

Position Effects in Free Recall

Lynn Hasher

Carleton University, Canada

Position effects in multiple-trial free recall were examined for subjects who learned three successive lists under one of two instructional conditions. With standard free-recall instructions, there were pronounced position effects for both level and order of recall. With subjective-organization instructions, subjects disregarded position cues. Apparently, recency is a disposition or strategy subjects may choose to rely upon to order their recall.

When subjects are instructed for free recall, the serial-position curve obtained is characterized by a stable asymptote over the middle positions and by an initial primacy effect that is less pronounced than is the terminal recency effect (Murdock, 1962). Evidence from experiments on single-trial free recall (Keppel and Mallory, 1969; Raymond, 1969) suggests that this strong recency effect actually develops across successive lists. That recency also develops across successive trials on a single list has been shown in an experiment using children as subjects (Cole, Frankel, and Sharp, 1971). Accompanying the change in probability of recall—at least under conditions of single-trial free recall—is thought to be a change in the order of recall such that items late in the presentation order are recalled early.¹ Thus, the recency effect said to characterize free recall may be the product of a response disposition or an output-order strategy adopted by a subject exposed to several lists or trials on a single list.

Systematic significance has been attached to the 'typical' serial-position curve for free recall. It has been argued that the bowed curve is actually the joint product of retrieval from two memory stores (Atkinson and Shiffrin, 1968; Glanzer and Cunitz, 1966)—that the initial peak and asymptotic portions of the curve represent recall from a long-term store, while the terminal portion represents recall from both the short- and long-term stores. Differential rehearsal (Rundus and Atkinson, 1970) and retention (Craik, 1970; Hasher, 1971; Postman and Phillips, 1965) functions are known to characterize the distinct components of the curve. Because of the theoretical significance of the recency effect in free recall and because of the minimal amount of evidence for its occurrence in

multiple-trial free recall, it seemed important to reconsider the conditions under which the position effects develop.

To this end, data from a previously published study using multiple-trial free recall (Postman, Burns, and Hasher, 1970) were reanalyzed. This particular experiment was selected chiefly because subjects recalled under two different instructional conditions: one group was given standard free-recall instructions; the other, instructions encouraging subjective organization in recall. In addition, this study offered the possibility of stable position effects: many lists had been used, and a large number of subjects. Two position functions are presented: level of recall and order of recall.

METHOD

Three successive lists were learned under one basic method of practice: random order of presentation on the study trials, with free recall on the test trials. There were two types of instructions to the subject about order of recall. Under one condition, subjects were simply told to recall, in any order, the words they had seen. Under the second condition, subjects were given instructions that encouraged subjective organization. Thirty-six subjects learned two successive lists under one of the two instructional conditions. Eighteen subjects in each condition then learned a third list under the same instructions. In all, nine lists were used in this study. Each list of 20 common nouns was practiced for six study/test trials. The words were presented on a memory drum at a 1.5-sec rate. Recall was oral and lasted for 1 min.² The analyses follow.

RESULTS AND DISCUSSION

Serial-position curves

For both conditions, the serial-position curves for the first two trials of lists 1, 2 and 3 are presented in Figures 1, 2 and 3 respectively.³ For all

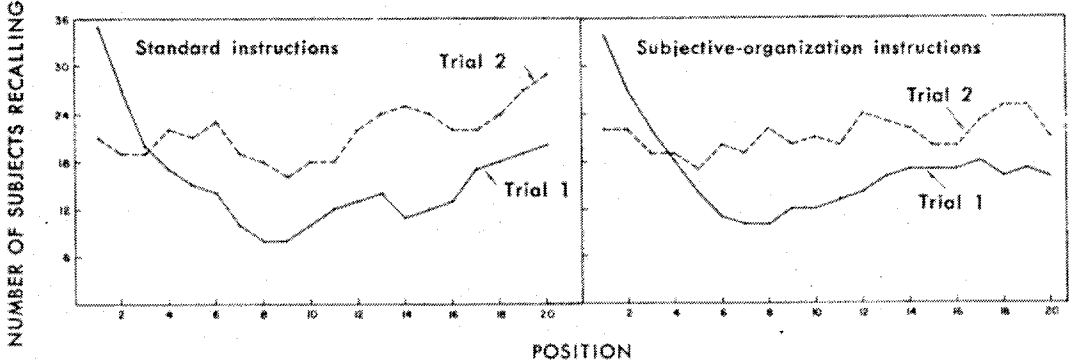


Fig. 1. Level of recall on list 1 as a function of serial position; shown for trials 1 and 2 for conditions with standard or subjective-organization instructions

