The Ranschburg Phenomenon: Failures of immediate recall correlated with repetition of elements within a stimulus[1]

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Abstract

Seven-consonant stimuli were recalled immediately. When the consonant in Position 2 was repeated in Position 5, 6, or 7, an increase in errors occurred at the latter position, as compared with control stimuli involving no repetition. Confirmation of the Ranschburg Phenomenon does not occur, however, when the repeated-element positions are 2 and 4. Nor was there an increased error rate for elements following a repeated element. These observations support the importance of intra-stimulus interference in immediate memory, but leave uncertain the associative mechanism responsible for such interference.

Problem

The Ranschburg Phenomenon refers to the omission or incorrect reproduction of a repeated element in a string of elements (usually alphanumeric) presented for immediate recall (McGeoch, 1942). It may also cover an increase in error rates for elements which precede or follow the repeated element in the stimulus. Both Schmitz (1922) and McGeoch (1942) favored a reproductive interference interpretation of these effects of element-repetition on error rates, i.e., "connection of the same or a similar item with two different response items and, on the other side, with two different stimulus items sets the stage for interference and confusion" (McGeoch, 1942, p. 100). Schmitz (1922) explicitly employed the A--B, A--C transfer paradigm to interpret an apparent increase in errors on the letter following the second occurrence of a repeated letter in a 7-letter string.

The effects of repetition of elements on immediate memory are not well established. Schmitz (1922) did not have the necessary control observations (stimuli without repetition) to substantiate his attribution of the error rates at Positions 5 and 6 of a 7-letter stimulus to the repetition of an element in Positions 2 and 5. More recently, Obonai & Tatsuno (1954) and Tatuno (1961) have observed both facilitation and interference in immediate recall as a consequence of intra-stimulus repetition. Although their studies are difficult to evaluate, there is the suggestion that the Ranschburg effect occurs only when the repeated elements are separated by 2 or more non-repeated elements and at least one of the repeated elements is in the central portion of the string.

The purpose of the present study was to replicate the Schmitz (1922) experiment with 7-consonant stimuli, using the proper control observations that involve no repetition, and varying the position of the second occurrence of the repeated element while holding the first occurrence at Position 2.

Method

Each of 20 paid college-student Ss heard 60 7-consonant strings that had been recorded on magnetic tape at 3/sec. Each S heard 12 instances of each of 5 kinds of stimuli in a randomized order. In the control stimuli (Condition 0), all 7 consonants were different; in the other 4 kinds of stimuli, the first occurrence of the repeated element was always in Position 2, and the second was in Position 4, 5, 6, or 7 (Condition 4, 5, 6, 7, respectively). The stimuli were derived from a basic computer-produced set of 60 7-consonant strings with the constraints that (1) y, v, and w were not used, (2) no two or more adjacent consonants appeared in alphabetic order, and (3) no trigram or longer sequence appeared more than once in the entire stimulus set. From these 60 basic stimuli, which were used as the no-repetition stimuli (Condition 0), the other 4 conditions were derived by replacing the consonants in Position 4, 5, 6, or 7 with the one in Position 2. Stimulus lists were arranged so that following this derivation the same 3 constraints held for the experimental lists as were true of the original computer-produced lists. Thus, 4 of the 20 Ss received each of the basic stimuli under each of the 5 conditions of stimulus structure, and all 60 basic stimuli contributed equally to the observations under each condition. No S heard, however, the same basic stimulus more than once, with or without modification.

During testing a buzzer sounded 1 to 2 sec. before each stimulus presentation. There was no signal for recall other than termination of the stimulus, but the rapid rate made this termination a distinctive cue. The S had 8 sec. for oral recall of the stimulus, after which E said "rest" and 6 sec. elapsed before the next buzzer. The E recorded S's oral recall, but tape recordings were made at the same time and were used to check E's records.

Results and Discussion

For each of the 5 conditions 240 completely correct recalls were possible (20 Ss x 12 instances of each condition per S). The obtained frequencies of errorless recalls were 92, 93, 72, 80, and 86 for Condition 0, 4, 5, 6, and 7, respectively. Similarly, for each condition, a total of 1680 correctly positioned recalls of elements were possible (240 stimuli as above x 7 positions in each stimulus). The obtained total errors (failures to recall an element in its proper position) were 446, 394, 438, 424, and 419, respectively, for the same conditions.

