Young children's memory encoding reflected in verbal discrimination learning and recognition memory performance*

JAMES W. HALL

Northwestern University, Evanston, Ill. 60201

In Experiment 1 4- and 5-year-old Ss were presented four verbal discrimination (VD) lists. For three of the lists, all correct items were either conceptually, acoustically, or affectively similar. The fourth was a control list. Only the conceptual list facilitated VDL, suggesting heavy use of the verbal associative attribute in memory encoding, with no evidence for the involvement of the acoustic or the affective attribute. Experiment 2 indicated that recognition memory (RM) for target items was better when those items had been preceded by associates than when they had not. Both the VD and the RM tasks appear promising for developmental research concerning memory encoding.

The experiments reported here constitute an attempt to develop additional techniques for use in examining memory-encoding processes, and particularly in tracing the development of such processes. A number of previous studies have employed a false recognition technique to attack such questions. In this approach, the frequency of false recognitions of words bearing a particular relationship to a given set of to-be-remembered items is compared with a baseline frequency of false recognitions of items unrelated to previous words. The most common relationship examined has been a verbal associative one. Thus, if an associate (e.g., CHAIR) of a to-be-remembered item presented earlier (e.g., TABLE) is incorrectly judged "old" more frequently than some equally familiar unrelated word (e.g., GRASS), it is inferred that the verbal associative attribute was active in the encoding of the item. In the above example it is inferred that CHAIR had occurred as an implicit associative response (IAR) in the encoding of TABLE. This technique has been useful in demonstrating that both the associative and the acoustic qualities of words are heavily involved in memory encoding both by adults (e.g., Underwood, 1965) and by children (e.g., Bach & Underwood, 1970).

Despite the demonstrated utility of the false recognition technique, it possesses an important limitation where developmental and comparative studies are concerned. Briefly, that

limitation is that differences in the degree to which verbal associative responses occur during encoding may be obscured or distorted by corresponding differences in Ss' abilities to distinguish, during the test phase, between words actually presented and those that had occurred only implicitly during the encoding of the presented item. This problem was illustrated in two experiments (Hall & Ware, 1968, Experiment II; Hall, 1968) in which IAR-produced false recognitions were more frequent by kindergarten than by third-grade children. Rather than ascribing these findings to a decrease in IAR occurrence with age, it seemed more likely that the older children simply were better able to discriminate as described above. Evidence that such discrimination does occur has been reported previously (Hall, Sekuler, & Cushman, 1969) and the developmental implications have been discussed at some length (Hall, 1969).

In the experiments reported here, two standard laboratory tasks were adapted for use in examining the role of various word attributes in memory encoding by young children as alternatives to the false-recognition technique just described. In Experiment 1 a verbal discrimination task is employed to study the role of the verbal associative, the acoustic, and the affective attribute in memory encoding by 4- and 5-year-olds. Experiment 2 employs the recognition-memory technique, but focuses on correct rather than false recognitions.

EXPERIMENT 1

In Experiment 1, four verbal discrimination lists were presented to 4- and 5-year-olds. The lists differed both in the specific words used and in the relationships among correct items from pair to pair within each list. In one list, all correct items rhymed with one another, in a second, each was a

member of the same common category, in the third, each was a word judged to possess positive affective qualities, and in the fourth (the control list), no systematic relations existed among them. It was assumed that to the extent that acoustic, conceptual, and affective qualities of the words were involved in encoding there would be a corresponding facilitation of learning for the respective lists relative to the control list. Following Underwood's (1969) view of the acoustic attribute as a more primitive one, it was anticipated that with the rhyming list considerable facilitation would occur with even the youngest children. The verbal associative attribute, considered more "advanced," was expected to increase in prominence with age in relation to the acoustic attribute. No specific prediction was made in the case of the affectively similar items.

Subjects

The Ss employed were 16 children aged 4:4 to 5:3 years ($M = 4:10$) and 16 children aged 5:4 to 6:3 years ($M = 5:9$) enrolled in a day-care center in Evanston.

