Speech identification and "knowing that you know"*

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Twenty-five Ss heard a random list and a context (food-related) list of 50 words masked in white noise for a total of three trials each. The Ss were required to write the word and indicate their certainty that it was correct. Confidence rating accuracy (Type 2 d') was greater for context than for random lists ($p < .001$). Probability correct also improved with context ($p < .001$). Unlike the context factor, repetitions led to greater probability correct ($p < .001$) but did not lead to changes in Type 2 d' . The results were interpreted as support for a feedback model of context and confidence rating accuracy.

Lack of research and research techniques have hampered the understanding of what Tulving and Madigan (1970) feel is "one of the truly unique characteristics of human memory: its knowledge of its own knowledge [p. 477]." A means of investigating this highly cognitive phenomenon is, however, provided by a unique signal detection analysis. Confidence ratings applied to evocative responses (e.g., speech identifications, recall memory attempts) yield a "Type 2" signal detection analysis (Clarke, Birdsall, & Tanner, 1959). As such, the Type 2 d' is an index of the ability to discriminate correct from incorrect responses. Here, then, is a way to study an S's "knowledge of his own knowledge."

In memory tasks, variables which affect retention do not affect recall rating accuracy (Bernbach, 1967), but in word identification tasks the Type 2 d' increases with increasing speech-to-noise ratios (Pollack & Decker, 1958). The purpose of the present experiment was to investigate the effects of another factor (context) on confidence rating accuracy.

Bruce (1956) found that random words were more difficult to perceive than lists of words constrained contextually (e.g., parts of the body, things to eat). Perhaps context forms a feedback system which provides the listener with important "knowing that you know" information. To test this hypothesis, the Bruce experiment was repeated, adding the requirement that listeners additionally rate the confidence of each speech identification attempt. It was hypothesized that confidence rating accuracy (measured by the Type 2 d') is greater for context than for random lists.

METHOD

Subjects

The Ss were 25 undergraduate students enrolled in the introductory psychology course at Iowa State University. All Ss received course credit for their participation.

Materials

Two lists of 50 words were constructed, a context (C) list of monosyllable food-related words and a random (R) list of monosyllable words matched word for word with the C list for frequency of occurrence in the language by the Thorndike-Lorge (1944) G list and for initial phoneme. The words were recorded at a constant level at 6-sec intervals onto one track of a Wollensak stereo tape recorder, with a break between lists. White noise was then recorded on the other track from a

Fig. 1. Average number of words identified as a function of type of list and number of presentations.

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Table 1
Analysis of Variance Summary

Source	df	MS	F
Conditions (C)	1	977.92	77.12*
Repetitions (R)	2	137.00	10.80†
C by R	2	9.85	.78
Ss	24	71.10	5.61

*Significant at the .01 level; †significant at the .001 level

Grason-Stadler noise generator. The speech-to-noise ratio was adjusted to about 25% intelligibility for three trial Ss. This recording was then transcribed onto a Bell and Howell monaural tape recorder.

Procedure

Up to six Ss were seated at a common distance from the tape recorder speaker. Each list was presented alternately for a total of three times. The Ss were told only that they would hear six lists of 50 words. They were not told how many different lists there were. They were instructed to write the word they heard on a prepared sheet and to indicate their certainty that the response was correct by circling a number, 1-5, adjacent to the answer blank. A response of 5 indicated "very certain" and 1 indicated "very uncertain." The Ss were encouraged to respond to every word unless they had absolutely no response, in which case they marked an "X" in the blank. There was a short rest between lists for collection of response sheets and distribution of new ones.

RESULTS

The results, summarized by Fig. 1, were in general agreement with those of Bruce (1956). Although Bruce dismissed any repetition effect as insignificant, the figure clearly suggests one. An analysis of variance, shown in Table 1, indicates a repetition effect significant at the

Fig. 2. Type 2 d' values as a function of type of list and number of presentations.

.001 level. The difference in the two conditions is also significant at the .001 level.

The table of Hochhaus (1972) was used to compute the values of Type 2 d' summarized by Fig. 2. The G test of Gourevitch and Galanter (1967) showed that Type 2 d' is greater for C than for R lists ($p < .001$), while repetitions did not affect this index ($p > .10$ for each of six comparisons).

DISCUSSION

There are two possible explanations for the significant repetition effect while Bruce (1956) reported none. One possibility lies in the fact that Bruce used only nine Ss. Second, the effect might conceivably be the result of the particular speech-to-noise ratio used in the present study. Subsequent studies should try more than one speech-to-noise ratio and look for a Repetition by Ratio interaction.

The finding that repeated presentations do not improve confidence rating accuracy is consistent with the results of memory experiments. Bernbach (1967) found that repetitions of paired-associate study trials did not change Type 2 d' based on recall responses, although repetitions led to better recall. It is interesting, however, that repetitions do not improve performance in a fashion analogous to changes in the speech-to-noise ratio. Pollack and Decker (1958) found that increases in the S/N ratio led to improvement in both probability correct and d' .

Also, the fact that repetitions do not change d' rules out an alternative interpretation of the higher context d' given in terms of changes in probability correct. Therefore, the context effect appears real and is taken as support for the hypothesis that contextual feedback provides a basis for "knowing that you know."

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