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ABSTRACT

The ability to select (a) suitable retrieval cues and (b) the main ideas of prose passages was examined in college students and in school students between fifth and twelfth grades. The ability to select the main elements of texts improved over the entire age range studied and was not affected by experience studying and recalling the passage. Retrieval cue selection was also sensitive to age, with a dramatic shift in flexibility occurring between the high school and college populations. Prior to experience recalling the text, college students selected mainly the most important elements to serve as retrieval cues. After experience recalling, however, they selected units of intermediate importance. Realizing they would remember the main ideas without further effort, they concentrated on the intermediate level material which caused them much more trouble on their previous recall attempt. This shift in retrieval cue selection represents a fine degree of sensitivity to the relative improtance of text segments and to the function of retrieval cues in recall, a sensitivity not displayed by even the oldest high school subjects. (Author)

CENTER FOR THE STUDY OF READING

Technical Report No. 53

The Effects of Experience on the Selection of Suitable Retrieval Cues for Studying from Prose Passages[1]

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Abstract

The ability to select (a) suitable retrieval cues, and (b) the main ideas of prose passages was examined in college students and school students of between fifth and twelfth grade. The ability to select the main elements of texts improved over the entire age range studied and was not affected by experience studying and recalling the passage. Retrieval cue selection was also sensitive to age with a dramatic shift in flexibility occurring between the high school and college populations. Prior to experience recalling the text, college students selected mainly the most important elements to serve as retrieval cues. After experience recalling, however, they selected units of intermediate importance. Realizing they would remember the main ideas without further effort, they concentrate on the intermediate level material which caused them much more trouble on their previous recall attempt. This shift in retrieval cue selection represents a fine degree of sensitivity to the relative importance of text segments, and to the function of retrieval cues in recall, a sensitivity not displayed by even the oldest high school subjects.

Interest in the area of memory development has shifted in recent years to a concentration on factors that have become subsumed under the heading of metamemory (Brown, 1975, 1978a, 1978b; Flavell, 1977; Flavell & Wellman, 1977). Metamemory refers to the whole gamut of information a person has concerning the workings of his own memory, information essential for the predicting, planning, monitoring, and checking activities that accompany mnemonic acts (Brown, 1978a). Initial investigations into the meta aspects of memory tended to give the impression that the "metas" could in some way be separated from memory in the strict sense. Of course this is not true, for the information we have concerning memory is intimately tied to how we set about remembering. As Flavell has recently pointed out, "in the complex interweaving of cognitive events, what we call 'metamemory' versus what we call 'memory behavior' or 'strategies' gets to look a bit arbitrary" (Flavell, 1977, ms. p. 29). This is nowhere more true than in the area of retrieval cue selection (Brown & DeLoache, 1978; Flavell, 1977).

We have a good deal of evidence that children only gradually come to understand and appreciate the nature and use of retrieval cues (Flavell, 1977). Yet even very young children seem to have some concept of the utility of planning ahead for future retrieval if the task is to find an object hidden in the environment (Ritter, 1976; Wellman, Ritter & Flavell, 1975), and by the early grade school years, they seem to be fairly well informed about the utility of retrieval cues for assisting in the location of items temporarily lost in the mind (Kobasigawa, 1977; Salatas & Flavell, 1976). The majority of retrieval cue studies, however, have concentrated on variations of list-learning tasks (Flavell, 1977). But the ability to plan ahead for future recall attempts is an essential prerequisite for effective study in a whole variety of situations, not least of which are the typical learning activities that occur in schools. Students engaged in studying texts are equally dependent on a variety of retrieval

cue activities that no doubt include sophisticated note-taking, underlining, and selective rereading activities that serve to focus attention on important elements (Anderson, 1978; Brown & Smiley, 1977a, 1977b).

Such sophisticated strategies are relatively late in developing, emerging as preferred idiosyncratically molded routines in the high school years (Brown & Smiley, 1977b). The development of these strategies is probably the result of repeated experience with the text-learning tasks that increasingly dominate the study activities of the later school years. The ability to form complex retrieval plans for studying from texts is a fine example of the "complex interweaving of cognitive events" (Flavell, 1977), for in order to take adequate notes one would need a certain amount of knowledge concerning study strategies, test demands, textual features, the strengths and weaknesses of memory for such materials and the mutual compatibility of all these facets in preparing for optimal performance (Brown, 1978b, 1978c; Bransford, Franks, Morris, & Stein, 1978).

