Recognition and recall of related and unrelated words*

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College students were trained to discriminate between sets of either related (R) or unrelated (U) words and were then given a recall test, followed by a recognition test. Results indicated that when equated for the amount of practice, R words were recalled more easily than they were recognized, but recognition was superior to recall for U words. The results are interpreted within a framework that distinguishes between different attributes of words and between storage and retrieval of memory traces.

College students who learned to discriminate between words from two conceptual categories (e.g., apple, pear vs shirt, dress) suffered a recognition loss for the individual instances as compared to a control group that discriminated between unrelated words (e.g., apple, arm vs shirt, doctor) (Kendler, Kendler, & Marken, 1970). Two hypotheses were tested to explain the memory loss of conceptually related items (Kendler & Ward, 1971). The first, a sequential-stage hypothesis, assumed that in a conceptual discrimination task, S first responds to a word's individual meaning (apple—apple) and then he transforms the word into its conceptual label (apple—fruit). If these two stages could be controlled experimentally by varying stimulus-exposure and response-delay periods, the expectation was that the memory loss of an individual word (e.g., apple) would be augmented by decreasing S's opportunity to respond to a word's individual meaning and by increasing his opportunity to transform the word into its conceptual label. The second hypothesis, the competing-attribute hypothesis, postulated that in a conceptual discrimination task, S responds simultaneously to two competing attributes (Anisfeld & Knapp, 1968; Underwood, 1969) of each word, its individual meaning and its conceptual category. The prediction would be that the greater the tendency of the conceptual instance to evoke the conceptual category, the smaller would be the tendency to remember the specific word.

Experimental evidence supported the competing attribute hypothesis (Kendler & Ward, 1971). Whereas varying conditions of stimulus-exposure and response-delay periods failed to influence the recognition of the conceptual instances, significant negative correlations were obtained between the frequency of occurrence of each word from the list of norms of conceptual instances (Battig & Montague, 1969) and the number of correct recognitions. That is, the greater the frequency a particular instance is given in response to the category label, the less likely is the instance to be recognized following conceptual discrimination training.

The question that the present study is designed to answer is whether the observed memory loss of conceptual instances in a conceptual discrimination task is limited to recognition or does it extend to a different measure of memory, such as recall.

SUBJECTS

Forty students from an introductory psychology course at the University of California, Santa Barbara, served as Ss to meet course requirements; they were assigned randomly to one of four experimental groups.

APPARATUS

A Polymetric Model V-0526 tachisto-projector, located outside a soundproof room, projected stimulus words onto a 9 x 12 in. milk glass screen in the experimental room. Directly below the screen, there was a light on a table that signaled S to respond. The response unit consisted of two buttons on the table, 1 ft apart, with reinforcement lights directly beside each one. The S sat at the table, facing the screen, and operated the response buttons with his left and right hand, respectively.

STIMULUS MATERIAL

The stimuli were of two types: related (R) or unrelated (U) words. The R words consisted of 16 instances, 8 from the conceptual category *parts of the human body* and 8 from the category *four-footed animals*. The U words were 16 instances, each instance being the most frequently given response for one of the different conceptual categories (Battig & Montague, 1969). These U instances were arbitrarily divided into two sets of 8. The R and U words did not differ in terms of frequency according to the Thorndike-Lorge count (1944) [$t(30) = .37$, $p > .05$].

PROCEDURE

After entering the soundproof experimental room, the S received written instructions describing the apparatus and his task. He read that a series of words would be projected on the screen and that his task was to discover which of the two buttons should be pressed for each word; a correct choice would be indicated by the appropriate reinforcement bulb being lit. The correct button for each of the two conceptual categories was assigned randomly.

