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ABSTRACT

College students were administered a list of middle-frequency words, in which individual words are presented from one to six times. Half the subjects pronounced the list, while the other half remained silent. On a subsequent frequency judgment task, pronunciation subjects failed to differ significantly from silent subjects on mean judgments of items presented only once; however, there were differences on these items as indexed by variance between and within subjects, as well as by mean total correct. Further, an analysis of judgments on "zero" items (not seen on the study list) indicated differences between silent and pronunciation subjects on all four measures. These results were contrasted with previous findings and explained within a frequency theory perspective. (Author)

Technical Report No. 241

PRONUNCIATION AND APPARENT FREQUENCY IN A BETWEEN-SUBJECTS DESIGN

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Report from the
Operations and Processes of Learning
Component of Program 1

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Statement of Focus

Individually Guided Education (IGE) is a new comprehensive system of elementary education. The following components of the IGE system are in varying stages of development and implementation: a new organization for instruction and related administrative arrangements; a model of instructional programing for the individual student; and curriculum components in prereading, reading, mathematics, motivation, and environmental education. The development of other curriculum components, of a system for managing instruction by computer, and of instructional strategies is needed to complete the system. Continuing programmatic research is required to provide a sound knowledge base for the components under development and for improved second generation components. Finally, systematic implementation is essential so that the products will function properly in the IGE schools.

The Center plans and carries out the research, development, and implementation components of its IGE program in this sequence: (1) identify the needs and delimit the component problem area; (2) assess the possible constraints—financial resources and availability of staff; (3) formulate general plans and specific procedures for solving the problems; (4) secure and allocate human and material resources to carry out the plans; (5) provide for effective communication among personnel and efficient management of activities and resources; and (6) evaluate the effectiveness of each activity and its contribution to the total program and correct any difficulties through feedback mechanisms and appropriate management techniques.

A self-renewing system of elementary education is projected in each participating elementary school, i.e., one which is less dependent on external sources for direction and is more responsive to the needs of the children attending each particular school. In the IGE schools, Center-developed and other curriculum products compatible with the Center's instructional programing model will lead to higher student achievement and self-direction in learning and in conduct and also to higher morale and job satisfaction among educational personnel. Each developmental product makes its unique contribution to IGE as it is implemented in the schools. The various research components add to the knowledge of Center practitioners, developers, and theorists.

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Abstract

College students were administered a list of middle-frequency words, in which individual words were presented from one to six times. Half the Ss pronounced the list, while the other half remained silent. On a subsequent frequency judgment task, pronunciation Ss failed to differ significantly from silent Ss on mean judgments of items presented only once; however, there were differences on these items as indexed by variance between and within Ss, as well as mean total correct. Further, an analysis of judgments on "zero" items (not seen on the study list) indicated differences between silent and pronunciation Ss on all four measures. These results were contrasted with previous findings, and explained within a frequency theory perspective.

I
Introduction

The frequency theory of verbal discrimination learning (VDL) posits that "the cue for discrimination is a subjective difference in frequency of occurrence between the C [correct] and I [incorrect] item in each VD pair" (Ekstrand, Wallace, & Underwood, 1966, p. 567). According to the theory, "subjective" difference in frequency occurs partially as a function of the pronouncing response (choice of the correct item in each pair) and the rehearsal of the correct response (overt or covert pronouncing of the correct response during the study trial or informative feedback interval).

Recent studies have reported that pronouncing the correct response during the study trial or informative feedback interval is superior to silent performance (Underwood & Freund, 1968; Wilder, 1971) in a VD task. Hopkins, Boylan, and Lincoln (1972) have attempted to account for this effect by determining whether the same difference occurs in a frequency judgment task. In one experiment, they found no difference in mean frequency judgments between Ss who pronounced all words on the study trial and Ss who studied the items silently (Experiment 3). However, when this manipulation was made within Ss, pronunciation did increase apparent frequency (Experiment 4). That is, when Ss pronounced some words but not others in the same list, they judged the pronounced words to have a higher frequency of occurrence. These results led the authors to conclude that pronunciation influenced (increased) apparent frequency only "if S has also had experience with silently studied items in the same experimental context" (Hopkins et al., 1972, p. 112), and at the same time permitted a "frequency theory" explanation of pronunciation effects in VDL.

The present experiment, designed independently of Hopkins et al. (1972), was intended to assess the effects of a between-Ss pronunciation manipulation on absolute frequency judgments. Unlike the preceding study, however, during the second (test) list, filler items were also included in order to determine the effect of pronunciation on items not previously seen. A second departure from the Hopkins et al. experiment is reflected in the greater number of performance measures subjected to analysis in the present study. Examination of mean frequency judgments may not provide a complete picture of all effects associated with pronunciation, since it has recently been noted that reduced variability in frequency judgments would also suggest superior learning according to frequency theory (Ghatala, Levin, & Wilder, in press). Accordingly, variability indices—not considered by Hopkins et al.—were computed in the present experiment.

II
Method

Subjects

A total of 42 upper-division University of Wisconsin Communication Arts students participated in the experiment for partial course credit.

Materials

The stimuli consisted of two lists of middle-frequency (10-20 on the general Thorndike-Lorge list) two-syllable nouns. The study list contained 90 words. Fifty of the words were presented once, 25 were presented twice, 10 were presented three times, 3 were presented four times, 1 was presented five times, and 1 was presented six times. In all, there were 153 presentations. The list was divided so that each word occurred equally often in equal divisions of the list (e.g., for the one word that occurred six times, the list was divided into sixths). The second list was the test list, which included all of the 90 words from the study list plus ten additional words that had not been presented on the study list.

