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ABSTRACT

This paper describes a series of studies which examine the early development of recall. Subjects were children about 2 1/2 and 5 years of age. Recall was tested on nine-item lists which were either composed of three objects from each of three conceptual categories or nine objects from nine different conceptual categories. Age differences were observed in level of recall. However, there was no evidence of age-related increases in active or deliberate strategy use. Parallel serial position curves, and comparable levels of clustering were obtained over the entire age range studied. Conceptual category effects were found on recall of even the youngest subjects. The children recalled more items from conceptually related than unrelated lists, responded more rapidly between adjacent pairs of conceptually related than unrelated items, produced above chance level conceptual clustering, profited from categorical blocking at presentation and from category cues at retrieval. A reliable Age X List Type interaction indicated that the presence of semantic relations in list materials facilitated older children's performance somewhat more than younger children's. Results suggest that early development of memory may be related to growth in the "knowing" component itself, rather than to growth in "knowing how to know." (Author/MS)

Semantic Effects and Development of Recall in Very Young Children

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Semantic Effects and Development of Recall

in Very Young Children

In spite of the recent upsurge of research on memory development, there is still relatively little known about early growth of memory, that is about memory development before the grade school years. Considerable work has indicated some recognition memory in young infants, and work by several investigators, including ourselves (Perlmutter & Myers, 1974, 1975, 1976), has extended that work demonstrating quite extensive recognition skills in preschool children as young as two. Few studies, however, have examined recall in children under four. Yet, knowledge of the earliest development of recall promises to provide important insights into our understanding of more complex memory skills.

Today I would like to report three studies we have carried out to examine the development of recall in preschool children between about two and a half and five years of age. We have been interested in assessing how these young children retrieve and produce information about previously seen, but no longer present stimuli. Additionally, we have investigated whether, and how, the semantic category knowledge these young children possess affects their memory.

General Methodology

In each study we have examined two age groups. The younger children have been between approximately 2-years 9-months and 3-years of age, and the older children between 4-years and 4-years 9-months of age. The older children have been individually tested in nursery schools, and the younger children tested at the University. When they arrive at our lab they enter a playroom (slide 1) where the child (slide 2) is encouraged to play and become acclimated to the unfamiliar surroundings and experimenter (slide 3). We then invite them to play a "memory game." We show the children small toy objects from colorful boxes (slide 4), and then ask them to tell us what they saw. Eact stimulus list contains 9-items familiar to young children (slide 5), for example one list contained a toy ball, book, bow, clock, comb, key, hat, heart, and horn. Each item is individually shown to the child, labeled for him, and then hidden in the box. After all items have thus been presented the child is asked to remember as many as he can. The testing session involves some preliminary practice on very short lists, to ensure that the child understands how to play the "game," and then testing on a series of 9-item test lists.

Experiments 1 & 2

In Experiment 1 there were eight males and eight females in each age group. In Experiment 2, which was essentially a replication of Experiment 1, there were 24 males and 24 females in each age group. All children were given three trials on a related list composed of three objects from each of three conceptual categories (slide 6) (e.g. bear, cow, pig, boat, car, plane, bowl, cup, and plate), and three trials on an unrelated list composed of nine objects from nine different conceptual categories (slide 7) (e.g. bell, clock, drum, flag, horse, leaf, pen, star, and truck). The three trials for each list always followed each other, with the items presented in a different random order on each trial. The order of related versus unrelated lists was counterbalanced across subjects.

The next slide (slide 8, Figure 1) shows the mean number of items correctly recalled by each age group in the first two experiments. As you may see none of the subjects performed very well. In Experiment 1, which is shown in the left panel, the younger children's recall averaged just over two items correct, and the older children's level of recall was 3.4 items correct. In Experiment 2 the level of recall was quite similar. Furthermore, these performance differences were statistically significant.