A primitive precursor of such elaborate study strategies is the ability to select the main idea of a passage. Danner (1976) asked grade school children to identify the main elements of short stories, or to select suitable retrieval cues to aid subsequent recall. Contrary to previous findings (Otto, Barrett & Koenke, 1969), Danner found that almost all his sample, even the second-grade children, were able to identify the three topic sentences or main ideas of the stories. Using a much more difficult set of stories, Brown & Smiley (1977a) found that even fifth-grade children had difficulty differentiating between degrees of importance of various units of texts. Not only were the stories more complex and less well organized into topics, but the procedure was also more demanding in the Brown and Smiley study. Danner required his subjects to consider each of the three topics of his stories separately and then give a

description of the main point of each section. Brown and Smiley required students to rate all the units (approx. 55 per story) of the texts on a four-point scale of relative importance. Although the younger children in the Brown and Smiley study (third-fifth grade) received considerable pretraining, it is conceivable that the difficulty of the procedure masked their sensitivity to gradations of importance.

Thus, the Brown and Smiley and the Danner studies differed in two ways: the complexity of the texts used and the difficulty of the rating procedures. One aim of the present study is to separate these factors by using the Danner procedure on the more complex Brown and Smiley stories. This clarification was thought to be essential for our ongoing research in prose recall in children. We have found that children above seventh grade, given extra study time, improve their recall of our stories differentially across levels of rated importance; the improvement following study is limited to the essential elements of texts. Younger children do not show this differential recall pattern (Brown & Smiley, 1977b). Our explanation of this stable finding is that older students use their knowledge of relative importance to guide their selective attention while studying. Younger children, unaware of the relative importance of the segments they are reading, can scarcely be expected to select out important units for extra study. It is essential for this argument that we substantiate our earlier assumption (Brown & Smiley, 1977a) that the younger children are ignorant of relative importance of the constituent units of the stories we have used.

A second focus of this study is the selection of adequate retrieval cues. Danner found that although second-grade children could identify important elements, it is not until fourth grade that they choose important elements as retrieval cues and not until sixth grade that they are able to justify their choices. We have two problems with this finding; one concerns the assumptions made about what would be an effective retrieval cue selection and the second concerns the

method by which these data were obtained. Danner assumes that the selection of a topic sentence would be the most effective plan for retrieval and while this seems intuitively reasonable we have no means of knowing whether it is right. For example, one of the few facts we are sure about in the emergent developmental literature on prose recall is that even the least mature subjects recall the main ideas and ignore trivia. This is true of even preschool and kindergarten children (Brown & Smiley, 1977a; Christie & Schumacher, 1975; Korman, quoted in Yendovitskaya, 1971), educable retarded children (Brown & Campione, 1978), poor readers (Smiley, Oakley, Worthen, Campione & Brown, 1977), and adults in incidental-orienting conditions where no warning is given that recall will be required (Brown & Smiley, 1977b). Thus, we can conceive of the development of very sophisticated retrieval plans that might capitalize on the experienced student's knowledge concerning his propensity to recall main ideas without conscious intent to do so. Such a plan might involve the selection of relatively less central or important facts as retrieval cues, for it will certainly be these that provide most difficulty when recall is attempted. Thus, under certain circumstances it is by no means intuitively obvious that important units or topic sentences would be the best retrieval cues.

Such a sopisticated plan for remembering should be a late-developing study skill for it would require a fine degree of sensitivity to the demands of gist recall tasks. It might also be dependent on particular experience recalling the target passages and hence one would expect changes in retrieval cue selection as a function of repeated recall attempts. For these reasons we considered retrieval cue selection in both experienced and naive subjects, i.e., those who had no prior interaction with the passage and those who had just completed a study-recall session with the specific passage we would require them to rate.