Lists and Procedure

Four verbal discrimination lists were employed. The conceptual list consisted of seven pairs in which the correct items were common zoo animals (e.g., LION, MONKEY) frequently encountered in children's stories and highly familiar (at least at a verbal level). In the acoustic list, the correct items consisted of seven common one-syllable words rhyming with SUN. In the affective list, the correct items comprised seven common words each judged to have positive affective value for children and to be relatively unrelated associatively to one another (e.g., LOVE, FRIEND). The incorrect items in the above list and all items on the control list were familiar words that appeared to be unrelated to one another in any systematic way. In all lists, the words within each pair were identical in number of syllables and in form class.

Since each S was exposed to every list, a counterbalancing procedure was used, resulting in four orders of presentation. Approximately equal numbers of Ss at each age level received each presentation order. Each S received each list in a separate experimental session with either 2 or 3 days intervening between sessions. At the initial session, the S was told that he would play some word games, that the games would take several days, and that he would receive a prize if he "tried hard" in the games. He was told that words were to be spoken "two at a time," that one word would be the right one, and that he was to try to

*This research was supported in part by a grant from the U.S. Office of Education. The author is grateful to the staff and children of the Evanston Child Care Center and of Lincolnwood Elementary School in Evanston who cooperated in the experiments, and to Marcia Halperin and Robin Kuttner who assisted in data collection.

remember the right words. The E then pronounced each pair at the rate of approximately 4 sec/pair, with the correct item indicated as follows: "SHOE and QUEEN, SHOE is the right word." After presenting the pairs this way, two test trials were given in which the S was presented with each pair in the following manner: "Which is the right word, QUEEN or SHOE?" Since feedback was given on these trials, they functioned also as learning trials. The order of presentation of pairs and words within pairs varied randomly over the three presentations, but was constant for all Ss.

Results

An Age by List by Trials analysis of variance indicated a reliable main effect of age [$F(1,30) = 6.02, p < .05$] and borderline reliability for the main effects of lists [$F(3,30) = 2.19, p < .10$] and trials [$F(1,30) = 3.56, p < .10$]. No interactions approached significance. Collapsing over lists and trials, the mean number of correct responses was 4.75 ($SD = 1.23$) for the younger group and 5.74 ($SD = 1.05$) for the older group. Thus, the older Ss exceeded the younger ones by an average of one word per S. Collapsing over lists and ages, the mean number of correct responses was 5.15 ($SD = 1.17$) for Trial 1 and 5.34 ($SD = 1.36$) for Trial 2, a difference that, while of borderline significance, shows relatively little learning. In fact, although the relevant interaction was nonsignificant, it is interesting that there was substantial improvement from Trial 1 to Trial 2 for the conceptual and control lists, and none at all for the acoustic and affective lists.

Of major interest in the experiment was the list's effect. The relevant means, collapsing over ages and trials, were 5.62 ($SD = 1.54$) for the conceptual, 5.17 ($SD = 1.55$) for the acoustic, 5.14 ($SD = 1.60$) for the affective, and 5.05 ($SD = 1.27$) for the control. Only the conceptual list was learned reliably better than the control list [$t(31) = 2.76, p < .05$, following Dunnett's procedure as described by Winer, 1962]. There was not even the suggestion of facilitation resulting from either the acoustic similarity or the positive affective quality.

EXPERIMENT 2

The disadvantage of the false-recognition procedure, wherein the S is working (often successfully) to avoid errors has been discussed above. Experiment 2, therefore, was designed to explore the effectiveness of an alternative recognition-memory procedure wherein the occurrence of IARs would be inferred from an increase in correct recognitions rather than in false recognitions. In this procedure, target items were preceded

in a list of to-be-remembered items by words with which the target items were associated. It was assumed, then, that if the target item occurred as an IAR in addition to its explicit occurrence in the list, the probability of correct recognition of the target item when it was presented subsequently would be increased relative to that probability for a word that had occurred only explicitly.

Subjects

The Ss were 18 kindergarten children (12 boys and 6 girls) aged 5:4 to 6:4 years ($M = 5:10$) enrolled in a public elementary school in Evanston.