The next slide (slide 9, Figure 2) shows the recall data for each age group in each experiment plotted as a function of serial position. As you can see a fairly consistent pattern emerged. The percentages of correct recall for the last list items were consistently high for both age groups, but recall levels for all of the other items were consistently low. Furthermore, for both age groups the levels of recall for the last list item were significantly higher than for any of the other items, and there were no significant differences in recall of the other items. Thus, a developmentally invariant single-item recency effect was observed. Furthermore, the last item presented was the first reported over half of the time. The very high level of recall on a limited recency portion of the serial position curve, coupled with the reverse read-out reporting tendency has been characterized as an echo-box effect. Another interesting aspect of the data is the consistently low levels of recall for all of the early list items. In short, there was no evidence of a primacy effect for either age group. Since high levels of recall for early serial positions are generally interpreted as evidence of deliberate rehearsal strategy, the lack of a primacy effect for the young children is not especially surprising. The poor recall for even the first few items merely points to limited or nonexistent rehearsal strategies. More importantly, however, the similar shape of the serial position curves for the two age groups suggests that the improved performance of the older children can probably not be attributed to age-related increases in strategic rehearsal.

The next slide (slide 10, Figure 3) shows each age group's mean recall on related and unrelated lists for each experiment. Both age groups recalled more items from related than unrelated lists, and the list type main effect was statistically significant. Apparently even these very young children encode information according to category dimensions, and related materials are easier to remember than unrelated materials. Furthermore, this semantic effect appeared somewhat stronger for older than younger subjects, and the age x list type interaction was marginally significant in the first experiment, and significant in the second experiment which included more subjects, and thus had greater statistical power.

Inter-item response times were measured from tape recordings of the experimental sessions in Experiment 1. The next slide (slide 11, Figure 4) shows the mean inter-item response times on related lists for related and unrelated adjacently recalled items for each age group. As you can see children in both age groups demonstrated shorter inter-item response times between pairs of adjacently recalled related than unrelated items. Furthermore, this difference appears somewhat greater for older subjects.

In order to assess organization in recall we carried out categorical clustering analyses on recall protocols from related lists. To assess the degree to which adjacently reported items were from the same conceptual category both ARC and RR scores were computed for each subject. In general, conceptual clustering was observed to occur at above chance levels for both age groups, and no significant age-related increases in clustering were detected.

Finally, in order to further assess possible organizational effects, intertrial repetition indices were computed for the three related and three unrelated trials. This measure of subjective organization indicates the degree of consistency of output order over trials, and could reflect semantic organization which does not match experimentally-defined semantic categories. No evidence of such subjective organization was detected for either age group.

In summary, although our previous research has demonstrated that two- to five year olds are able to proficiently code and retain information sufficiently well to recognize it as it is again presented for testing (e.g., Perlmutter & Myers, 1974, 1975, 1976), Experiments 1 and 2 suggest that in a recall task, where the items are not before the child, they are not very proficient at retrieving or producing the information in memory. Furthermore, while an age-related improvement in recall over this age range was observed, no age differences in strategy use were detected. There was no indication of rehearsal or subjective organization by either age group, and no evidence of age-related increases in use of conceptual organization. There was, however, evidence of semantic category knowledge affecting recall of even the youngest children. Both age groups recalled conceptually related lists more completely than conceptually unrelated lists, showed shorter inter-response times for adjacently recalled related than unrelated items, and conceptually clustered their limited recall protocols. Furthermore, the finding that the facilitating effect of conceptually related lists was greater for older than younger subjects suggests that semantic influences may increase between two- and five-years of age.

Experiment 3

The semantic effects on recall of these young children suggests that they encode stimuli along categorical dimensions, but the nature of the semantic operations are not clear. Experiment 3 was carried out to further assess them. For example, it is possible that as items are presented the children don't just tag them with their categories, but organize or chunk them. On the other hand, it is possible that at time of retrieval a category cuing process contributes to the observed semantic effects. One way to assess organization at time of encoding is to use a blocking manipulation. If presenting conceptually related items adjacently, rather than randomly, improves recall, it may be concluded that subjects are not themselves entirely effective in organizing items as they are presented. Likewise, a categorical cuing process at time of retrieval can be assessed by providing category cues during testing. Limitations in a subject generated cuing process may be inferred from increased recall with experimenter provided cues.

