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Examination of the letter serial position effect in the "TOT" and the "don't know" states

ASHER KORIAT and ISRAEL LIEBLICH
Hebrew University of Jerusalem, Jerusalem, Israel

Brown and McNeill (1966) found that subjects in the "tip of the tongue" (TOT) state were better able to guess letters in earlier and later positions of an inaccessible word than letters in the middle positions. This finding was re-examined in terms of Koriat and Lieblich's (1974) analysis of sources of information detection. The relatively high detection of letters in later positions was also found for a "don't know" state and appears to result from: (a) a better ability to approximate the distribution of letters in these positions and (b) a stronger correlation in these positions than in others between the semantic and structural features of words. Only the relatively high correct detection of initial letters in the TOT state appears to be particularly indicative of the manner in which specific words are stored in memory and retrieved from it.

Brown and McNeill (1966) have demonstrated that subjects in a "tip of the tongue" (TOT) state are able to guess correctly certain parts and properties of the as yet inaccessible word. One ancillary finding of their study concerns the differential recall of letters in different positions. When the words of similar sound provided by subjects in a TOT state were compared to target words, higher percentages of correct letter matches were obtained for letters in the initial and final positions than for letters in the middle positions. This serial position effect in the recall of letters was interpreted by the authors to suggest economy in information storage. The initial and final letters of words are assumed to carry more information than the middle letters, and they are therefore favored in attention and storage.

A recent study by Koriat and Lieblich (1974) introduced a few refinements into the study of the TOT state. It was demonstrated that even subjects who declared having no knowledge of the solicited items ("don't know") exhibited correct detection of partial information. This detection was partly due to the subjects' ability to approximate in their guesses the ecological distribution of characteristics of English words. In fact, it was demonstrated that these guesses were specifically attuned to the population of potential target words, namely uncommon English words. Subjects in the don't know state also demonstrated some degree of differential detection, i.e., detection of partial information over and above what might be expected on the basis of the similarity between the input (target words) and output (guess) distributions. This differential detection is most probably due to correlations existing in English between semantic and formal aspects of words (e.g., Anisfeld, 1968; Johnson, 1967).

On the basis of these results, it can be concluded that the findings reported by Brown and McNeill regarding detection of information in the TOT state are likely to represent a pooling of three sources contributing to correct detection. In addition to the two sources outlined above, which obtain for the don't know state, there is a third source which is intimately tied to the near-recall availability of the specific word solicited. The purpose of the present report is to re-examine the letter serial position effect in light of the foregoing distinctions.

As interpreted by Brown and McNeill, the serial position effect reflects the manner in which specific words are stored in memory. According to this view, the ends of a word are more selectively attended to and are therefore more salient than the middle parts. Accordingly, the order of emergence of the parts of words into consciousness is such that the ends of words become accessible before the middle parts do. The validity of this rather intriguing suggestion rests on the demonstration that the serial position effect obtained by Brown and McNeill is due to the detection of information which is specifically attuned to the target word in question. If, however, the same pattern of results is shown to hold for the don't know state as well, this would suggest that the serial position effect, rather than reflecting the manner in which specific words are processed (i.e., analyzed, stored, and retrieved from memory), might be revealing of such general factors in the organization of English words as the relative redundancy of different parts of words. Indeed, several studies concerned with the organization of single words in English (Horowitz, White, & Atwood, 1968; Marchbanks & Levin, 1965; Miller & Friedman, 1957) have indicated that redundancy is greatest in the middle of a word and that initial and final letters are more important cues for identifying or eliciting a word than middle letters.

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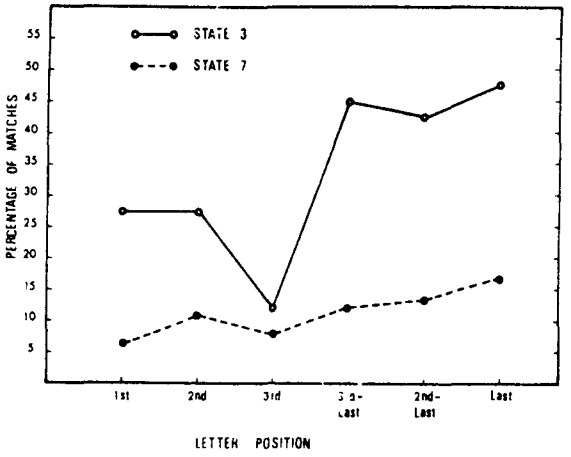

Figure 1. Percentages of letter matches between target words and SS words by serial position for States 3 and 7.

