Recency and recall time¹

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Abstract

The intervals between successive presentations of a given letter were varied within a cyclic list, in which each of six letters appeared equally often at each of 11 recurrence intervals (0-10 intervening items). Ss responded with the name of the letter. Voice key reaction times increased with the length of the interval.

Problem

The question which motivated this study was whether the process by which asymptotically well-known information is retrieved from human memory is such as to produce a recency effect on time required for recall. Incidental data from studies by Hyman (1953) and Mowbray (1960), on newly acquired light-nonsense syllable reactions, and arabic numeral naming responses, respectively, suggest that reaction time increases as the time or number of intervening items between two successive occurrences of the same S-R pair increases. Unfortunately, in these experiments the different item-interval did not occur equally often and the results may have been biased by frequency effects. I report here the results of a direct experiment on the relation of recency of prior recall of an item to its speed, with frequency controlled.

Method

Subjects were eight adult males, ages 19-50. The apparatus was a Hunter Card-Master mounted in a darkened reduction box. S fixated a small spot of light where the stimulus item was to appear. Every 5 sec. a new white card bearing a black block letter ("Magic" transfer lettering) was illuminated by electromechanically removing an occluder from a pin-hole light source in the opposite end of the box, simultaneous with actuation of an electronic clock. Actuation of a voice key by a sensitive directional microphone directly in front of S's mouth stopped the clock and occluded the light. S was in a sound isolated, air conditioned compartment; timing apparatus and E were in an adjoining room.

An internally counterbalanced list of 6 letters (T, D, P, B, C and Z) was constructed in which each letter appeared equally often (11 times), and each letter appeared exactly once per cycle at each of 11 different intervals (0, 1, 2,.....10 intervening items, or 5, 10, 15, ...55sec.). The series was: TPBPZTBPPCDPTBBZPDDCTCPBZBCCDPCTDTZDBZPCDZBTTCZBPDCTDCTZBCDBPZZTZCD. This 66 item series was repeated cyclicly without stop until each item had appeared at each interval three times (just over three cycles). The first occurrence of each letter and the fourth occurrence, where there was one, were omitted from analysis.

Ss were fully instructed in the procedure including the names of the letters which they would see and the fact that each item would occur equally often at each of several different repetition intervals. They were not told the number of different intervals, except that it would be "large." They were told that on every trial every item was as likely to occur as any other. Ss were instructed to inhale on hearing the card change and to pronounce the name of the exposed letter fluently and loudly and as quickly as possible without making errors. They were shown a demonstration set and practiced on two sets, one of two letters (A, K) and three intervals, and one of three letters (F, H, S) and five intervals, constructed and run in the same way, prior to beginning the experimental series. The overall error rate, including false triggerings and card change irregularities, was less than 4%.

Results and Discussion

Figure 1 shows a clear, and apparently steady increase of recall time with increasing time (and number of intervening items) since the last recall of the same letter name. The linear regression is significant at the .02 level.

Apparently the retrieval of a given item from the human memory store leaves the system in a state from which the same input-output event can be accomplished in slightly less time. In some sense, then, the retrieval is not a purely random access process. In what sort of mechanism or stage of the input-output path the heightened efficiency lingers after use (e.g., whether in hyperactivity or hyperexcitability of the central neurons involved, or simply in the tone of tongue muscles) remains to be determined.

Fig. 1. Relation between recall time (RT) and recency of recall of the name of a letter. The line represents a least-squares best fit.

References

- HYMAN, R. Stimulus information as a determinant of reaction time. *J. exp. Psychol.*, 1953, 45, 188-196.
- MOWBRAY, G. H. Choice reaction times for skilled responses. *Quart. J. exp. Psychol.*, 1960, 12, 193-202.

Note

1. The research reported here was supported by Grant MH 06856-01 from NIH.

Comment

The report of Pick and Hay (*Psychon. Sci.*, 1964, 1, 199-200), on the prolonged wearing of 20-diopter prisms, suggests that the varying rates and amounts of adaptation to the different dimensions of distortion are "best understood in terms of the changes in stimulus dependencies involved." On the surface this is true, but the most important variable is the amount of behavioral adaptation to the distorted retinal input. In my own experiment (J. G. Taylor, *The Behavioral Basis of Perception*. Yale University Press, 1962) there was virtually complete adaptation to the lateral displacement of objects on my work table, but much less to the displacement of points on the ground on which I stood or walked. The essential difference between these situations is that in the former, movements designed to make contact with objects had to be accurately directed, but not in the latter, since one part of the floor will support the feet as well as another.

Pick and Hay report that the smallest amount of adaptation was found with respect to the instability of perceived shapes under rotation of the head about its vertical axis. In my experiment the work table and the objects on it remained perceptually stable under rotation of the head within the range that was customary while I was at work, but there was no reduction in the instability of objects beyond my reach, at the end of the experiment as compared with the beginning. Evidently such results cannot easily be related to "stimulus dependencies."

If the stimulus dependency hypothesis were valid there could be no objection to the tests used by Pick and

Hay to measure adaptation, but if we adopt a behavior dependency hypothesis their validity is questionable. For example, adaptation to the convergence of horizontal lines above and below eye level was measured by having Ss arrange four dots to make a square, presumably with its center at eye level. Now we are constantly taking action relative to horizontal surfaces below eye level, such as tables and floors; and if these surfaces, seen through prisms, appear to be oblique, the resulting action is erroneous and has to be corrected. But we do not live on our ceilings, and any behavioral errors, relative to them, that the prisms might induce remain uncorrected. Surfaces such as high shelves require occasional action, but not nearly as much as tables and floors. It is evident then that the "square" test measures two dimensions of adaptation and not one. Complete adaptation to obliquity below eye level together with zero adaptation to obliquity above eye level would yield a measure of 50% in the test. The average obtained by Pick and Hay was 51.5%.

The behavioral theory of perception leads to the conclusion that tests applied in laboratory conditions remote from those in which behavioral errors are corrected are likely to yield erroneous measures of perceptual adaptation. My own test depends on the fact that if the spectacles are worn for only part of each day the customary after-effects of continuous wearing are eliminated. This makes possible a direct comparison between (a) present perception through the prisms, (b) normal perception without prisms, and (c) perception through the prisms as it was at the beginning of the experiment. To obtain (c) one has only to turn the spectacles so that the bases are on the other side. The resulting distortion is the same as at the beginning but in the opposite direction. This test is applicable in all situations and therefore yields more valid results than any test applied in an artificial laboratory situation.

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(See page 414 for a reply by H. L. Pick, Jr. and J. C. Hay)