In Experiment 3 twenty-four children in each age group were tested on four different 9-item related lists, each composed of three objects from each of three conceptual categories. Half of the lists were presented in a blocked order, with adjacently presented items from the same conceptual category, and half were presented in a random order. On one blocked and one unblocked list free recall was followed by category cuing, and on the other blocked and unblocked list a constraining recall procedure, in which children were immediately asked to recall items from specific categories, was used.

The results may be seen in the next slide (slide 12, Figure 5) which shows the mean number of items younger and older subjects correctly recalled on blocked and unblocked lists under free recall, cued recall, and constrained recall procedures. In all conditions older children recalled more than younger children. More interesting, however, were the effects of the blocking and cuing manipulations. Blocking items at presentation significantly increased recall, although this effect was not strikingly large. Furthermore, the age x blocking interaction was not statistically significant. The cuing manipulation, on the other hand, had a large and comparable effect on both age groups. Providing category cues at time of testing, either by cuing or constraining recall, considerably improved the young children's recall.

It appears that although these young children encode category information, they do not spontaneously or effectively chunk items. While this organization may be somewhat facilitating, the results indicated that providing category cues at retrieval leads to a far greater improvement in recall. Apparently the children experience difficulties in accessing their considerable memory stores, and this is at least in part related to their failure to generate their own category cues. This of course is quite consistent with the contrasting findings obtained in recall and recognition studies with preschool children. Given sufficient stimulus support young children demonstrate rather substantial storage and retention capacities. Placed in a free recall situation, however, where stimulus information is not concretely before them, the preschool child's non-deliberate character impedes proficient memory performance.

Conclusions

In conclusion then, even the youngest children we have examined appear fairly proficient at encoding and retaining stimulus information. Moreover, their semantic knowledge affects their performance, that is they seem to encode stimuli in terms of semantic categories. On the other hand, even the oldest children we have tested fail to demonstrate effective strategy use, either in rehearsal, or in semantic organization or cuing operations. Furthermore, between the ages of about two-years nine-months, and four-years nine-months, improved performance is observed. There is no evidence that this memory growth is related to increased strategy use, as is the case with memory improvement during the grade school years. Growth in semantic knowledge, however, may contribute to the improved performance between two and five.