Procedure

The first list was presented on a memory drum at a 2-sec. rate. Two groups of Ss (pronunciation and silent) were used. The pronunciation group was told:

> This is an experiment on word memory. You will be shown a long list of words. Some words will occur only once, while others will occur twice on up to six times. Your task is to look at each word carefully and pronounce it. The list is too long to actually count and remember all of the words, so just try to get an impression of the number of times each word has occurred.

The silent group was given the same instructions, but they were told only to look at each word carefully. A test list was presented once on a memory drum at a 3.5-sec. rate to both groups. All of the Ss reported verbally how many times they had seen the word before. They were told that they could report "zero" for any item that they had not seen previously.

III
Results

A summary of four measures representing Ss' frequency judgments for the "one" and "zero" items is presented in Table 1, along with the statistics based on pronunciation-control differences. Since the predictions derived from frequency theory (Ghatala et al., in press) were all quite explicit (i.e., pronunciation should result in larger means and smaller variability on "one" items, and in smaller means and smaller variability on "zero" items), all comparisons made were directional, and thus the significance probabilities reported in Table 1 are one-tailed.

Mean apparent frequencies were computed for each S by averaging his frequency judgments on the 50 "one" items. The same was done for each S on the ten "zero" items. The "Mean" in Table 1 therefore represents the average mean across Ss in the same condition. As may be seen, the difference between the pronunciation and control conditions for mean judgments of "one" items was in the wrong direction and consequently nonsignificant, which corresponds to the Hopkins et al. (1972) result. Mean judgments for "zero" items did result in significant differences between the

Table 1
Various Summary Measures and One-Tailed Significance Probabilities Corresponding to Pronunciation-Control Differences on "One" and "Zero" Items

Actual Frequency	Measure	Condition: Control	Condition: Pronunciation	Statistic	Significance Probability
	Mean	1.090	0.947	$t(40) = -1.46$	Wrong direction
1	Variance (Between Ss)	0.176	0.029	$F(20,20) = 6.10$	$p < .001$
	Variance (Within Ss)	0.603	0.456	$t(40) = -1.84$	$p < .05$
	Total Correct	24.71	31.76	$t(40) = 3.08$	$p < .005$
	Mean	0.348	0.115	$t(40) = -3.63$	$p < .001$
	Variance (Between Ss)	0.068	0.017	$F(20,20) = 4.00$	$p < .001$
0	Variance (Within Ss)	0.326	0.152	$t(40) = -2.37$	$p < .025$
	Total Correct	7.19	9.10	$t(40) = 4.14$	$p < .001$

two conditions, however, as did each of the other variables considered.

The second variable, between-*S* variance, refers to the variability associated with the mean judgment scores just described. For both "one" and "zero" items, pronunciation served to reduce individual differences in frequency judgments. These tests being significant implies heterogeneity of variance in the distribution of mean judgments in the two conditions, thereby questioning the appropriateness of *t*-test comparisons of mean differences. As a result, nonparametric rank tests were conducted, with the results corroborating the statistical decisions previously noted: no significant pronunciation effect was detected on the "one" items, but the "zero"-item judgment mean was significantly lower in the pronunciation condition.

Within-*S* variances were obtained on "one" and "zero" items by computing each *S*'s mean squared deviation (about his apparent frequency mean). The entries in Table 1 represent the average of these intra-*S* variances within each condition. Pronunciation resulted in lower average within-*S* variability, particularly on the "zero" items.

The "Total Correct" measure was computed by counting the total number of times *S*'s frequency judgment corresponded exactly to the appropriate actual frequency. Thus, for the "one" items the maximum score possible was 50, while for the "zero" items this score was 10. Since these scores are highly correlated with within-*S* variances on the "one" items (the pooled within-sample correlation was -.74) and are virtually synonymous with mean apparent frequencies on the "zero" items,[1] it is not surprising that the statistical tests on these data support the previous conclusion. Subjects are more accurate (less variable and better able to identify "false alarms") when they pronounce the items than when they remain silent.

[1]Note that for "zero" items, these two measures will be identical if the only type of frequency judgment error made is to call a "zero" item a "one."

IV
Discussion

These results are consistent with those of Hopkins et al. (1972) in that there was no significant difference between pronunciation and silent _S_s on mean frequency judgments of "one" items. However, going beyond mean frequency judgments suggests several significant differences between silent and spoken performance in a between-_S_s design. There was less variability both between and within _S_s, as well as a greater mean total correct, for _S_s who pronounced. Further, the mean frequency judgment measure was significantly lower for pronunciation _S_s on the "zero" items. In other words, pronunciation _S_s were better able to recognize what they had not seen previously than were silent _S_s.

On the basis of the present results, it would appear that Hopkins et al. (1972) are premature in discounting the effect of pronunciation in a between-_S_s design. While a within-_S_s design could be regarded as the proper analogue to VDL (wherein it is the _relative_ difference between the pronounced and unpronounced item that is assumed to contribute to a frequency build-up for the former), it can be argued that an appropriate analogue to VDL could also be constructed from a between-_S_s design as long as both items pronounced and those not pronounced (i.e., "zero" items) are included on the test list. Although it was found that smaller variability was associated with pronouncing "one" items (relative to remaining silent), no apparent frequency increase was detected. On the other hand, pronunciation reduced the apparent frequency of the "zero" items. Thus, if the analogy between this between-_S_s frequency judgment task and VDL is reasonable, it is tempting to conclude that pronouncing the correct response in a VD pair may serve to increase discriminability associated with the incorrect item rather than to increase frequency associated with the correct item. (A similar conclusion was reached in a recent recognition memory experiment by Hopkins and Edwards [1972].) In addition, the present results suggest that pronunciation may decrease the variability associated with frequency judgments of both the correct and the incorrect items, and thus increase the likelihood of correct discriminations based on frequency differences in VDL.

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