A further reason for the inclusion of the experience variable was to address a possible source of confounding in the original Danner data. Danner's students

were required to select main ideas and retrieval cues only after they had considerable interaction with the stories, i.e., they had listened to them, attempted recall, rated them for subjective difficulty, completed a detection test designed to see if they understood the benefits of a tight organization, and grouped the individual sentences by topics. All of these procedures seem to be potential training vehicles for the final tasks of selecting the main ideas and then the retrieval cues. Thus, the precocious sensitivity of Danner's second graders could have resulted from the considerable experience they had with the stories. In addition, the procedure allowed another potential source of contamination. The children were read (or themselves read) the four sentences under each topic and then were asked "what one thing do these four sentences tell you about the (fox)?" (Danner, 1974, p. 18). A response such as "Tells me where he lives" for a section on the main character's habitat would be regarded as correct identification of the topic sentence. But if, as we know, young children only recall the main points, and, if they responded to this task with the only information they could remember, they would probably produce a response rated as correct, even if they had little idea of what were the main ideas. This might explain both the precocious sensitivity of the second graders when selecting main ideas and the difference between choosing and justifying the selection of retrieval cues. For these reasons the subjects in our study selected main ideas and retrieval cues before and after experience studying the passages and the task was such that they did not need to rely on memory when making their decisions.

Method

Subjects. The subjects ranged from fifth to twelfth grade school students and college volunteers. The school population was divided into three groups: young (fifth grade, N = 80), middle (seventh and eighth grades, N = 101), and old (eleventh and twelfth grades, N = 58). There were also 80 college students.

Stimulus materials. Two Japanese folk tales[2] were used in this study and in previous studies of prose recall conducted in our laboratory (Brown & Smiley, 1977a, 1977b; Smiley, Oakley, Worthen, Campione, & Brown, 1977). Full details of these stories are therefore available in a variety of other sources. In brief, the stories, entitled "The Dragon's Tears" and "How to Fool a Cat" were of equal length (390 and 403 words, 34 and 28 lines) and contained the same number of previously identified idea units (59 and 54). They were also of approximately fifth-grade reading level (Dale-Chall readability scores of 5.2287 and 5.3682, respectively). The units of the stories had been rated into four levels of importance to the theme by approximately 30 college students, using a procedure introduced by Johnson (1970)--for full details see Brown and Smiley (1977a).

Procedure. The basic procedure was the same for all groups. The students were seen in small groups or individually depending on scheduling. They twice listened to a tape recording of one of the stories (stories counterbalanced across treatment groups) and simultaneously read the story through. They were then given the idea units of the story, each typed on an individual index card. The units were presented in the same sequential order they occupied in the text. The students were advised to read the whole story again on the individual cards. Half of the students (at each age except the eleventh and twelfth grades) were then asked to select 12 of the available (approximately 50) units because they were the most important ideas in the story (data not available for the old school children). The remainder were asked to select the 12 units they would prefer to have by them (retrieval cues) if they were to be asked to remember the story. All of the eleventh and twelfth grade sample were in the retrieval cue condition.

The second major variable was that some of the subjects in each treatment group were tested after they had attempted study and recall of the story now

to be rated. These subjects had just taken part in a prior study of gist recall (Brown & Smiley, 1977b). The N ranged from 20 - 45 subjects. The remaining subjects (N = 20 per age group) had no prior experience on our prose recall tasks. After completing the selection task the students in the college group were asked to justify their choices.

Results and Discussion

Preliminary inspection of the data revealed no effects due to story; therefore we combined the data across this variable in all the analyses. The selected units were scored with reference to the four previously identified levels of importance to the theme of the passage. The number of units at the various importance levels ranged from 13 - 15, therefore, it would be possible for a subject to make all selections of the same importance level.

The overall analysis of variance conducted on the selection scores included only three levels of the age variable, as we were unable to find additional eleventh- and twelfth-grade subjects to take part in the importance level rating condition. The mixed analysis of variance was, therefore, a 3 (Age) x 2 (Experience, Before & After) x 2 (Instructions: Select retrieval cues, or important units) x 4 (Importance Level). The only reliable main effect was that of Importance Level, F (3,747) = 651.27, $p < .001$. However, the higher-order interaction, Age x Experience x Importance Level x Instruction was reliable, as were all of the other interactions involving the importance variable (F values ranged from 6.15 - 103.39, $p < .01$ in all cases). These data are shown in Figures 1 and 2.

Insert Figures 1 and 2 about here

The clear trend was for choices to increase regularly with increases in importance level. The dramatic exception to this pattern was obtained when experienced college students were selecting retrieval cues.