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Footnotes

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Figure Captions

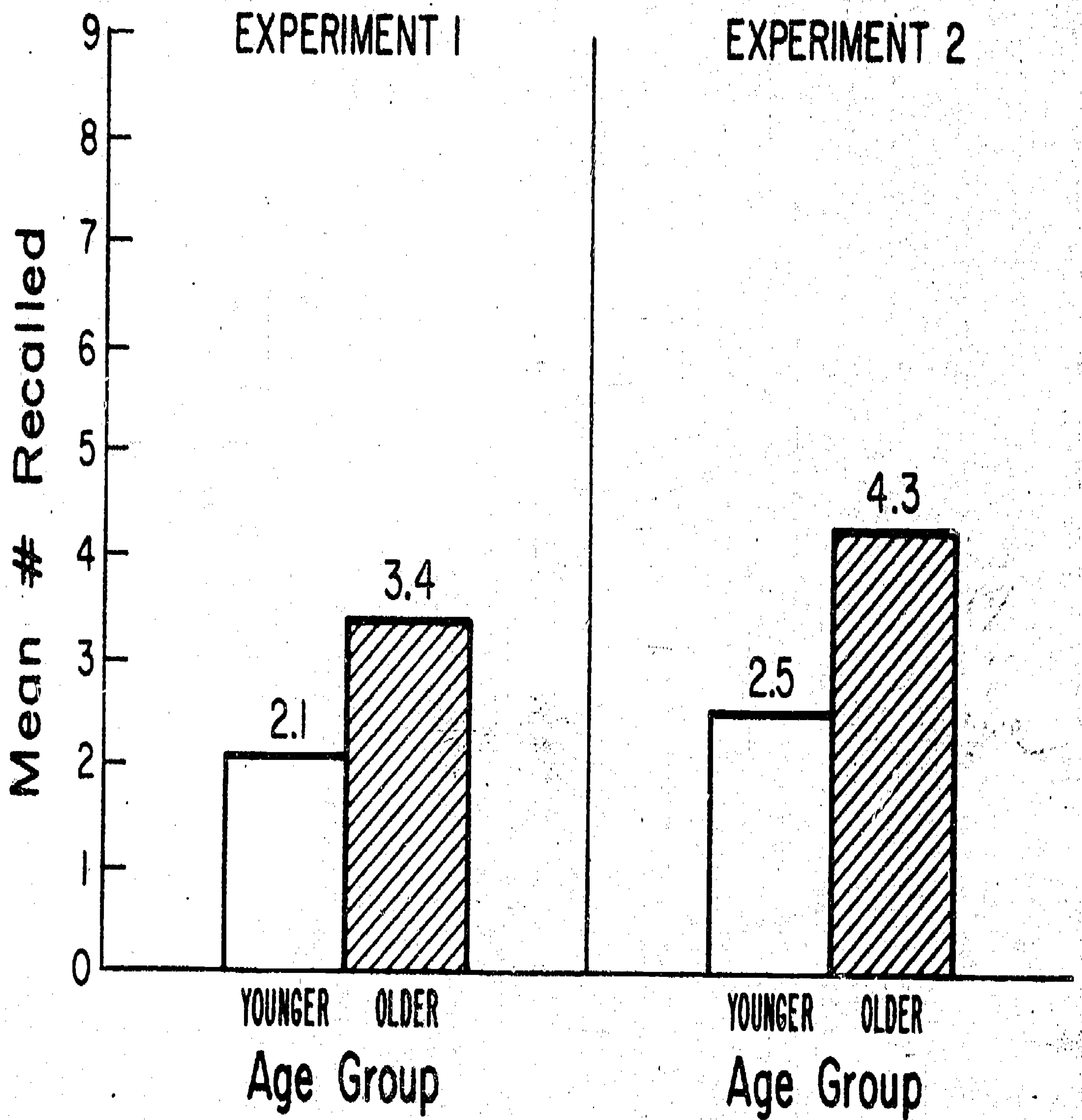
Figure 1. Mean number of items correctly recalled by each age group in Experiments 1 and 2.

Figure 2. Mean percentage correct recall as a function of serial position for each age group in Experiments 1 and 2.