The sequence of events on each trial was as follows: stimulus exposure, delay period, response period, and intertrial interval. Half of the R and U groups received one of two possible timing sequences in order to check on previous results indicating that recognition scores were uninfluenced by variations in stimulus exposure and delay periods (Kendler & Ward, 1971). A fast (F) group saw the word exposed for .5 sec and received a 0-sec delay period prior to the response period. A slow (S) group saw the word exposed for 2 sec and received a 2-sec delay period. Both groups received a response period of 1 sec and an intertrial interval of 1 sec. These timing operations were included to check upon previous evidence (Kendler & Ward, 1971) that recognition scores were not influenced by various exposure and delay periods.

Training commenced with either R or U stimuli. The criterion of learning for the R Ss was one complete block of trials in which the responses to all 16 instances were correct. Since it was expected that the R group would learn the discrimination faster than the U group (Kendler, Kendler, & Marken, 1970; Kendler & Watson, 1969), each U S was yoked to an R S, thus making equal the amount of practice for each group. It should be noted that most U Ss did not reach the criterion of a correct block of trials.

After discrimination training was completed, Ss from both groups were instructed to record all the words from the training task that they could remember. When S indicated that he could not recall any additional words, he was given a list of 48 words which comprised the test of recognition. For the R Ss, the list consisted of 8 instances each from the categories of *parts of the human body* and *four-footed animals*, which were presented during training, and an

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Table 1
Result of Discrimination Training and the Two Tests of Retention

Group	Timing	Discrimination Training (Number of Blocks) Mean	SD	Recall (Number of Items Correct) Mean	SD	Recognition (Number of Items Correct) Mean	SD
Related	F	3.6	2.65	9.8	1.99	13.0	1.26
	S	3.5	2.54	10.2	1.17	13.9	1.81
Unrelated	F	3.6	2.65	8.9	2.07	15.2	1.89
	S	3.5	2.54	8.6	2.20	14.4	1.39

additional 16 instances from each of these two categories that had not appeared during training. For the U Ss, the list contained the 16 words from the training period plus 2 extra instances from each of the 16 conceptual categories represented.

RESULTS

The results for discrimination training, recall, and recognition are reported in Table 1.

A 2 by 2 by 2 analysis of variance with repeated measures was conducted involving two stimulus conditions (R and U), two timing sequences (F and S), and two response measures (recognition and recall). Of the three main effects, only the difference in response scores, recognition, and recall produced a significant main effect [$F(1,36) = 223.27$, $p < .01$]. Neither the differences in timing (F or S) nor stimulus conditions (R or U) produced significant main effects; in both cases, $F(1,36) < 1$. The interaction between stimulus groups and the measure of memory (recognition and recall) proved significant [$F(1,36) = 223.27$, $p < .01$]. To determine the basis of this interaction, a comparison between the effects of R and U words on each test of memory was conducted. Consistent with previous evidence (Kendler, Kendler, & Marken, 1970), the recognition of U words (mean = 14.8) was superior to that of R words (mean = 13.5) [$F(1,18) = 5.97$, $p < .05$]. Recall, however, produced opposite results, the means being 8.8 for U words and 10.0 for R words [$F(1,18) = 5.12$, $p < .05$].

Consistent also with previous findings (Kendler, Kendler, & Marken, 1970) was evidence that suggested that the greater the frequency a particular word is given in response to a category label (e.g., *animals*), as revealed by the norms of Battig & Montague (1969), the less likely is that instance to be recognized. The rank order correlation between the frequency of occurrence and the number of correct recognitions of *animals* was −.71 ($p < .05$). For *parts of the body*, the rho value was a nonsignificant −.03. A similar relationship prevailed for recall; the correlated frequency of occurrence and correct recall for *parts of the body* was −.83 ($p < .01$) and a nonsignificant −.08 for animals.

During recall, three R Ss emitted one intrusion, i.e., "recalled" a category word which did not appear during discrimination training. None of the U Ss produced any intrusions. During recognition, six R Ss had one or more false alarms (identifying a word not present during discrimination training), with the total number being nine, while four U Ss produced five false alarms.