To substantiate this claim we conducted separate analyses of variance on the retrieval cue selection condition and the importance rating condition. Consider first the important unit selections depicted in Figure 1. The pattern of results replicates the original Brown and Smiley (1977a) rating data where the more difficult Johnson (1970) procedure was used. Here, with the simpler Danner (1976) procedure, the same overall pattern emerged. College students and seventh graders do show a fine sensitivity to the importance of constituent units of texts, but the college students are still somewhat more adroit than the younger students. The majority of choices made by college students are of level 4 units (88%). The seventh and eighth graders are not quite as discriminating as adults, with 73% of their choices directed to level 4 units. Fifth graders are able to pick out the level 4 units and half their choices are of level 4 units (47%). The remaining half of their choices are distributed relatively evenly across levels one to three.

A 3 (Age) x 2 (Experience) x 4 (Importance Level) mixed analysis of variance on the importance unit choice scores confirmed this visual impression. The interaction of Age x Importance Level was reliable, F (6,330) = 43.62, $p < .001$. Post hoc tests revealed that all groups reliably chose more level 4 units than any other. In the two older samples there were very few choices of the other three levels. In the younger group half the choices were of the lower three levels but these choices were not distributed in any particular fashion. Differences between levels 1 and 2, and levels 2 and 3 were not reliable. This is the same pattern found with these stories and these age groups for the more complicated rating procedure used by Brown and Smiley (1977a). There was no effect of the experience variable on the importance rating data.

Consider next the retrieval cue selection data. Here we had data from all four age groups. The distribution of choices of suitable retrieval cues is

illustrated in Figure 2. The pattern of choices appears to be very similar for naive subjects of all ages but a developmental trend is found in the experienced subjects, with college students changing their pattern of selection after experience learning the passage.

A 4 (Age) x 2 (Experience) x 4 (Importance Level) mixed analysis of variance on the retrieval cue selection data revealed a main effect of Importance Level, F (3,585) = 250.63, $p < .001$. Of more interest, the Age x Experience x Importance Level higher-order interaction was reliable, F (9,585) = 10.49, $p < .001$, as were the composite interactions: Age x Importance Level, F (9,585) = 9.89, $p < .001$, and Experience x Importance Level, F (3,585) = 10.01, $p < .001$. It is the higher-order interaction that is illustrated in Figure 2. The school students do not change their pattern of choices following experience actually recalling the passages. College students, however, respond differently if they have one prior experience recalling the text. Now, their prime targets for retrieval cues are the two intermediate levels of importance. After experience with the passages, college students still reject the least important units as potential retrieval cues but they now also reject the most important elements. The most commonly offered explanation for this change (on posttest interrogation) was that students realized they would remember the main theme without further effort, but in order to improve overall recall they would need to concentrate on the intermediate level material which caused them much more trouble on their previous recall attempt. Therefore, they selected mainly level 2 and level 3 units as retrieval cues. Of the 20 students in the retrieval-after condition, 13 gave a verbal justification that essentially made the above point, without prompting. This shift in selection represents a fine degree of sensitivity to the important elements of texts, and to the function of retrieval cues in recall, a sensitivity not displayed by even the eleventh and twelfth grade school sample.

As a check that the college student pattern did represent a true shift in choice, we compared the importance rating selection and retrieval cue choices for this sample only. When students are asked to select important elements there is no shift in choices as a function of experience (see Figure 1); indeed the two sets of scores are virtually identical. When asked to select suitable retrieval cues, however, college students show a reliable change in preference as a function of experience. This shift resulted in a reliable Experience x Importance Level x Instruction interaction for the college students, F (3,228) = 15.33, $p < .001$. On subsequent separate analyses of variance on the retrieval cue selections only, the Experience x Importance Level interaction, F (3,114) = 21.41, $p < .001$ was reliable. No reliable Experience x Importance Level interaction was found in the analysis of the importance unit selections only.

Our final consideration of these data focused on the relationship of importance choices versus retrieval cues at the other grade levels where such a comparison was possible, fifth and seventh and eighth grades. The Age x Importance Level x Instruction higher-order interaction was reliable, F (3,519) = 9.51, $p < .001$. Separate analysis of variance for the two ages provided an explanation of this effect. For fifth graders, the only effect to reach significance was that of Importance Level, F (3,228) = 83.73, $p < .001$. There are no differences in fifth graders' selection of units as a result of instructions to find main ideas or suitable retrieval units. For the seventh- and eighth-grade sample, however, the Importance Level x Instructions interaction was significant, F (3,291) = 30.81, $p < .001$. When selecting retrieval cues the older children distribute more of their choices to level 2 and 3 units (40%) than they do when selecting main ideas (21%).