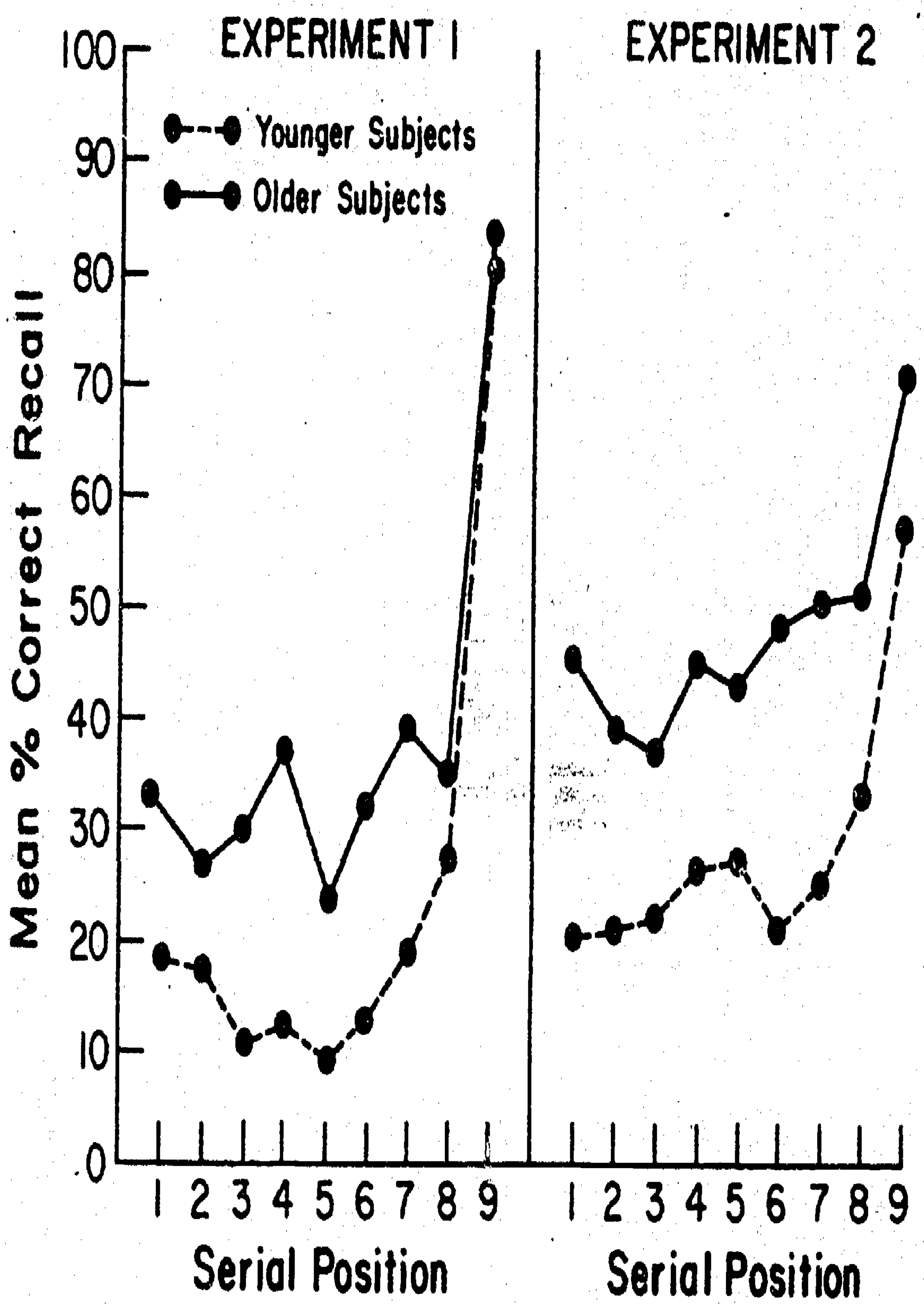
Figure 3. Mean number of items correctly recalled on related and unrelated lists by each age group in Experiments 1 and 2.