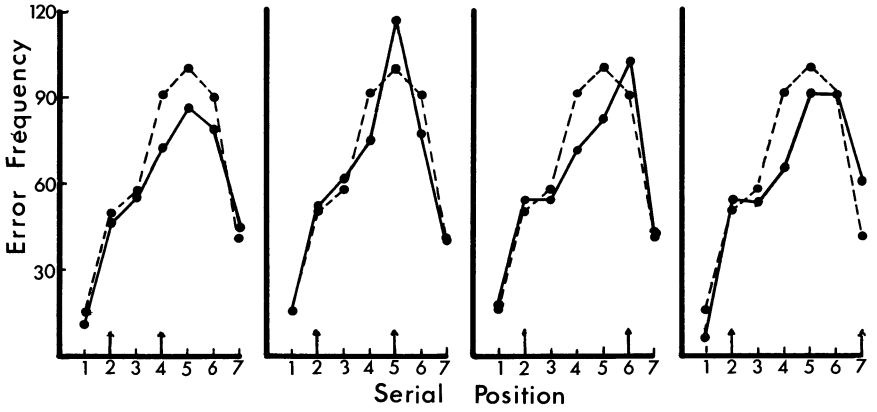

Fig. 1. Serial position functions for repetition conditions (solid lines) as compared with the same non-repetition control condition (dotted lines). The arrows on the abscissa indicate the positions of the repeated element for each condition.

A two-way repeated measurements ANOVA involving Condition (5 levels) and Serial Position (7 levels) showed, however, that the main effect of Condition was non-significant ($F\ 4/76 < 1.00$). Naturally, a highly significant main effect of Serial Position was found ($F\ 6/114 = 37.08$; $p < .01$).

The data of primary interest, however, are the absolute numbers of errors at each serial position as a function of the presence and location of element repetition within the stimulus (see Fig. 1). The overall significance of these effects is affirmed by the significant Condition x Serial Position interaction ($F\ 24/456 = 2.24$; $p < .01$). Each repetition condition (solid line) is compared separately with the same non-repetition control condition (dotted line). The four repetition conditions are identified by the arrows on the abscissa at the positions of the repeated elements. The suggestion of Fig. 1 is that element-repetition has an increasing effect on the shape of the serial position function as the second occurrence of the repeated element is advanced through Position 4, 5, 6, and 7. Analyses of variance of individual conditions paired with the control showed the interaction of Condition and Serial Position to be non-significant for Condition 4, significant at $p = .10$ for Condition 5, at $p = .05$ for Condition 6, and at $p = .01$ for Condition 7, thus confirming what is apparent in Fig. 1.

Excluding for the moment Condition 4, it appears that an increase in errors is associated with the position of the second occurrence of the repeated element. A gradient of increased errors around the repeated element, as suggested by McGeoch (1942), was not found; quite the contrary, there seems to be a compensatory reduction in errors in the immediate neighborhood of the repeated element. Comparing Condition 5 with the report of Schmitz (1922) there is confirmation for his finding of increased errors at Position 5 (the repeated element) but no confirmation for such an increase in Position 6.

Two aspects of the data require additional comment. (1) An effect might have been expected at the first as well as the second occurrence of the repeated element; however, the absence of such an effect is not conclusive since the error rate is very low at Position 2. (2) The data from Condition 4 are at variance with the other data since they show reduced errors at all positions. It may be, as the data of Obonai & Tatsuno (1954) suggest, that beneficial grouping occurs when the repeated elements are close together in the string.

The basic Ranschburg Phenomenon has been verified at least for the special case in which 2 occurrences of an element in an otherwise heterogeneous string of elements are separated by at least 2 nonrepeated elements and the total string is near memory span length. However, there is no evidence for the operation of an A--B, A--C or an A--B, C--B interference paradigm within the serial elements of the string; in fact, the recall of elements other than the second occurrence of the repeated element appears either to be unchanged or improved by the presence of the repeated element.

The Ranschburg Phenomenon, as observed here, seems compatible with the hypothesis that serial learning involves associations between serial positions and elements, but incompatible with the traditional "specificity" or chaining hypothesis (Young, 1962). Nevertheless, full theoretical interpretation must necessarily await more complete parametric studies.

References

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Notes

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