Bulletin of the Psychonomic Society
1976, Vol. 8 (4), 275-278

A serial position effect in recall of United States presidents

HENRY L. ROEDIGER, III
Purdue University, West Lafayette, Indiana 47907

and

ROBERT G. CROWDER
Yale University, New Haven, Connecticut 06520

College students asked to recall the names of all the presidents of the United States, either in their order of occurrence or in any order, produce a classical serial position curve with best performance at the beginning and end of the series. Except for extraordinarily high recall of Lincoln, memorability of presidents is strongly related to their chronological position in history. This result extends generality of the serial position effect to semantic memory and, if one seeks a general explanation of serial position effects in semantic and long-term episodic memory experiments, rules out several theoretical candidates. It appears most congruent with the hypothesis that end points of a series serve as distinct positional cues around which memory search is begun.

A distinction between episodic and semantic memory systems was outlined by Tulving (1972). The crux of the distinction is whether or not temporal factors surrounding the conditions of presentation of to-be-remembered material are stored and retrieved. Recall of the temporal context of the learning situation is considered crucial to successful recall in tasks involving memory for discrete episodes, but relatively unimportant in recall of more or less permanently memorized information involving semantic relations, such as naming the states of the United States. If such a distinction between "autobiographical" and "permanent" memory systems is accepted, and we think it should be, then it is of interest to ask whether or not the two systems obey the same empirical laws.

In episodic memory experiments, which typically involve an arbitrary list of items to be learned and recalled either with or without regard to the order of presentation, the bow-shaped relations between recall and serial position of the list items was first reported by Ebbinghaus (1902, pp. 624-626) and has since been replicated with overwhelming regularity (see Crowder, 1976, Chapter 12 for a review). The first few and last few elements in a series are best recalled (the primacy and recency effects), while the nadir in performance is slightly after the midpoint in the list, at least with ordered recall. Our experiment was intended, in part, to add to the meager information on serial position effects in the semantic memory system. The most directly relevant previous experiment is a serial position function obtained in latency measures by Koriat and Fischhoff (1974). They simply asked people what day it was and timed the responses. Latencies grew slower from Sunday to Wednesday and then were sharply faster between Wednesday and Friday (no data were collected on Saturday), but there were no such day-to-day changes in latencies to retrieve other facts from semantic memory.

If episodic and semantic memory obey the same laws, a second important issue emerges—whether the same theory should be used in explaining the episodic and semantic memory serial position effects. Hypotheses accounting for the episodic memory serial position effect may be classified according to whether they propose a common explanation for the primacy and recency effects or, instead, propose different explanations for them. Single-factor hypotheses include formulations based on the combined influences of retroactive and proactive inhibition (Foucault, 1928; Hull, 1935), processing order (Feigenbaum & Simon, 1962; Ribback & Underwood, 1950), and distinctiveness of positional stimulus representations (Bower, 1971; Ebenholtz, 1972; Murdock, 1960). Two-factor hypotheses of the serial position effect (especially in free recall) have largely agreed that recency should be attributed to retrieval from some sort of highly accessible, limited capacity, short-term store or primary memory mechanism (Glanzer, 1972; Waugh & Norman, 1965), and that primacy should be attributed to differential processing of early items during learning relative to processing of later items (Bruce & Papay, 1970; Crowder, 1969; Rundus, 1971). If it is assumed that serial position effects in long-term episodic and semantic memory situations are theoretically related, it is obvious that certain of the hypotheses mentioned above are so

We would like to thank Katherine Golden, Christine McCormick, and Leslie Roediger for their aid in scoring the results, and Scott Paris for allowing us to test students in his classes. Requests for reprints should be sent to Henry L. Roediger, III, Department of Psychology, Purdue University, West Lafayette, Indiana 47907.

intimately associated with the circumstances of acquisition that they could never accommodate a serial position effect in semantic memory. This is because in semantic memory, by definition, the circumstances of acquisition have been dissociated from the remembered knowledge itself.

Subjects in the experiment were asked to recall a well-known series involving a natural serial order, the presidents of the United States, either in any order (free recall) or in their correct ordinal position according to term of office. Our interest was in the relationship of recall to ordinal position in the series.

METHOD

Design and Procedure

Subjects served in two different recall conditions. In both cases, subjects were given 5 min to write the names of all the presidents of the United States they could think of on a sheet of lined paper. Subjects in the free recall condition were told to write the names in any order they wished. The other subjects received a "free position recall" instruction. They first numbered their lined response sheets from 1 to 36 (or 1 to 37) and then were instructed that during the 5-min recall period they were to place each president next to the number corresponding to his term of office. If they remembered the name of a president but not when his term of office occurred, they were instructed to guess or to put his name anywhere on the sheet. Subjects in both instructional conditions were told to distinguish presidents with identical last names by including initials. Free position recall subjects were told that the current president was 36th or 37th, depending on when they were tested.