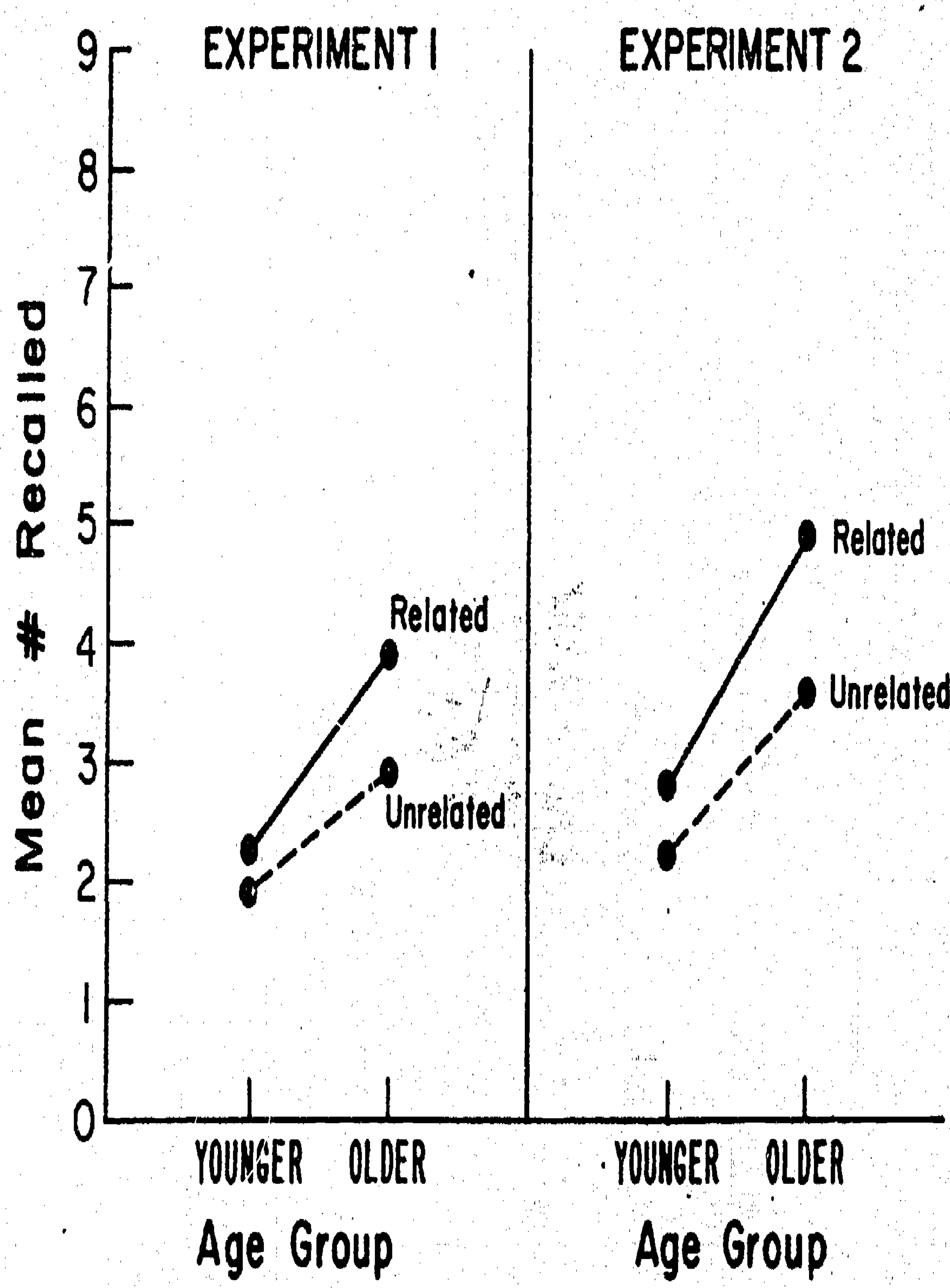
Figure 4. Mean inter-item response times on related lists between unrelated and related adjacently recall items for each age group in Experiment 1.

