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ABSTRACT

Subjects at three age levels were administered picture pair or word pair discrimination lists. They pronounced or pointed as a method of choice, and they pronounced or pointed at the correct item (or remained silent) during rehearsal. The results indicated that with picture pairs, pronunciation facilitated learning as a method of choice and a type of rehearsal in nursery school subjects. For fifth-grade and college subjects, there was no significant difference between pronouncing and pointing as a method of choice. Spoken rehearsal was superior to control performance for the fifth-grade subjects. College subjects performed equally well in the control and pronouncing conditions, but pointing during rehearsal produced significantly more errors than pronouncing. Word pairs produced no significant pronunciation effects. The verbal stimuli tend to elicit implicit pronouncing responses sooner than the nonverbal stimuli. These results were discussed within an internalization of speech perspective. (Author/WR)

Technical Report No. 228

A DEVELOPMENTAL STUDY OF PRONOUNCING RESPONSES IN THE DISCRIMINATION LEARNING OF WORDS AND PICTURES

by

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Report from the Project on
Letter-Sound Relationships and the
Development of Reading Skills

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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.

Contents

List of Figures

Abstract

Subjects at three age levels were administered picture pair or word pair discrimination lists. They pronounced or pointed as a method of choice, and they pronounced or pointed at the correct item (or remained silent) during rehearsal. The results indicated that with picture pairs, pronunciation facilitated learning as a method of choice and a type of rehearsal in nursery school Ss. For fifth-grade and college Ss, there was no significant difference between pronouncing and pointing as a method of choice. However, spoken rehearsal was superior to control performance for fifth-grade Ss. College Ss performed equally well in the control and pronouncing conditions, but pointing during rehearsal produced significantly more errors than pronouncing. Word pairs produced no significant pronunciation effects. These results were discussed within an internalization of speech perspective.

I
Introduction

In a typical discrimination learning experiment, S is presented with a list of paired items (usually words or pictures), with one item in each pair arbitrarily designated "correct" by E. The task involves learning to choose the correct item; if an anticipation method of testing is adopted, S begins by guessing, and then is given informative feedback concerning the correctness of his choice. Task completion is based on a predetermined number of errorless trials, or a block of trials constant for all Ss.

The present study was concerned with the effect of the pronouncing response as a method of choice as well as a type of rehearsal in discrimination learning involving pairs of pictures and words. Further, it was concerned with possible differences in these effects as a function of chronological age. Although there has been some research with children (Goulet, 1969) and adults (Carmean & Bauman, 1969) which has examined the effect of pronouncing both items in a picture pair before making a choice, no previous research specifically manipulates pronouncing as a method of choice in children or adults.

There are also studies of the effects on pronouncing the correct item during the informative feedback interval. Carmean and Weir (1967), for example, reported that adult Ss who pronounced the correct item during feedback learned ten pairs of line drawings of common animals with fewer errors than control Ss given no pronunciation instructions. In another study Carmean (1969), using a smaller number of the above picture pairs, found that pronouncing the correct item facilitated learning in first-, third-, and sixth-grade Ss.

With an adult sample and very low-frequency word pairs (e.g., JARL-MUTT, TAW-VOX), Wilder (1971a) found that pronouncing the correct item during feedback aided learning. However, Norton (1972) detected no facilitation when adult Ss pronounced middle-frequency word pairs (CALM-DRIP, TILE-MASH). Also, Rowe and Paivio (1971b) reported a small effect due to spoken rehearsal when high-frequency concrete nouns were used and adult Ss were instructed to pronounce the correct response three times. There are no studies using word pairs which examine the pronouncing of the correct response in children. Thus, pronouncing the correct response during the feedback interval appears to facilitate the discrimination learning of picture pairs in both children and adults. The effect of pronunciation during feedback with adults presented word pairs appears to vary as a function of the characteristics of the words used, while there are no data on children's performance. At present, data on the pronouncing response as a method of choice are lacking also.

The present study included both picture and word pairs, and two types of pronouncing responses (method of choice and type of rehearsal). In order to determine possible developmental differences associated with pronouncing responses, independent samples were tested at two levels—nursery school and fifth grade.

The question of principal interest was whether any facilitation due to pronouncing is exclusively speech-related, or can these effects be explained by hypothesizing that any overt response related directly to the stimulus aids learning? For example, O'Brien and Carmean (1967) reported that writing the correct response during rehearsal was equivalent to pronouncing it. However, since it may be argued that this procedure does not eliminate implicit speech responses (Wilder, 1971b), an alternative kind of overt response (viz., pointing at the correct item) was compared with pronouncing in the present study.