Lists and Procedure

A list of 24 to-be-remembered items (List 1) was presented aurally to each S, followed, after a 10-sec interval, by the presentation of the 15-item test list (List 2). Two forms of List 1 were prepared, with half the Ss randomly assigned to each form. Each form consisted of four target items, immediately preceded by three target associates and immediately followed by a control item (an item unassociated with other items on the list). The target items on one form, along with their target associations were HORSE (SADDLE, GALLOP, PONY), WATER (DRINK, THIRSTY, RAIN), SLEEP (BED, DREAM, NAP), and FRUIT (BANANA, ORANGE, APPLE). On the other form, the target items and target associates were DOG (PUPPY, BARK, PET), CUT (KNIFE, SLICE, SCISSORS), FAST (QUICK, SLOW, RUN), and BIRD (ROBIN, FEATHERS, EAGLE). The control items were DOG, CUT, FAST, AND BIRD for the first form and HORSE, WATER, SLEEP, and FRUIT for the other. Thus, each target item of one form served as a control item on the other form, a counterbalancing procedure that eliminates the possibility of biased results due to particular properties of items chosen as target or as control items. The remaining four items in List 1 were fillers, two occurring at the beginning and two at the end of the list. Each word in List 1 was pronounced twice by the E with a 3-sec interval between words. The Ss were asked to listen carefully and to try to remember the words.

List 2 was the same for all Ss and consisted of the 8 target-control items named above, and 4 "new" items unrelated to any previous ones. The order of these 12 items was determined randomly and they were preceded by 3 filler items which were used to ensure that the Ss understood the task. The Ss were told, "Now I'm going to see whether you can remember the words that I said to you earlier. You listen carefully and don't let me trick you. Ready?" The first

test-list item (a filler item) was then spoken as follows: "Did I say TELEPHONE?" If the S correctly said, "No," he was praised, and if he said, "Yes," he was corrected. The remaining items were presented in the same fashion, but feedback was given only for the filler items. If a S did not respond immediately, or if he showed uncertainty, the question was repeated and he was told to guess whether or not the item had been presented previously. All responses were recorded by the E, who then went immediately to the next item.

Results

The mean number of correct recognitions was 3.06 ($SD = 1.00$) for target items and 2.28 ($SD = 1.18$) for controls. Expressed in percentages, 76% of the target words and 57% of the control words were correctly identified, whereas only 4% of the new words were incorrectly judged old. The mean target-control difference of .78 was highly reliable [$t(17) = 3.30, p < .01$], indicating facilitation of learning of the target items produced by the presence of the target associates.

DISCUSSION

Both the tasks employed in the experiments just reported appear to be promising insofar as techniques for the study of developments in memory-encoding processes in young children is concerned. No Ss were lost in either experiment, and both yielded data of interest concerning the memory-encoding characteristics of the children.

The results of Experiment 1 were of particular interest in that whereas the verbal associative characteristics of items were clearly operative during learning, no evidence that the acoustic attribute was involved was found. This appears surprising in light of the notion of acoustic encoding as a primitive process which becomes decreasingly prominent relative to the verbal associative attribute as the child develops (Underwood, 1969). It is interesting that when several experienced nursery school teachers were asked to predict the outcome of Experiment 1, all of them anticipated marked facilitation by the rhyming relationship, most predicting as great or greater a facilitative effect as for the conceptual list. Surely this finding deserves further investigation, since on the surface it suggests that some revision of thinking about the early role of the acoustic attribute in memory-encoding may be necessary. A hypothesis that seems worth investigating is that the retention of acoustic information about a word requires, or is facilitated by, the pronunciation (overtly or covertly) of the word. If this is true, the lack of

such retention in very young children is more understandable, since there is ample evidence that they are less likely than are older children to rehearse spontaneously items presented for learning (e.g., Flavell, Beach, & Chinsky, 1965). In any case, the data suggest that the verbal discrimination task may be a useful one in attacking developmental questions concerning memory-encoding processes.

The recognition-memory task, as it was used in Experiment 2, also appears promising. The data suggest that verbal associations are heavily involved in the memory encoding of children as young as 5 years, and thus are consistent with

the results of previous studies employing the false recognition technique (Hall & Ware, 1968; Hall, 1968), and with the findings of Experiment 1 with respect to the facilitation observed for the conceptual list.