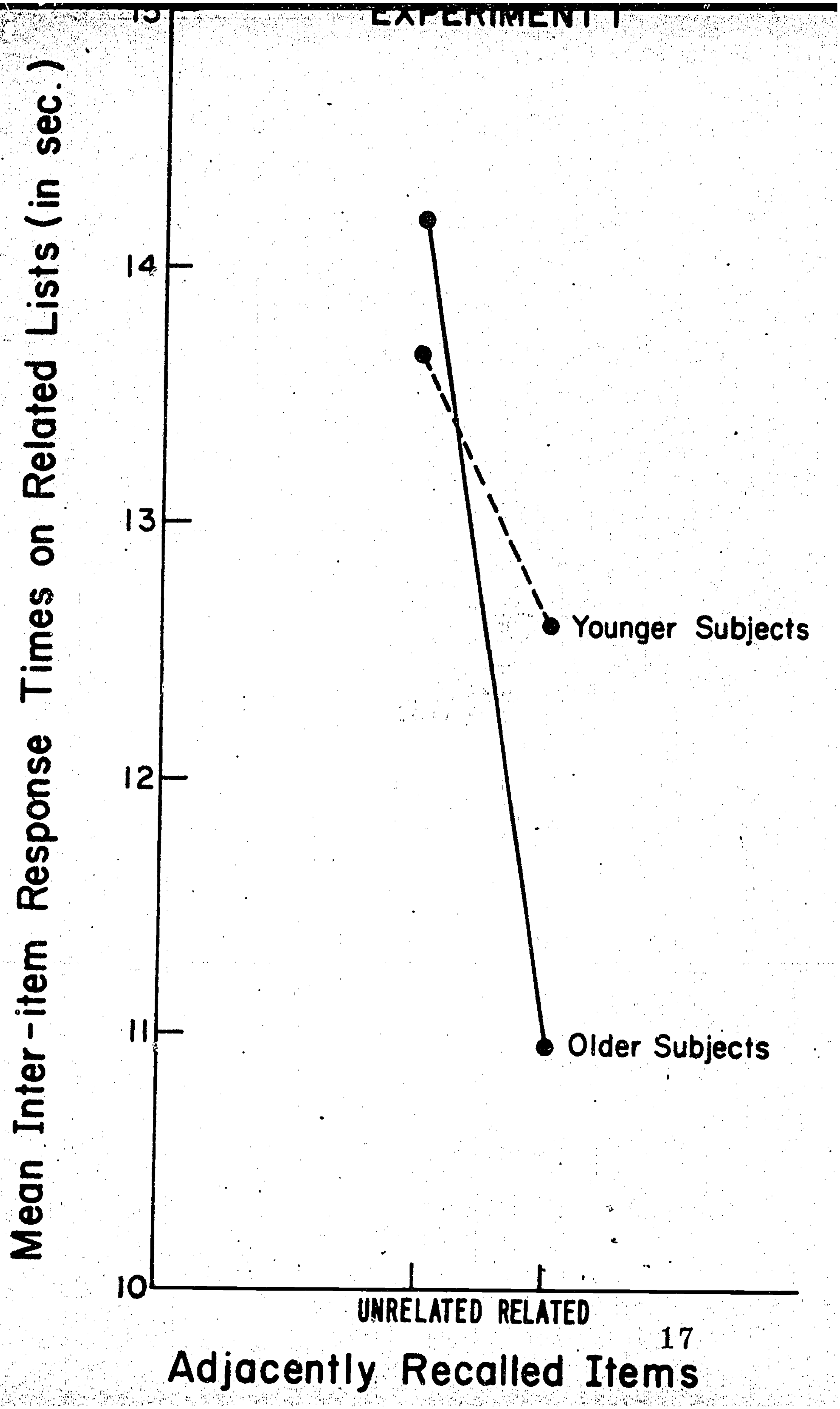
Figure 5. Mean number of items correctly recalled on blocked and unblocked lists with free recall, cued recall, and constrained recall, by each age group in Experiment 3.



EXPERIMENT 1
EXPERIMENT 2
Mean # Recalled
9
8
7
6
5
4
3
2
1
0
2.1
3.4
2.5
4.3
YOUNGER
OLDER
Age Group
YOUNGER
OLDER
Age Group


EXPERIMENT 1
EXPERIMENT 2
Younger Subjects
Older Subjects
Mean % Correct Recall
100
90
80
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9
1 2 3 4 5 6 7 8 9
Serial Position
Serial Position


EXPERIMENT 1
EXPERIMENT 2
Mean # Recalled
9
8
7
6
5
4
3
2
1
0
Related
Unrelated
Related
Unrelated
YOUNGER
OLDER
Age Group
YOUNGER
OLDER
Age Group


Mean Inter-item Response Times on Related Lists (in sec.)
15
14
13
12
11
10
Younger Subjects
Older Subjects
UNRELATED RELATED
Adjacently Recalled Items

EXPERIMENT 3