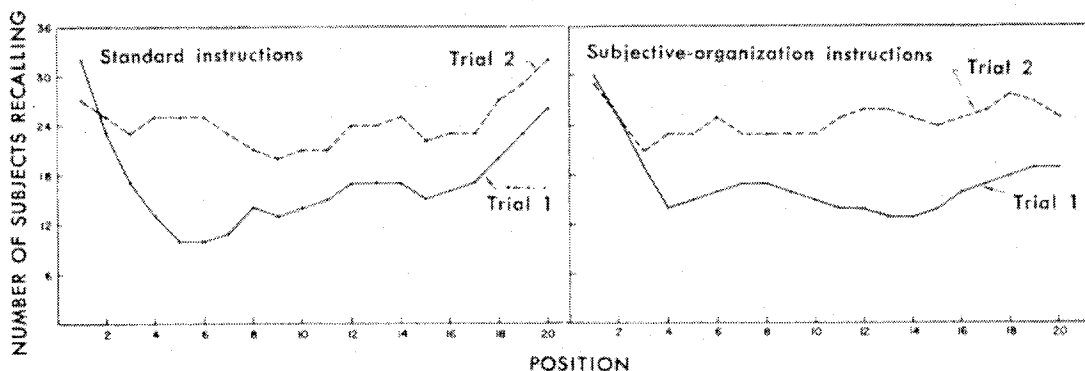


Fig. 2. Level of recall on list 2 as a function of serial position; shown for trials 1 and 2 for conditions with standard or subjective-organization instructions

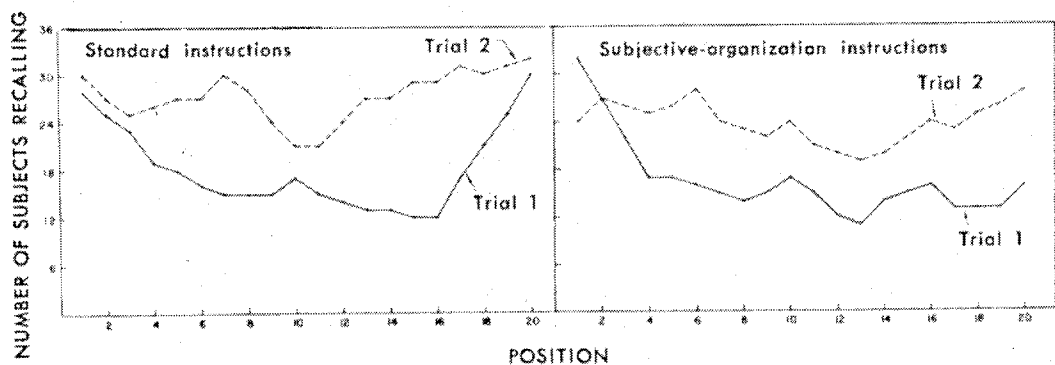


Fig. 3. Level of recall on list 3 as a function of serial position; shown for trials 1 and 2 for conditions with standard or subjective-organization instructions

but the first and last items, the curves were smoothed by averaging the number of subjects recalling at a given position with the numbers of those recalling at the immediately preceding and succeeding positions. For each condition, the important observations to make are, first, position effects on trial 1 and, then, any changes across subsequent trials and lists.

On trial 1 of list 1 the standard condition showed a marked primacy effect over positions 1-6, unstable performance over the middle of the list, and a recency effect over positions 17-20. A dramatic change in performance can be seen on trial 2: the primacy effect diminished while the recency effect increased. This pattern of change between the first two trials occurred again on list 2. By list 3, the recency effect was quite marked even on trial 1. Thus, only by list 3 did the serial-position curve for multiple-trial free recall resemble the Murdock (1962) curve. Recency, conceived of as a response disposition, requires some practice before it can be successfully implemented.