Subjects

The subjects were 159 students from Yale and Purdue Universities. Originally, 31 Yale undergraduates served in the free recall condition and 33 served in the free position recall condition during the Nixon administration. During the Ford administration, 95 graduate and undergraduate students at Purdue were tested under free position recall instructions. Since neither the mean number of items recalled nor the shape of the serial position curve differed from Yale subjects tested under this condition, the results from the two samples were pooled. Thus, altogether, 31 subjects were tested under free recall instructions and 128 were tested under free position recall instructions.

RESULTS

The results of the experiment are presented in Figure 1, where the probability of correctly recalling a president is plotted as a function of his ordinal position in office. The open circles joined by dashed lines represent performance of all 159 subjects scored by a free recall criterion, whatever their instructional group. (In the original Yale sample, the two groups did not differ when scored by a free recall scoring criterion, with free recall subjects recalling 23.7 and free position recall subjects recalling 23.4. The shapes of the serial position curves did not differ, either.) The filled circles and solid lines represent performance of the 128 free position recall subjects when scored by a position recall criterion that allowed credit only for correctly placed responses.

The curves of Figure 1 resemble quite closely serial position curves from episodic memory experiments. For both curves there is the familiar bowed shape produced by primacy and recency effects. Both curves also show strikingly anomalous performance on Lincoln, who is recalled far more frequently than his unfavorable

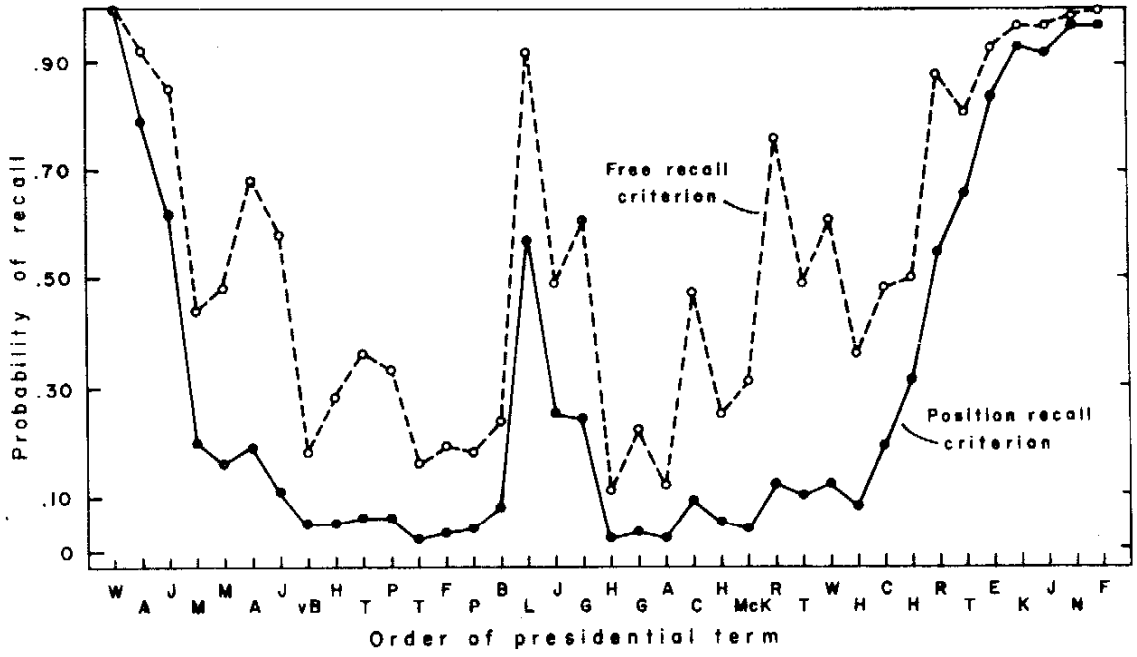

Figure 1. Recall probability for presidents of the USA as a function of the order of their terms of office. The free recall criterion requires only that the name appear somewhere in recall, but the position recall criterion requires that each name be placed next to the proper position.

position would permit us to expect. This performance "spike" is similar to that found when a unique item is embedded in an otherwise homogeneous episodic memory list (the von Restorff effect); our data also show the "spread of effect" that is sometimes found in such situations, the elevation in recall of items surrounding the unique item (von Restorff, 1933; Wallace, 1965). A similar tendency appears, in free recall scoring only, on John Adams and Theodore Roosevelt.