REFERENCES

- BACH, M. J., & UNDERWOOD, B. J. Developmental changes in memory attributes. *Journal of Educational Psychology*, 1970, 61, 292-296.
- FLAVELL, J. H., BEACH, D. H., & CHINSKY, J. M. Spontaneous verbal rehearsal in a memory task as a function of age. *Child Development*, 1966, 37, 283-299.
- HALL, J. W. Word recognition errors by children of two age levels. *Journal of Educational Psychology*, 1968, 59, 420-424.
- HALL, J. W. Errors in word recognition and discrimination by children of two age levels. *Journal of Educational Psychology*, 1969, 60, 144-147.
- HALL, J. W., SEKULER, R., & CUSHMAN, W. Effects of IAR occurrence on response time during subsequent recognition. *Journal of Experimental Psychology*, 1969, 79, 39-42.
- HALL, J. W., & WARE, W. B. Implicit associative responses and false recognition by young children. *Journal of Experimental Child Psychology*, 1968, 6, 52-60.
- UNDERWOOD, B. J. Attributes of memory. *Psychological Review*, 1969, 76, 559-573.
- WINER, B. J. *Statistical principles in experimental design*. New York: McGraw-Hill, 1962.

CURRENT LITERATURE ON HUMAN MEMORY

- BADDELEY, A. D. (Experimental Psychology Laboratory, University of Sussex, Brighton BN1 9QY, Sussex, England). Language habits, acoustic confusability, and immediate memory for redundant letter sequences. *Psychonomic Science*, 1971, 22, 120-121.
- CARROLL, D. (Australian National University, Canberra, A.C.T., Australia), & HORNE, P. V. Semantic and acoustic labeling. *Psychonomic Science*, 1971, 22, 241-242.
- DELPRATO, D. J. (Eastern Michigan University, Ypsilanti, Mich. 48197), & HUDSON, R. L. Association by contiguity: Clustering in free recall. *Psychonomic Science*, 1971, 22, 98-99.
- DETERMAN, D. K. (University of Dayton, Dayton, Ohio 45409), & ELLIS, N. R. Distinctiveness in short-term memory. *Psychonomic Science*, 1971, 22, 239-241.
- FISCHLER, I., & PUFF, C. R. Organization in free recall with verbal and pictorial modes of input and output. *Psychonomic Science*, 1971, 22, 85-87.
- FUCHS, A. H. (Bowdoin College, Brunswick, Maine 04011). Response latency and serial position in short-term memory. *Psychonomic Science*, 1971, 22, 75-76.
- LOWE, D. G., & MERIKLE, P. M. (University of Waterloo, Waterloo, Ontario, Canada). Interpolation effects in short-term memory. *Psychonomic Science*, 1971, 22, 89-91.
- MOODY, W. B. (University of Delaware, Newark, Del. 19711), BAUSELL, R. B., & CROUSE, J. H. The probability of probability concept transfer. *Psychonomic Science*, 1971, 22, 107-108.
- MUELLER, J. H. (University of Missouri, Columbia, Mo. 65201), JABLONSKI, E. M., & WEINBACH, J. Correction procedures in A-B transfer: Error elimination? *Psychonomic Science*, 1971, 22, 105-107.
- PHILLIPS, W. A. (Experimental Psychology Laboratory, University of Sussex, Brighton BN1 9QY, Sussex, England), & BADDELEY, A. D. Reaction time and short-term visual memory. *Psychonomic Science*, 1971, 22, 73-74.
- RABINOWITZ, F. M. (Tulane University, New Orleans, La. 70118), KRONFIELD, D. B., & CAMPIONE, J. C. Stimulus alternation and continuous short-term memory in young children. *Psychonomic Science*, 1971, 22, 99-100.
- SHAPIRO, S. I. (University of Hawaii, Honolulu, Hawaii), & BELL, J. A. The formation of organizational units in free recall learning. *Psychonomic Science*, 1971, 22, 217-218.
- SLAYTON, A. J. (University of South Carolina, Columbia, S.C. 29208), & BLACK, R. W. Effects of knowledge of results and amount of stimulus change on "resistance to extinction" on a perceptual motor task. *Psychonomic Science*, 1971, 22, 111-112.
- SOUTHALL, S. D. (University of Virginia, Charlottesville, Va. 22904), & BLICK, K. A. The role of interference and trace decay in the retention of a simple psychomotor task. *Psychonomic Science*, 1971, 22, 223-224.
- WEARING, A. J. (Yale University, New Haven, Conn. 06510). Vividness in the recall of English nominalizations. *Psychonomic Science*, 1971, 22, 121-122.