Such an interpretation of the recency effect receives support from the performance of the subjects in the subjective-organization condition, whose position curves stand in marked contrast to those of the subjects

given standard free-recall instructions. In general, the position curves for the subjective-organization condition showed a primacy effect but then were flat across all other positions. What recency did exist showed little increase across both successive lists and trials within lists, in contrast to the large gains seen under standard instructions. Thus, compared to subjects given standard free-recall instructions, the subjects encouraged to subjectively organize items in the list were less influenced by position cues. Several important differences in performance between these two groups of subjects should be noted here: (a) the subjects given subjective-organization instructions showed higher levels of output-order consistency than did the subjects given standard instructions; (b) by list 2, when recency was beginning to be a systematic strategy for subjects given standard instructions, their recall performance was inferior to that of subjects given subjective-organization instructions.

When the order of presentation varies from trial to trial, as it does in a typical procedure using multiple-trial free recall, consistency in recall order can be best achieved if position cues are in fact ignored. Apparently, subjects instructed for subjective organization are successful in disregarding presentation position, while subjects given standard instructions utilize position as a device to systematize retrieval. Whatever the impact of the recency effect, it clearly is not an 'optimal' strategy (Tulving and Arbuckle, 1963) for performing under conditions of multiple-trial free recall; recall is not superior for the condition that shows a pronounced recency effect.

A comparison of the recall performance of individual subjects was also made. For this, subjects in both conditions were subdivided into three categories on the basis of the order in which they recalled items on a given trial. A subject was placed in the 'early' or 'late' category if two out of the first three words he or she recalled came from either the first six or last six positions, respectively, on the trial of interest. Those subjects who did not meet these criteria were placed in the 'neither' category. The frequency of subjects in these classifications and their recall may be seen in Table 1. There is a suggestion of superior recall for 'late' subjects, but only on trial 1 of a list. A main effect of recall order using a least-squares solution was significant on trial 1 of list 1 [$F(2, 66) = 3.28, p < .05$]. In addition to the overall performance scores for the standard and subjective-organization conditions already discussed, this analysis strengthens the conclusion that a recency strategy is not an optimal technique for recall.

With regard to serial-position curves, one final comment is in order. On trial 1 of list 1 neither the standard nor the subjective-organization

Table 1. Recall of subjects grouped by output-order strategies

	Early		Neither		Late	
	<i>f</i>	\bar{X}	<i>f</i>	\bar{X}	<i>f</i>	\bar{X}
Standard instructions						
List 1						
Trial 1	22	8.3	7	8.3	7	10.1
Trial 2	4	12.5	12	11.8	20	12.0
List 2						
Trial 1	4	8.5	6	8.3	26	9.6
Trial 2	3	14.3	6	11.8	27	13.6
Subjective-organization instructions						
List 1						
Trial 1	26	8.8	7	9.7	3	10.7
Trial 2	8	13.2	15	11.3	13	11.6
List 2						
Trial 1	14	9.6	14	8.8	8	10.4
Trial 2	8	13.9	13	13.8	15	13.1

condition showed the expected stable asymptote over the mid-list positions. Rather, there was a gradual improvement in performance beginning at the halfway mark. A similar effect has also been found on trial 1 recall of a 30-item list (Hasher, 1970). If the probability of recall is not flat over middle positions, a bias will exist in favor of later positions in any single-trial experiment that confounds an independent variable with input order. Such a bias may pose problems in experiments that attempt to assess the effect of repetitions of items under various schedules of occurrence (e.g., Underwood, 1969).

Output-order effects

In an attempt to account for the development of the recency effect under the standard condition, output-order effects were examined. Recall order has long been implicated in serial-position effects (Deese and Kaufman, 1957; Raffel, 1936; Welch and Burnett, 1924) and is known to play a significant role in determining retention after the free-recall learning of a two-list task (Postman and Hasher, 1972). The questions in the present analysis were, Does the order of recall change across successive trials on a list? Or across successive lists? Further, do these order effects account for the decline in recall of initial items and the improvement in recall of terminal items that are shown by subjects performing under standard recall instructions?

Figures 4 and 5 show the serial-position curves generated for the three recall classifications of subjects on trials 1 and 2, respectively, of list 1.⁴ On trial 1, all subjects contributed to the primacy effect, while only 'late' subjects showed substantial recall of terminal items. On trial 2, however, primacy was contributed to by 'early' recallers; and recency, by 'late' recallers.