Thus, there is a reliable difference in the pattern of results obtained from fifth-grade and seventh- and eighth-grade children. Fifth graders do not differentiate the task of selecting main ideas from selecting retrieval units. The older

children do behave differently as a function of task demand and the pattern of choices may be the primitive precursor of the mature adult sensitivity. Thus, while the middle school children are not yet sophisticated enough to change their retrieval selection as a function of one experience recalling the target passage, they are sufficiently aware of retrieval demands to select more of the intermediate level units as aids for recall. This same pattern of differentiation between the task of selecting retrieval cues or main points was also found in the naive college sample. When selecting main ideas 89% of their choices were of level 4 units and only .08 were of levels 2 and 3. When choosing suitable retrieval cues, however, only 54% of choices favored level 4 units and 36% favored levels 2 and 3. As we have seen (see Figure 2), after practice recalling the passage, the distribution shifts to 17% level 4 choices and 64% levels 2 and 3 choices for the college population.

General Discussion

The selection of suitable retrieval cues to aid in the recall of complex passages is by no means a simple task. It requires a fine sensitivity to the relative importance of various elements of text, an understanding of suitable study strategies, and an appreciation of the complex interweaving of these factors. Because of this complexity, we find a very late emergence of a flexible retrieval strategy. Only college students change their pattern of responses dramatically after one experience studying the passage, selecting units of intermediate importance to form the scaffolding for their subsequent recall attempt. This modification is an intelligent one, for approximately 80% of the most important units would have been recalled on their first try (Brown & Smiley, 1977b). Thus, selection of relatively less central units as retrieval cues would be an optimal plan for a second recall attempt.

We know that in a simpler paradigm, much younger children seem to be aware that items they have failed to recall should be given extra study (Brown & Campione, 1977; Kelly, Scholnick, Travers, & Johnson, 1976; Masur, McIntyre, & Flavell, 1973). But it is not until college age that this knowledge is reflected in suitable retrieval plan modification for studying text materials. The influence of task and text complexity on the deployment of flexible strategies is well illustrated.

Younger children do not show the same flexibility in changing their retrieval plans as a function of one recall attempt. There is, however, some evidence of the early emergence of sensitivity to the demands of selecting a retrieval plan. Middle school children did differentiate between the task of selecting important units versus selecting retrieval cues, but one experience with recall was insufficient to produce a major modification in their planning. Repeated experience with the task of selecting retrieval cues, and, perhaps, actually using them to aid recall, may be needed before school children become effective users of this form of study plan.

The present data suggest that we should exercise caution when assuming what would be an efficient retrieval cue plan for any one task. Careful examination of the behavior of experts might provide a better index of effective cue selection than personal introspection. If there is an effective plan that many experienced studiers report using, this should be the model to use when assessing the immaturity of less experienced learners.

The second major finding of this study is that the younger children were relatively insensitive to fine degrees of importance of the constituent units of complex text. This confirms the original Brown and Smiley (1977a) data and allows us to maintain our explanation of the inefficiencies of studying shown by grade school children. Insensitive to the relative importance of all but the most

important elements of texts, they cannot be expected to attend differentially to ideas as a function of their rated importance.

The interweaving of knowledge about textual importance and deployment of suitable study strategies has been examined elsewhere (Brown & Smiley, 1977b). We should point out, however, that we do not believe there is a magical age at which children become able to indicate the important elements of text, for there must be a close correspondence between the child's current knowledge and the complexity of material he can deal with adequately. The ability to plan flexible retrieval activities must be dependent on general knowledge about consistent features of all texts, and specific knowledge about the particular exemplar at hand. Quite simply, if the text is so complex (in terms of subject matter, organization, or exposition) that the reader cannot identify the main points, he can scarcely be expected to select them for extra study, even if he possesses the prerequisite strategic knowledge that this would be a good study activity. Thus we predict that even college students may behave immaturely, i.e., select unsuitable retrieval cues, when faced with a text that is too difficult for them, one aimed at a level beyond their competence.