A comparison between pronunciation and an overt response which does not directly involve speech also has interesting developmental implications. Flavell and his associates (e.g., Flavell, Beach, & Chinsky, 1966; Keeney, Cannizzo, & Flavell, 1967) have advanced a "production deficiency" hypothesis based

on the young child's need to produce overt verbal labels (i.e., pronounce) during learning situations, a need which diminishes with increasing chronological age. Presumably, the necessity for overt production of the label is alleviated with the development of implicit speech responses. Such a position suggests that pronouncing responses are more important for children than for adults. In each age group, the comparison between pronouncing and pointing should help to distinguish between hypotheses about speech responses and those concerned with overt responses and learning.

II
Method

Subjects

A total of 300 Ss participated in the experiment: 60 nursery school Ss, approximately four years old, drawn from day-care centers serving middle-class residential areas in Madison, Wisconsin; 120 fifth-grade Ss, ten and eleven years of age, drawn from a local school; and 120 college Ss enrolled in a communication arts course at the University of Wisconsin.

Materials

Line drawings of familiar objects (e.g., WHALE, DRUM, KEY, APPLE) were paired in two lists of ten pairs each. There were four random orders of each list; the position of the correct item was random with the restriction that it occur twice on the left and twice on the right. Lists for nursery school Ss were constructed in a similar fashion, with four pairs drawn from the larger lists. The names of the pictures comprised the word-pair lists for fifth-grade and college Ss. The pairs, correct responses, and list orders were the same for words as for pictures.

Procedure

The picture and word pairs were presented in a loose leaf notebook with one pair on each page. The anticipation method was used, with approximately a 2:2 second presentation rate. First a pair was presented, and then the page was turned, showing the same two items (in the same position) with a colored asterisk beneath the correct response. The Ss were instructed that when they first saw the two items, they were to choose the one which they thought was correct, and then they would be shown which one was correct. At each age level, half of the Ss were instructed to make their choice by pronouncing the item, and the other half were told to point at the item of their choice.

Within each method of choice, one-third of the Ss were instructed to pronounce the item with the asterisk beneath it, one-third were asked to point at it, and the remaining third were given no instructions about rehearsal. In the nursery school sample, all Ss were shown picture pairs, while in the fifth-grade and college samples, half of the Ss were shown picture pairs and half word pairs.

In summary, there were two methods of choice (point, pronounce) and three types of rehearsal (pronounce, point, and control) for nursery school, fifth-grade, and college Ss. Nursery school Ss were administered only picture pairs, while fifth-grade and college Ss received both picture and word pairs. Following two practice pairs in a separate folder, each S was taken to a criterion of two successive errorless trials.

III
Results

All Ss in the experiment were administered a minimum of two anticipation trials following the guessing trial. The number of errors made on each of these two trials constitutes the dependent variable for the following analysis.[1] The nursery school data were analyzed separately since only four picture pairs were used. At the other two age levels, ten word pairs and ten picture pairs were used. The method of choice (point vs. pronounce) and the type of rehearsal (control vs. point vs. pronounce) factors were nested within mode of materials (pictures vs. words) and grades (fifth grade vs. college). The two trials were treated as a repeated measure in the analysis. Each hypothesis in the design was tested with the probability of a Type I error set equal to .05, and significant simple main effects were followed by Tukey post hoc comparisons where indicated.

Nursery School Data

Performance on the four-pair picture discrimination learning task in the nursery school sample, as a function of the two kinds of pronouncing responses, is shown in Figure 1. Analysis of variance revealed a significant main effect for method of choice (F [1,54] = 5.25, $p < .05$) and type of rehearsal (F [2,54] = 8.78, $p < .001$), and no interaction between the two ($F < 1$). Pronouncing was superior to pointing as a method of choice, and post hoc comparisons among the three rehearsal conditions indicated that Ss who pronounced during rehearsal made significantly fewer errors than either Ss who pointed or control Ss. The mean number of errors in the latter two conditions did not differ significantly. Although there was substantial improvement over trials (F [1,54] = 14.56, $p < .001$), there was no trials interaction with either of the pronunciation variables.