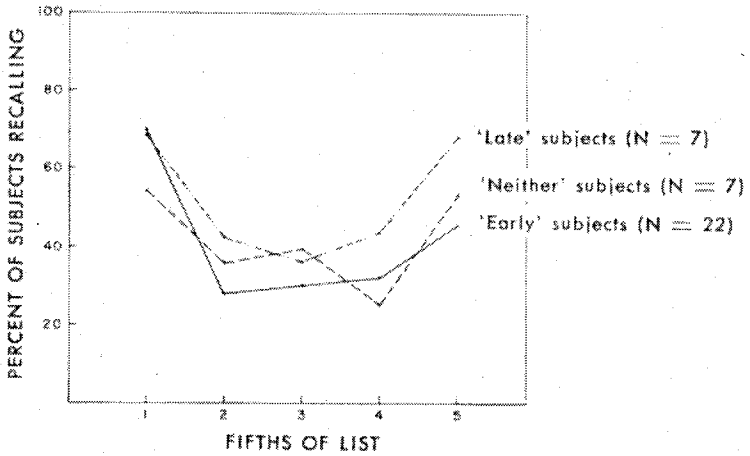


Fig. 4. Percent of 'early,' 'neither,' and 'late' subjects recalling on list 1, trial 1, as a function of serial position; shown for condition with standard instructions

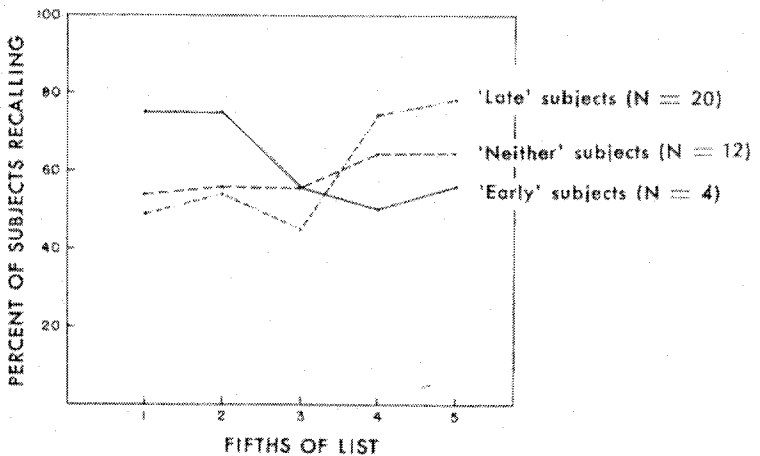


Fig. 5. Percent of 'early,' 'neither,' and 'late' subjects recalling on list 1, trial 2, as a function of serial position; shown for condition with standard instructions

While the curves in Figures 4 and 5 suggest that the list 1 position effects are the result of output order, more definitive evidence is available from the distribution of subjects among these recall categories (Table 1).

For the *standard* condition, there was a pronounced increase, between trial 1 and 2, in the number of subjects falling into the 'late' category, together with a pronounced decrease in the 'early' category. Hence the loss of primacy and increase in recency seen between trials 1 and 2 of list 1 can be accounted for by a change in the distribution of subjects beginning their recall from particular portions of the list.

Thus, on the initial test trial (list 1, trial 1) in a free-recall learning task, subjects under standard free-recall instructions recalled first those items in the beginning of the list. By trial 2, list 1, most of these subjects recalled the terminal items first. Central to the issue of the development of the recency effect is what experienced subjects then do when confronted with a *new* list. The distribution of subjects into the recall-order categories on list 2 (Table 1) clearly shows that performance on one prior free-recall list resulted in a pronounced change in the order in which most standard-instruction subjects recalled items. On trial 1 of list 2 26 of the 36 subjects fell into the 'late' category, whereas on trial 1 of list 1 only 7 fell into the 'late' category.

Further support for the critical role of recall order in position effects may be seen from a similar analysis of the distribution of subjects among recall categories (Table 1) for the *subjective-organization* condition. As in the standard condition, most subjects under these instructions recalled from the beginning of the list on list 1, trial 1. By trial 2, list 1, many of these subjects had shifted away from recalling initial items first; in contrast to the high frequency of standard-instruction subjects falling into the 'late' category on this trial, however, subjects under subjective-organization instructions largely distributed themselves between the 'neither' and 'late' categories. On list 2, the subjects under subjective-organization instructions distributed themselves among all three recall categories.