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Footnotes

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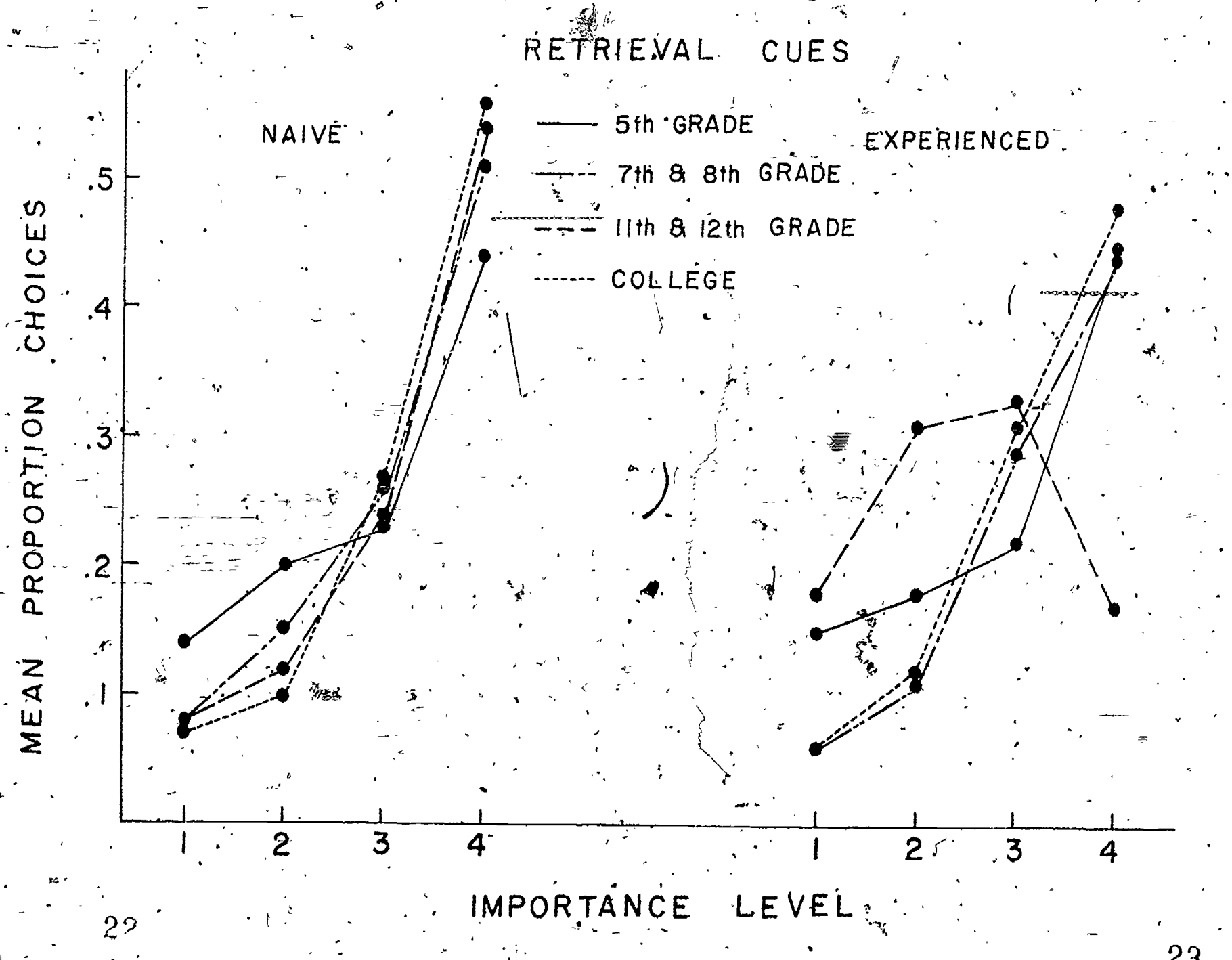
[2]The stories were taken from Florence Sakade (Ed.), Japanese Children's Stories. (Rutland, Vt. and Tokyo: Tuttle, 1957). Copies of the stories, with the corresponding pausal units and rated importance values are available on request.

Figure Captions

Figure 1. The distribution of importance level choices as a function of age and experience.

Figure 2. The distribution of retrieval cue choices as a function of age and experience.