It is hoped that the present study will help further to clarify the nature of the relationship between the TOT and word organization.

METHOD

The results to be reported were collected as part of a study on the TOT phenomenon (Koriat & Lieblich, 1974). The reader is referred to that study for the full description of the method employed and the definition of the various memory states. In that report, only the results for the subjects' explicit guesses were analyzed. The present report is based on the similar-sound (SS) words reported by subjects, and the analyses to be carried out follow closely the procedure employed by Brown and McNeill (1966) for SS words. The analyses will be particularly concerned with a comparison between State 3 ("pure TOT") and State 7 (don't know).

RESULTS

The detection rates for the various letter positions were determined on the basis of the match between SS words and target words. Following the method used by Brown & McNeill (1966), the test was limited to instances where the SS word as well as the effective target word equaled or exceeded six letters. the detection rate was determined for each of the following positions: first, second, third, third-last, second-last, and last. Figure 1 displays the percentages of letters of SS words in each of the six positions which matched the letters in the same positions of the corresponding targets. The data are presented for States 3 and 7, which are based on 40 and 590 observations, respectively. The curve for State 3 ("pure TOT") is at all points above that of State 7 (don't know), corroborating the result presented in the previous report (based on explicit guesses) that overall detection rate is higher for TOT states than for the don't know state. The function relating detection rate to letter position, however, appears to differ for the two states. For State 3, a U function is obtained, indicating better detection of ends of words than middle letters, thus replicating Brown & McNeill's finding. For the don't know state, however, the results seem to suggest a shallow monotonic rise in detection rate from initial to final positions. For State 4 (TOT-unintended), a U-shape function was obtained when SS words were matched with the subject's ("incorrect") word targets. When SS words were matched against the experimenter's ("correct") target, however, a positive monotonic function similar to that found for the don't know state, was obtained. The data for States 5 (TOT-"Got it"-Correct) and 6 (TOT-"Got it"-Incorrect) included too few observations to permit a meaningful analysis.

One source of the higher detection rates for letters at the final parts of words may be found in the higher redundancy of final-position letters in English words. The following procedure was employed to examine this possibility. For each letter position, the distribution of English letters in SS words was compared to the respective distribution in the corresponding target words. Pearson coefficients (with N =26) were employed to estimate the degree to which the distribution of letters on each position of SS words approximates the distribution of letters in the corresponding position of the target words. Figure 2 displays the correlation coefficients obtained for each of the six positions for States 3 and 7.

It can be seen that for both states the similarity between SS and target letter distributions increases rather monotonically from initial to final positions, with a somewhat steeper curve for the pure TOT state than for the don't know state. Similar functions were obtained for State 4 when the results were analyzed either against the "correct" targets or against the subjects' effective targets. These results suggest that population detection, i.e., detection due to the ability to approximate the ecological distribution of letters, is higher for later than for earlier positions. Inspection of the letter distributions indicates that this finding is probably due to the smaller variety in the letters appearing in later positions of English words.

The final analysis involved differential detection, i.e., detection over and above that expected on the

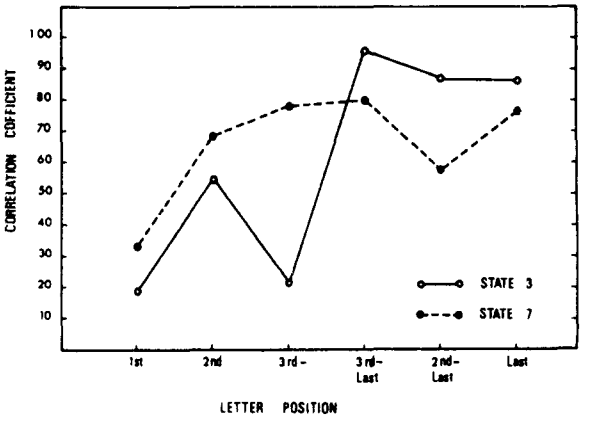

Figure 2. Pearson correlations between SS word and target letter distributions by letter serial position for States 3 and 7.