Thus, the lack of a pronounced serial-position curve for subjects recalling under subjective-organization instructions, taken together with the recall-order data and the output-order consistency measures, argues strongly that these subjects did not rely on position cues to organize their retrieval patterns. If these measures are viewed in contrast to those produced by subjects recalling under typical free-recall instructions, two conclusions may be drawn. First, recency is a disposition, or perhaps strategy, on which subjects may or may not rely in ordering their recall. If they do, then some experience is required before recency becomes pronounced. Second, position cues appear to play a significant role as an organizational factor in multiple-trial free recall where the subject's task

is to produce the same items on successive trials. The suggestion from these data is that reliance on position cues as a device to order recall may actually impede that process.

Notes

This research was supported by Grant MH-12006 from the National Institute of Mental Health. During the preparation of this article, the author was a research associate at the Institute of Human Learning, Berkeley. Leo Postman's assistance throughout this project is gratefully acknowledged. Reprint requests should be sent to Lynn Hasher, Department of Psychology, Temple University, Philadelphia, Pennsylvania 19122. Received for publication May 15, 1972.

1. Dallett (1963) presented some evidence to suggest a change in the output order adopted by subjects who learned several lists under conditions of multiple-trial free recall. Because these data were collapsed across several trials on early lists and compared to the same trials on later lists, the effects are small and the locus of change is unclear.

2. For greater detail on the method, see Postman, Burns, and Hasher, 1970.

3. To allow for comparison across lists 1, 2 and 3, recall on list 3 is shown to a base of 36 subjects; actually there were only 18 subjects in each group who learned list 3 under the same conditions as lists 1 and 2. Position curves are shown for trials 1 and 2 of successive lists because of near-asymptotic performance by trial 3 on each list.

4. This analysis was done to determine the sources of recency. Figures are not presented for subjects with subjective-organization instructions, because this condition did not show a recency effect.

References

- Atkinson, R. C., and Shiffrin, R. M. 1968. Human memory: A proposed system. In *The psychology of learning and motivation*, ed. K. W. Spence and J. T. Spence, vol. 2. New York: Academic Press.
- Cole, M., Frankel, F., and Sharp, D. 1971. Development of free recall learning in children. *Developmental Psychology* 4:109-123.
- Craik, F. I. M. 1970. The fate of primary memory items in free recall. *Journal of Verbal Learning and Verbal Behavior* 9:143-148.
- Dallett, K. M. 1963. Practice effects in free and ordered recall. *Journal of Experimental Psychology* 66:65-71.
- Deese, J., and Kaufman, R. A. 1957. Serial effects in recall of unorganized and sequentially organized verbal material. *Journal of Experimental Psychology* 54:180-187.
- Glanzer, M., and Cunitz, A. R. 1966. Two storage mechanisms in free recall. *Journal of Verbal Learning and Verbal Behavior* 5:351-360.
- Hasher, L. 1970. The whole versus part problem in free recall: Acquisition and retention. Unpublished doctoral dissertation, University of California, Berkeley.

- Hasher, L. 1971. Retention of free-recall learning: The whole-part problem. *Journal of Experimental Psychology* 90:8-17.
- Keppel, G., and Mallory, W. A. 1969. Presentation rate and instructions to guess in free recall. *Journal of Experimental Psychology* 79:269-275.
- Murdock, B. B., Jr. 1962. The serial position effect in free recall. *Journal of Experimental Psychology* 64:482-488.
- Postman, L., Burns, S., and Hasher, L. 1970. Studies of learning to learn: X. Non-specific transfer effects in free-recall learning. *Journal of Verbal Learning and Verbal Behavior* 9:707-715.
- Postman, L., and Hasher, L. 1972. Conditions of proactive inhibition in free recall. *Journal of Experimental Psychology* 92:276-284.
- Postman, L., and Phillips, L. W. 1965. Short-term temporal changes in free recall. *Quarterly Journal of Experimental Psychology* 17:132-138.
- Raffel, G. 1936. Two determinants of the effect of primacy. *American Journal of Psychology* 48:654-657.
- Raymond, B. 1969. Short-term storage and long-term storage in free recall. *Journal of Verbal Learning and Verbal Behavior* 8:567-574.
- Rundus, D., and Atkinson, R. C. 1970. Rehearsal processes in free recall: A procedure for direct observation. *Journal of Verbal Learning and Verbal Behavior* 9:99-105.
- Tulving, E., and Arbuckle, T. Y. 1963. Sources of intratrial interference in immediate recall of paired associates. *Journal of Verbal Learning and Verbal Behavior* 1:321-334.
- Underwood, B. J. 1969. Some correlates of item repetition in free-recall learning. *Journal of Verbal Learning and Verbal Behavior* 8:83-94.
- Welch, G. B., and Burnett, C. T. 1924. Is primacy a factor in association formation? *American Journal of Psychology* 35:396-401.