DISCUSSION

The results are inconsistent with a model that assumes simply that the strength of a memory trace will determine what will be remembered (Kintsch, 1970). According to such a simple strength model, recall and recognition scores should have yielded relatively similar results for the retention of R and U words. Because of the discrepancy between recognition and recall scores, the conclusion must be drawn that in the present experiment, they were affected by different memory processes.

One possible explanation of the present results rests upon the distinction between the storage and retrieval of memory traces (Melton, 1963; Tulving, 1968). Within the framework of this distinction, one would postulate that the storage of the memory traces of the R and U words differed in that the former were stored more in terms of two major attributes, individual meaning, and conceptual label, while the latter were stored primarily in terms of their individual meaning. Superior recall of R over U words resulted from the advantage the former had due to the availability of the retrieval cues from the two conceptual categories (Cohen, 1963). In the test of recognition, however, the retrieval cues of the conceptual categories functioned more as a liability. These conceptual cues failed to discriminate between the instances that were previously present during discrimination training and those that were not. In contrast, the U words were not stored primarily in terms of conceptual attributes and did not suffer equivalent interference effects from instances from the same categories as did R words. As Table 1 indicates, after only three exposures of the 16 words, the recognition for U words was practically perfect.

The finding that the words that were most highly associated with the category labels were the most difficult to remember suggests that essentially similar retrieval processes operate for R words in both recall and recognition. Such a conclusion would be inappropriate for U words which exhibit a greater difference between recall and recognition scores. Because Ss do not have available any simple retrieval cue for U words, recall is relatively poor when compared to recognition. In contrast, U words are easier to recognize than R words because of the absence of marked interference effects produced by a common conceptual label.

The present experiment could be criticized because the recall test preceded the recognition test for all Ss. However, if the words recalled facilitated recognition, then the expectation would be that the words that produced superior recall would also yield better recognition. This was not the case.

The question that this experiment was designed to answer, whether the recognition loss of conceptual instances would be reflected in recall scores, yields a negative response. Memory is obviously a multiprocess phenomenon, and the difference in the functioning of two processes, storage and retrieval of memory traces, can account for the obtained difference in the recognition and recall of related and unrelated words.

REFERENCES

ANISFELD, M., & KNAPP, M. Association, synonymity, and directionality in false recognition. Journal of Experimental Psychology, 1968, 77, 171-179.

BATTIG, W. F., & MONTAGUE, W. E. Category norms for verbal items in 56 categories: A replication and extension of the Connecticut Category Norms. Journal of Experimental Psychology Monograph, 1969, 80, 1-46.

COHEN, B. H. Recall of categorized word lists. Journal of Experimetnal Psychology, 1963, 66, 227-234.

KENDLER, H. H., KENDLER, T. S., & MARKEN, R. S. Stimulus control and memory loss in reversal shift behavior of college students. Journal of Experimental Psychology, 1970, 83, 84-88.

KENDLER, H. H., & WARD, J. W. Memory loss following discrimination of conceptually related material. Journal of Experimental Psychology, 1971, 88, 435-436.

KENDLER, H. H., & WATSON, G. W. Economy of representation and reversal shift behavior. Journal of Verbal Learning & Verbal Behavior, 1969, 8, 129-135.

KINTSCH, W. Models for free recall and recognition. In D. A. Norman (Ed.), *Models of human memory*. New York: Academic Press, 1970.

MELTON, A. W. Implications of short-term memory for a general theory of memory. Journal of Verbal Learning & Verbal Behavior, 1963, 2, 1-21.

THORNDIKE, E. L., & LORGE, I. *The teacher's word book of 30,000 words*. New York: Bureau of Publications,

Teachers College, Columbia University, 1944.
TULVING, E. Theoretical issues in free recall. In T. R. Dixon and D. L. Horton (Eds.), *Verbal behavior and general behavior theory*. Englewood Cliffs, N.J: Prentice-Hall, 1968.
UNDERWOOD, B. J. Attributes of memory. Psychological Review, 1969, 76, 559-573.