RETRIEVAL CUES
NAIVE
EXPERIENCED
5th GRADE
7th & 8th GRADE
11th & 12th GRADE
COLLEGE
MEAN PROPORTION CHOICES
.1
.2
.3
.4
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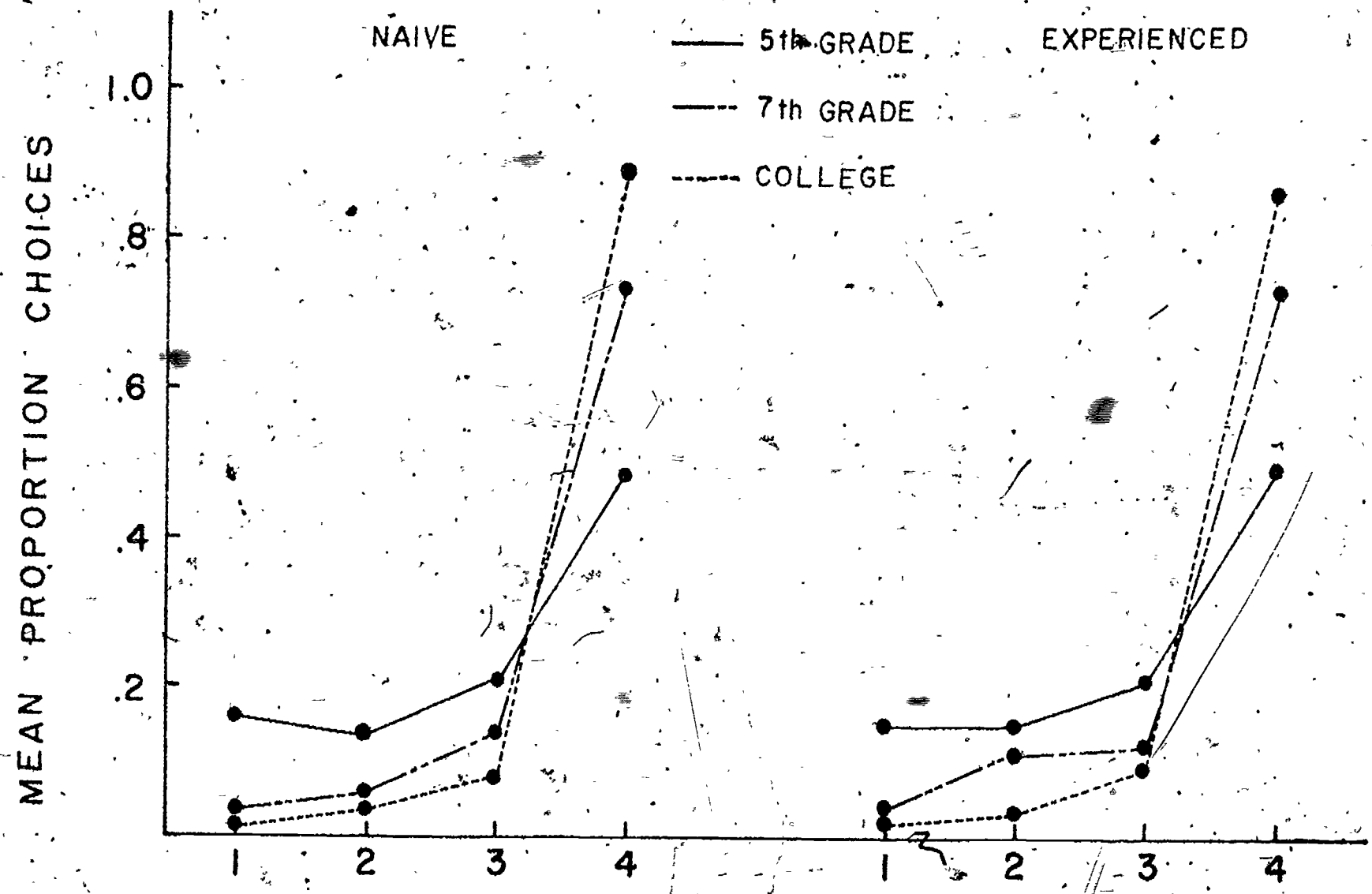
1
2
3
4
IMPORTANCE LEVEL


IMPORTANCE UNITS
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