continued from page 388

- Murray, Robert, and Rosser, Paul, eds. *The Genetic Metabolic, and Development Aspects of Mental Retardation*. Springfield, Ill.: Charles C Thomas, 1972. Pp. 343. \$16.75.
- Myer, John Colby. *The Psychology of Western Culture*. New York: Philosophical Library, 1972. Pp. 149. \$8.50.
- Olivero, Carmen Garcia. *Study of the Initial Involvement in the Social Services by the Puerto Rican Migrants in Philadelphia*. New York: Vantage Press, 1971. Pp. 316. \$5.95.
- Ornstein, Robert E. *The Psychology of Consciousness*. San Francisco, Calif.: W. H. Freeman, 1972. Pp. 247. Paperback, \$3.50.
- Parrott, L. W. *My Alcoholic Virgin*. New York: Vantage Press, 1972. Pp. 447. \$7.95.
- Piers, Maria W., ed. *Play and Development*. New York: W. W. Norton, 1972. Pp. 176. \$5.95.
- Powell, Daniel. *John Hay Whitney Foundation*. Vol. 2. New York: John Hay Whitney Foundation, 1972. Pp. 180.
- Rauschenbush, Esther. *John Hay Whitney Foundation*. Vol. 1. New York: John Hay Whitney Foundation, 1972. Pp. 201.
- Redl, Fritz. *When We Deal with Children*. New York: The Free Press, 1972. Paperback. Pp. 511. \$3.95.
- Reed, Graham. *The Psychology of Anomalous Experience*. London: Hutchinson University Library, 1972. Pp. 175.
- Reidy, Joseph J. *The Sensitivity Phenomenon*. Saint Meinrad, Indiana: Abbey Press, 1972. Pp. 134. \$4.95.
- Reisman, J. M. *Principles of Psychotherapy with Children*. New York: Wiley, 1973. Pp. 329. \$12.95.
- Roff, Merrill; Sells, S. B.; and Golden, Mary M. *Social Adjustment and Personality Development in Children*. Minneapolis: University of Minnesota Press, 1972. Pp. 206. \$8.50.
- Rogers, Barril. *Human Personality: Toward a Unified Theory*. New York: Vantage Press, 1972. Pp. 233. \$6.95.
- Rollins, Nancy. *Child Psychiatry in the Soviet Union*. Cambridge, Mass.: Harvard University Press, 1972. Pp. 293. \$12.95.
- Royce, Joseph R. *The Psychology of Knowing*. New York: Gordon & Breach, 1972. Pp. 496. \$24.50; paperback, \$14.50.
- Ruddock, Ralph, ed. *Six Approaches to the Person*. Boston: Routledge & Kegan Paul, 1972. Pp. 212. \$10.95; paperback, \$5.95.
- Rundle, Bede. *Perception, Sensation and Verification*. New York: Oxford University Press, 1972. Pp. 256. \$12.00.
- Sanford, Nevitt, and Comstock, Craig. *Sanctions for Evil*. Boston: Beacon Press, 1972. Pp. 387. Paperback, \$3.95.
- Sawyer, Charles H., and Gorske, Roger A., eds. *Steroid Hormones and Brain Function*. Berkeley and Los Angeles: University of California Press, 1972. Pp. 400. \$30.00.
- Schlesinger, Hilde S., and Meadow, Kathryn P. *Sound and Sign: Childhood*

continued on page 424