Except for performance on Lincoln and his successors, the position recall data are about as "noise free" as one could expect from a carefully counterbalanced episodic memory experiment with randomly selected words. There were more perturbations in free recall, but if one is willing to discount scores from repeated names and repeated terms (note the high scores for J. Q. Adams, Cleveland, and the two Roosevelts), the pattern of data here is also quite acceptable. Free recall was poorest for Hayes and Arthur, located in the notorious point of maximum difficulty just beyond the center of the list. The free recall data of Figure 1 were correlated, president by president, with recall from a completely independent group of 90 Purdue undergraduates given free recall instructions and a 3-min period for recall. The Pearson product-moment correlation coefficient was .95, indicating that the perturbations in Figure 1 are probably not experimental error.

Several scoring difficulties should be mentioned. Four names (Adams, Harrison, Johnson, and Roosevelt) belong to more than one president, and thus, in cases where the subject did not include first name initials, it was necessary to decide which of the two was recalled. Often this could be done on the basis of the context; for example, Johnson recalled between Kennedy and Nixon. In cases in which a subject did not include initials and it was not possible to make a decision based on context, half credit was given to both presidents. There were only 19 such cases. Another problem in strict position scoring is presented by Cleveland, who served nonconsecutive terms. The free position recall subjects were given credit for Cleveland if he was recalled in the correct position from the beginning or end. This may result in a slight overestimation. Finally, it should be pointed out that the proportion of subjects recalling Ford is based on 95 observations, that is, only on recall of Purdue subjects.

DISCUSSION

We are strongly inclined to accept the data of Figure 1 as evidence for a conventional serial position effect in semantic memory. In order to accept this conclusion, it is necessary to meet two potential criticisms. One is that recall in this task is actually from episodic rather than semantic memory, since many people are required at some point during their years in school to learn the presidents and their terms of office. It seems unlikely that the position effects in Figure 1 could be produced by learning a serial list years previously, but nonetheless we asked our original sample of Yale subjects to indicate whether or not they remembered having to learn the presidents in order at any point in their education. Very few did, and the serial position curves for subjects who did and did not remember learning the presidents were quite similar.

A more potent objection is that the serial position effect in Figure 1 is simply attributable to differences in degrees of learning the different presidents produced by differing frequencies of exposure. It is, of course, inherently impossible to counterbalance items against serial position when one is studying serial position effects in semantic memory, so this criticism must be seriously considered. Although we cannot now definitely rule out this alternative, there are three reasons we think the data of Figure 1 represent a serial effect rather than an effect due to frequency of exposure. First, we are not convinced that the frequency of exposure argument is even true. Is John Adams really a more frequent stimulus than Thomas Jefferson? Or is Coolidge more frequent than Harding? Second, even if frequency of exposure might account for some of the perturbations when a free recall criterion is used in scoring, the serial position effect is even clearer and more regular when strict position scoring is used (the filled circles and lines of Figure 1). Since subjects only receive credit for recalling a term in its correct position under this criterion, any simple frequency of exposure argument must be elaborated considerably to account for the serial position effect when recall is scored by the position recall criterion. Finally, even if it were true that frequency of exposure is correlated with recall, this may be simply a manifestation of the same phenomenon. Perhaps it is because the end points in a continuum have a priority in retrieval that the initial and most recent presidents keep emerging. Of course, there is some variation in frequency of exposure, as there is in recall, that is not correlated with term of office. There are actually a number of covariates of recall that might be investigated, including term of office. What we are saying is that, from the looks of Figure 1, especially the curve representing recall scored by the position recall criterion, such other factors play a surprisingly small role in determining recall.

Assuming that the data of Figure 1 represent a true serial position effect, let us consider the issue of how serial position functions are best explained in light of this new evidence. This result presents no *necessary* implications for theories of long-term episodic memory, because one can adopt a pluralistic theory in which apparently similar serial position functions are produced by different underlying mechanisms in different paradigms. We acknowledge, for example, that there are serial position effects in tachistoscopic experiments (Harcum, 1967) and in auditory immediate memory (Crowder & Morton, 1969) that involve mechanisms distinct from those under discussion here. Our own strong preference is initially to accept the assumption that the long-term episodic and semantic memory serial position functions reflect a common mechanism and then abandon that assumption only as the evidence obliges us to do so. The burden of evidence should fall on those who postulate multiple causality of serial position functions rather than those who postulate common causality. The serial position effect in Figure 1 appears quite difficult to reconcile with two-factor theories of the serial position effect (for example, Glanzer, 1972) because of their emphasis on conditions affecting initial acquisition. The single-factor theories based on inhibition (Foucault, 1928; Hull, 1935) and processing order (Feigenbaum & Simon, 1962; Ribback & Underwood, 1950) also seem to require extensive modification to account for serial position effects in semantic memory.

