. Soon, however, it will become just another facet of life. It is difficult to foresee any end to the necessity for this task in the immediate future, but then one never can tell.

Making and Flying a Kite Passage

A newspaper is better than a magazine. A seashore is a better place than the street. At first it is better to run than to walk. You may have to try several times. It takes some skill but it's easy to learn. Even young children can enjoy it. Once successful, complications are minimal. Birds seldom get too close. Rain, however, soaks in very fast. Too many people doing the same thing can also cause problems. One needs lots of room. If there are no complications, it can be very peaceful. A rock will serve as an anchor. If things break loose from it, however, you will not get a second chance.

[3] From "Contextual Prerequisites for Understanding: Some Investigations of Comprehension and Recall" by J. D. Bransford and M. K. Johnson, *Journal of Verbal Learning and Verbal Behavior*, 1972, *11*, 717–726. Copyright 1972 by Academic Press. Reprinted by permission.

Appendix B

Distractor Items

Experiment 1

Making and Flying a Kite
1. Many kinds of shapes can be used.
2. It has its ups and downs.
3. Some people never get the chance.
4. Everything is anything.
Washing Clothes
1. Children can even do it.
2. Depending upon the amount, more might have to be done.
3. Once you know what you are doing, you might not really want to do it.
4. It can be done on any day of the week, but a weekend might be more convenient.
5. Some kinds of people are more likely to do it more often than other kinds of people.

Experiments 2 and 3

Making and Flying a Kite
Valid with lexical overlap
1. In the beginning, you may have to walk or run to make it work.

2. Most people learn it when they are children.
3. You can enjoy it most when there is lots of room.
4. It takes some skill at running with it.
Valid without lexical overlap
1. The tail must not be too long or too short.
2. The proper weather is important.
3. Most of the work is in getting it started.
4. Many kinds of shapes can be used.
Invalid with lexical overlap
1. At the seashore, it takes more skill.
2. If you run, you may break it.
3. One needs for it to be very peaceful.
4. Young children will not get a second chance.
Washing Clothes
Valid with lexical overlap
1. The different groups require slightly different procedures.
2. Mistakes can damage the material.
3. Some facilities are more complicated than others.

4. Too few things will be wasteful.

Valid without lexical overlap

1. It must be done on a fairly regular basis.
2. You must be careful when sorting the items.
3. Before long, you may consider the task to be boring.
4. If you are not equipped to do it at home, there will be greater inconvenience.

Invalid with lexical overlap

1. It is important that the facilities be lacking.
2. The expensive procedure requires too much explanation.
3. The immediate future promises too few things.
4. It is better to do this task in the immediate future.