basis of the similarity between SS and target letter distributions. The following procedure was employed to estimate differential detection. For each of the six positions, the proportion of hits expected to be obtained on the basis of the relative incidence of the various letters in the target and SS words was calculated. A gain score was defined as the ratio of the observed number of hits to the expected number of hits. In such an analysis, differential detection is revealed by gain scores exceeding 1.00. Figure 3 displays the detection gain scores for each letter position, for States 3 and 7. For the don't know state, differential detection appears to be constant for the first four positions and to increase for the last two positions. For TOT 3, on the other hand, differential detection is highest for initial position, somewhat lower for the final two positions, and smallest for the middle positions. The highest discrepancy between the TOT and don't know states obtains for the initial position, otherwise the serial position curves appear to be quite parallel. The gain in information detection in the TOT state over the don't know state does not appear to be higher for the final than for the middle letters. Thus, granted the general finding reported earlier (Koriat & Lieblich, 1974), that overall differential detection is higher for the TOT than for the don't know state, the results of Figure 3 appear to indicate that only the initial position is particularly favored in the TOT state, and this may be attributed to the near-recall availability of specific memory entries in this state.

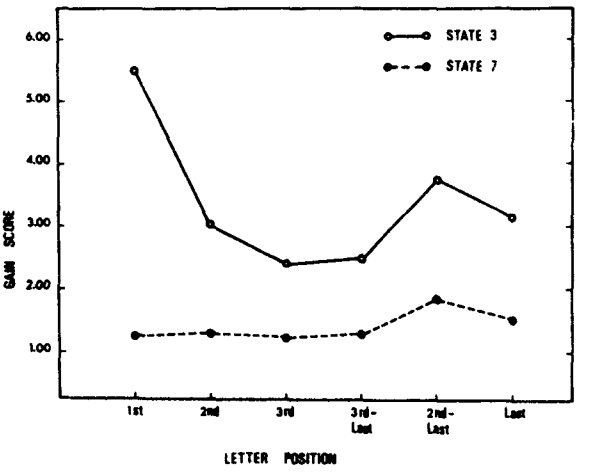

Figure 3. Detection gain scores for each of six letter positions for States 3 and 7.

DISCUSSION

The present study attempted a closer examination of the serial position effect obtained by Brown and McNeill with regard to the detection of information in the TOT state. Brown and McNeill have interpreted their finding to indicate that parts of words are processed by the memory system in accord with their relative informative value: letters in earlier and later positions are favored in attention and leave stronger memory traces than letters in middle positions. A finer examination of the data, however, reveals that only the relatively high detection of letters in earlier positions should be attributed to the manner in which specific words are stored in the memory system and retrieved from it. The relatively high detection of letters in later positions is more likely attributable to the organization of English words in general rather than to the manner in which such words are processed by the cognitive system.

Two sources of the higher detection rate obtained for the later parts of words were distinguished. First, the skewed distribution of letters in later positions of words increases the probability of the individual to make a correct bet. This, of course, is true insofar as the information regarding the distribution of letters in different letter positions is "available" to the individual and affects his bets. Second, the results of the present study suggest that, given general definitions of several words, a person declaring that he has no knowledge of these words is more likely to make correct differential guesses—i.e., guesses attuned to the definitions supplied—with regard to later parts than with regard to earlier parts of the words. This is probably due to the fact that in the English language, a word's semantic features are more strongly correlated with the letter composition of its later parts than with that of its initial part. The simplest example of this principle is that such semantic markers as grammatical class, verb tense, plurality, and the like are more often expressed in terms of variations in the final than in the initial parts of words.

It might be instructive to compare the serial position curve displayed in Figures 1 and 3 to the serial position effect found in studies of word organization. Horowitz et al. (1968) found that the ends of words had a better likelihood of eliciting a correct word than did middle fragments. Initial fragments, however, were far more effective than final fragments. This pattern is similar to that displayed for the pure TOT state in Figure 3 and is unlike the pattern found for overall detection (Figure 1) which reveals the highest detection rate for letters in the final positions.

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