The concept of distinctiveness of positional cues (Bower, 1971; Ebenholtz, 1972; Murdock, 1960) is one idea that is general enough to encompass data from both semantic and episodic memory. One elaboration of this idea has recently been applied by Bjork and Whitten (1974) to recency in free recall as a consequence of results that seem to refute the more popular ascription of such recency to primary memory. A related idea

comes from Shiffrin (1970), who articulated a search model of retrieval that would apply with equal ease to episodic and semantic memory. He argued that memory search is begun around distinctive locations at the beginning and end of a list and goes on to say that, "If the search explanation of the primacy effect is correct, then the provision of a distinctive cue at some intermediate point in a free recall list should result in a pseudo-primacy effect [a la the 'von Restorff' effect commonly examined in serial learning]" (1970, p. 410). Such a distinctive point occurs in Figure 1 in the recall of Lincoln and, as Shiffrin argues, recall of succeeding presidents (Johnson, Grant) is elevated over most other presidents occupying interior serial positions. Primacy, recency, and the von Restorff effect are thus seen as cases of the same retrieval anchor mechanism. This argument is, of course, somewhat circular at the moment, since there is no way to establish distinctive positions (other than the ends of a list) independently from recall level; nonetheless this account appears to better accommodate the generality of serial position effects than do the alternatives.

REFERENCES

BJORK, R. A., & WHITTEN, W. B. Recency-sensitive retrieval processes in long-term free recall. *Cognitive Psychology*, 1974, **6**, 173-189.

BOWER, G. H. Adaptation-level coding of stimuli and serial position effects. In M. H. Appley (Ed.), *Adaptation level theory*. New York: Academic Press, 1971.

BRUCE, D., & PAPAY, J. P. Primacy effects in single trial free recall. *Journal of Verbal Learning and Verbal Behavior*, 1970, **9**, 473-486.

CROWDER, R. G. Behavioral strategies in immediate memory. *Journal of Verbal Learning and Verbal Behavior*, 1969, **8**, 524-528.

CROWDER, R. G. *Principles of learning and memory*. Hillsdale, N.J: Lawrence Erlbaum, 1976.

CROWDER, R. G., & MORTON, J. Precategorical acoustic storage (PAS). *Perception & Psychophysics*, 1969, **5**, 365-373.

EBBINGHAUS, E. *Grundzüge der psychologie*. Leipzig: von Veit, 1902.

EBENHOLTZ, S. M. Serial learning and dimensional organization. In G. H. Bower (Ed.), *The psychology of learning and motivation* (Vol. 5). New York: Academic Press, 1972.

FEIGENBAUM, E. A., & SIMON, H. A. A theory of the serial position effect. *British Journal of Psychology*, 1962, **53**, 307-320.

FOUCAULT, M. Les inhibitions internes de fixation. *Année Psychologique*, 1928, **29**, 92-112.

GLANZER, M. Storage mechanisms in recall. In G. H. Bower (Ed.), *The psychology of learning and motivation* (Vol. 5). New York: Academic Press, 1972.

HARCUM, E. G. Parallel functions of serial learning and tachistoscopic pattern perception. *Psychological Review*, 1967, **74**, 51-62.

HULL, C. L. The conflicting psychologies of learning—a way out. *Psychological Review*, 1935, **42**, 491-516.

KORIAT, A., & FISCHHOFF, B. What is today? An inquiry into the process of time orientation. *Memory & Cognition*, 1974, **2**, 201-205.

MURDOCK, B. B. The distinctiveness of stimuli. *Psychological Review*, 1960, **67**, 16-31.

RIBBACK, H., & UNDERWOOD, B. J. An empirical explanation of the skewness of the bowed serial position curve. *Journal of Experimental Psychology*, 1950, **40**, 329-335.

RUNDUS, D. Analysis of rehearsal processes in free recall. *Journal of Experimental Psychology*, 1971, **89**, 63-77.

SHIFFRIN, R. M. Memory search. In D. A. Norman (Ed.), *Models of human memory*. New York: Academic Press, 1970. Pp. 375-447.

TULVING, E. Episodic and semantic memory. In E. Tulving & W. Donaldson (Eds.), *Organization of memory*. New York: Academic Press, 1972. Pp. 590-600.

VON RESTORFF, H. Über die wirkung von bereichsbildungen im Spurenfeld. In W. Köhler & H. von Restorff, Analyse von Vorgängen in Spurenfeld. I. *Psychologische Forschung*, 1933, **18**, 299-342.

WALLACE, W. P. Review of the historical, empirical, and theoretical status of the von Restorff phenomenon. *Psychological Bulletin*, 1965, **63**, 410-424.

WAUGH, N. C., & NORMAN, D. A. Primary memory. *Psychological Review*, 1965, **72**, 89-104.

(Received for publication June 28, 1976.)