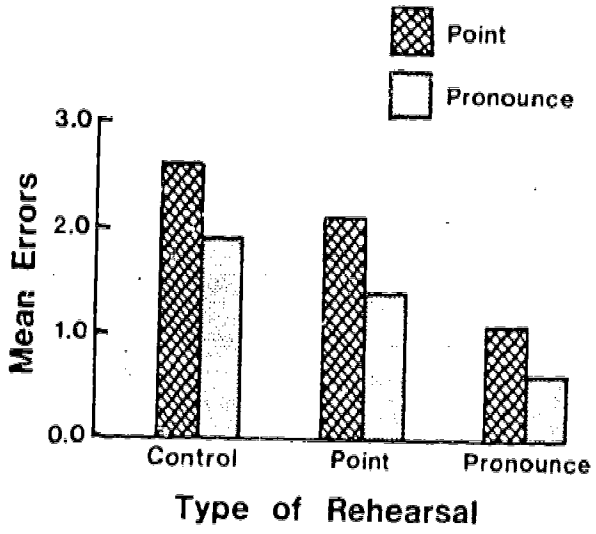

Fig. 1. Mean errors on Trials 2 and 3 for nursery school subjects (picture pairs) according to type of rehearsal and method of choice.

Fifth-Grade and College Data

Overall, picture pairs were more easily learned than word pairs (F [1,216] = 24.43, $p < .0001$). The performance of college Ss was superior to that of fifth graders on pictures (F [1,216] = 7.23, $p < .001$), but not

[1] Although all Ss were run to criterion, errors over two trials was regarded to be a measure more sensitive to treatment effects. A subsequent analysis of the trials to criterion data did not substantially alter any of the conclusions reached here.

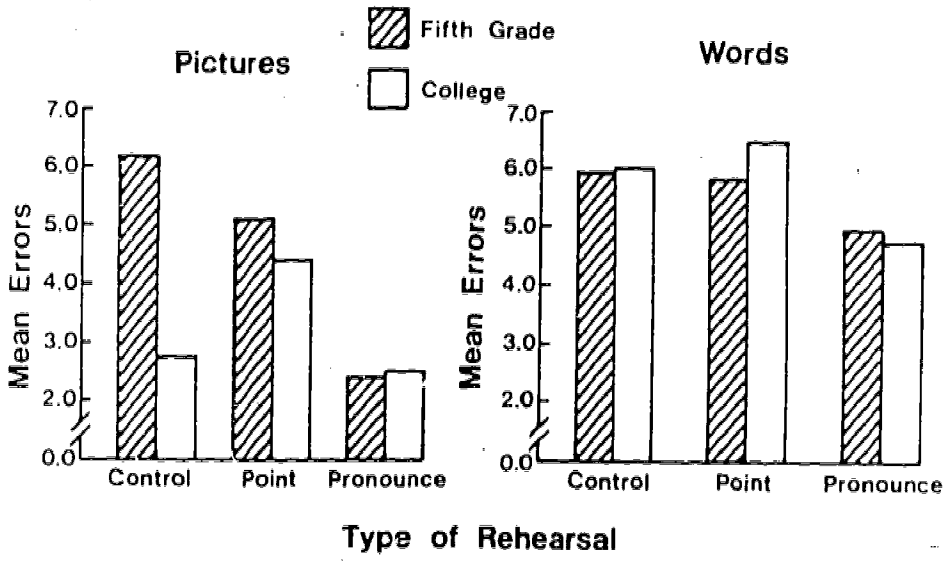

Fig. 2. Mean errors on Trials 2 and 3 for fifth-grade and college students according to the type of rehearsal and mode of materials.

on words ($F < 1$). Not surprisingly, there was significant improvement over trials for both grades with both picture and word pairs. Regarding the pronunciation variables, within pictures there was no significant difference between pronouncing and pointing as a method of choice at either grade, but a significant main effect of type of rehearsal was detected in both grades (Fifth: $F\ [2,216] = 10.66$, $p < .0001$; College: $F\ [2,216] = 3.20$, $p < .05$). As Figure 2 suggests, however, post hoc comparisons within the picture rehearsal effect produced different statistical conclusions for each grade. In the fifth grade, pronunciation Ss made fewer errors than either control or point Ss; the latter two did not differ significantly. On the other hand, college pronunciation Ss were not significantly different from control Ss, but made significantly fewer errors than point Ss.

The results with word pairs were quite different from the picture pair results. The main effect of pronunciation was not significant either as a method of choice or as a type of rehearsal (see Figure 2). However, for fifth-grade Ss, the method of choice x trials interaction was significant ($F\ [1,216] = 6.11$, $p < .05$), as was the type of rehearsal x trials interaction ($F\ [2,216] = 4.58$, $p < .05$). Scheffe post hoc comparisons produced the same conclusion for each interaction, namely that pronunciation (either as a method of choice or as a type of rehearsal) led to significantly greater improvement from trial one to trial two.

IV
Discussion

The results of this experiment suggest that pronunciation has a unique effect on discrimination learning, and that the magnitude of this effect (relative to control performance) varies as a function of the type of materials used and the age of Ss. The data for the pictorial discrimination task suggest that pronunciation is of greater benefit as a type of rehearsal than as a method of choice. At each of the three age levels investigated, pronouncing the correct item during feedback was superior to not pronouncing it (for nursery school and fifth-grade Ss) or to pointing at it (for Ss at all three ages). On the other hand, pronouncing one's choice produced no significant effects at the fifth-grade or college levels, and though significant for nursery school Ss, the effect was descriptively smaller than the corresponding pronunciation during rehearsal effect. It is of additional interest to note that college Ss were quite superior to fifth-grade Ss in the control condition on picture pairs; however, pronouncing during rehearsal completely eliminated this difference in performance between the two age groups (see Figure 2).

The frequency theory of verbal discrimination learning (Ekstrand, Wallace, & Underwood, 1966) posits that the acquisition of a discrimination list is dependent upon pronouncing a response during the anticipation interval and implicit or explicit pronouncing of the correct response during the informative feedback interval. However, frequency theory, in its present form, fails to distinguish between implicit and explicit verbal responses. Hopkins, Boylan, and Lincoln (1972) recently argued that frequency theory accounts for the facilitative effects of spoken rehearsal of the correct response. The present study suggests that such effects vary as a function of age, and as the individual develops, the effect of vocalization is replaced by visual and semantic cues.

It is also interesting to note that frequency theory does not account for the superiority of pronunciation over pointing as a method of choice in nursery school children. It is possible that pronouncing one's choice facilitates the performance of nursery school Ss by drawing their attention to the task and/or enhancing response learning, operations which older Ss are assumed to be engaging in spontaneously. This argument may be extended to account for two other findings in the present experiment: (a) the superiority of pronounce relative to control as a type of rehearsal for fifth-grade but not for college Ss with picture pairs, and (b) the lack of significant pronunciation effects in fifth-grade and college Ss when word pairs were used.

Concerning the first finding, it is reasonable to assume that the older S is, the more inclined he is to supply a covert label to a pictorial stimulus. This assumption, elaborated on previously by others (e.g., Flavell, Beach, & Chinsky, 1966; Reese, 1970; Rohwer, 1971), may be used to explain the difference between fifth-grade and college Ss in the control condition. When younger Ss are not explicitly instructed to pronounce during rehearsal, they fail to do so. College Ss, however, are more likely to be labeling the pictorial stimuli covertly, which is borne out by the finding that explicit instructions to label are not facilitative relative to leaving S to his own devices. At the same time, when college Ss are required to rehearse in a manner which is inappropriate or antagonistic to the task at hand (here, pointing may have induced a "positional cue" set), performance is interfered with relative to appropriate rehearsal (pronouncing) or control conditions. This result is consistent with findings based on the development of subject-generated mediational strategies in associative learning (cf. Rohwer, 1971).

Secondly, the facilitation attributable to pronunciation for pictorial materials disappeared when printed word pairs were employed. The obvious explanation for this is that in perceiving

(reading) printed words, S engages in concurrent covert pronunciation of both items initially and of the correct item during rehearsal. Systematic replications and extensions of this finding might be relevant to the continuing controversy regarding subvocal speech in reading (e.g., Levin & Williams, 1971). The fact that college students learned picture but not word pairs more easily than fifth graders (see Figure 2) lends further support to such "development of covert pronunciation" arguments. In this regard, it is interesting to note that the production deficiency hypothesis (Flavell, Beach, & Chinsky, 1966) was based on memory tasks involving nonverbal stimuli.

As was noted previously, picture pairs were, in general, more easily learned than word pairs, a finding consistent with previous results (e.g., Rowe & Paivio, 1971a). At the same time, the apparent increase in this effect from fifth grade to college among control Ss (see Figure 2) corroborates recent investigations wherein picture-word differences have been found to get larger with age (Levin, 1972; Reese, 1970).

Although these results support the conclusion that adults implicitly pronounce the correct item (a word or picture) during rehearsal, they may be contrasted with previous research where pronunciation during rehearsal was found to aid adult discrimination learning. However, the picture and word pairs used in these studies were of a more complex nature. Conceptually alike pictures which produce high intralist similarity (Carmean & Weir, 1967) or very low-frequency words (Wilder, 1971a) might be assumed to be more difficult to learn, and perhaps this difference in task complexity could account for the facilitative effects of pronouncing in adults.

These results can be included with the growing body of literature which suggests that verbal processes develop in part as a function of the child's speech communication experiences, and that such processes internalize during the course of human development. The most significant finding, however, is that verbal stimuli tend to elicit implicit pronouncing responses sooner than do nonverbal stimuli.

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